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ECOLOGICAL AND ENVIRONMENTAL ENGINEERING

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Use of the phytoremediation for tuning olive mill wastewater pretreated by chemical precipitation

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ABSTRACT

Olive mill wastewater (OMW), the liquid by-product generated during olive oil extraction. Most of them deal with conventional treatment technologies, including anaerobic digestion, physic-chemical pre-treatments or advanced oxidation processes. Some of them, although achieving effective treatment, are characterized by high operational costs and/or require experienced personnel. The aim of this study was to treat wastewater from an olive oil mill in the Serpa region, in the south of Portugal. It was evaluated the efficiency of a phytoremediation treatment preceded by a chemical precipitation to remove organic matter, suspended solids, oils and fats, in order to obtain an effluent compatible with the standards of discharge. It was used a vertical flow constructed wetland (VFCW), planted with *Vetiveria zizanioides* in Leca® NR10 / 20 and fed in a continuous vertical mode. The chemical pre-treatment allowed to obtain a removal efficiency of about 98% of suspended solids and oils and fats, reason why the content of these parameter were not determined in the affluent to the VFCW. The hydraulic loads applied varied from 29 $Lm^{-2}d^{-1}$ to 177 $Lm^{-2}d^{-1}$. The organic matter load (COD) of affluent to the bed increased from 12 $gO_2m^{-2}d^{-1}$ ± 1 to 123 $gO_2m^{-2}d^{-1}$ ± 2; COD removal efficiencies up to 70% ± 3 were observed. Vegetable biomass never showed symptoms of toxicity. The sludge obtained in the chemical pre-treatment can be valued as agricultural corrective. The results obtained in this work allowed us to conclude that this is a viable solution to be applied to olive mill wastewaters.

KEY WORDS

Olive mill wastewater; vertical flow constructed wetland; *Vetiveria zizanioides*

The effect of the moisture on the runoff from extensive green roofs at different substrates composition

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ABSTRACT

Due to progressive development of cities, there is a needof new alternative solutions enabling the retention of rainwater and increasing the biologically active area. Green roofs can be the solution to these problems. Analysis of environmental factors affecting the outflow of green roofs is the subject of many studies. Evapotranspiration (ET) is a key process that regulates the ability of a green roof to retain rainfall, because it affects substrate drying between precipitation events. In this paper we examined, the changes of the moisture of two types of substrates in dry periods due to ET and how the moisture influenced the volume of the outflow. Monitoring of the moisture and the outflow were conducted for 20 months on two extensive (moss-sedum-herbs) green roofs models, filled with organic-mineral (with peat and compost additions) and mineral substrate. Moisture sensors placed at two depths recorded moisture changes with a ten-minute resolution. In order to compare the differences between substrates, the average daily changes of moisture in relation to the previous day were calculated. In both models, changes of moisture with a depth were observed. The green roof model filled with the organic-mineral substrate showed higher moisture values n relation to the model with the mineral substrate. However, higher outflow values were recorded in the model with a mineral substrate, which indicates lower retention capacity. The obtained results provide information necessary for designing the green roofs hydrological benefits.

KEYWORDS

moisture content, green roof, evapotranspiration, retention, substrate

An attempt of calibration NOAA's Hydroestimator data over the area of Poland

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ABSTRACT

Climatology, agriculture, forestry, insurance companies, stock prices prediction market and many other branches are in great need of a reliable precipitation data, especially in the era of climate changes and extreme weather events. Spatial resolution of rain gauge network belonging to the Institute of Meteorology and Water Management in Poland is not sufficient to depict spatial extent and intensity of precipitation, particularly in case of heavy rainfalls. National Oceanic and Atmospheric Administration (NOAA) has developed a method of obtaining estimated rain rates from cloud top temperature with the use of IR data from GOES, METEOSAT and MTSAT satellites, called Hydroestimator. For the area of Poland estimates are produced every hour providing critical rainfall information with 4 km^2 pixel resolution, but the algorithms have only been calibrated over the United States area. In this paper an attempt has been made to calibrate Hydroestimator data over Poland for the warm season of 2015, using data from the IMWM ground-based measuring stations. The regression analysis was performed to model the relationship between these two data sets, for the area of whole country in the first place, and then, separately, for the Polish climatic zones. Additionally, a discussion about comparison of point and area precipitation data was carried out.

KEYWORDS

precipitation data, Hydroestimator, Poland, regression analysis

The study of dependency between land-use coverage and parcel boundaries

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ABSTRACT

Land-use constitutes as a part of the earth's surface which is used in a specific, unitary manner. In Poland, data concerning land-uses are registered in the Real Estate Cadastre. This data plays an important role, inter alia, in the context of land properties taxation as well as performing statistical analyses in the field of spatial structure and land development form on various levels of administrative division of a country. Data on land-uses also form basis for activities aimed to agricultural and forest land protection.

In this article, the study concerning identification of dependency between parcel boundaries and land-use coverage has been conducted. Occurrence of such a dependency is determined by the characteristics of Polish legal regulations and the fact of carrying out the Real Estate Cadastre in the form of informational system. On this basis it could be concluded that parcel boundary is one of determinants influencing the coverage shape of specific land use form. Using GIS tools, the assessment of size of this impact has been performed at the level of individual land properties as well as the whole cadastral districts. The spatial structure of land-uses in selected cadastral districts in southern Poland has been also compared. The results of analysis were presented both in graphical and analytical form.

KEYWORDS

land-use, land development, parcel boundary, Real Estate Cadastre, GIS analyses

Problematic aspects of registering ecological land-use in the Real Estate Cadastre

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ABSTRACT

Land-use as a part of the earth's surface used in an unitary manner, constitutes as one of the objects of Real Estate Cadastre in Poland. This register gathers data concerning actual grounds status, buildings and premises. Cadastre is carried out in an informational system on the basis of Geodetic and Cartographic Law and its implementing act. The contents of mentioned legal regulations are very general in terms of capturing and revealing data on ecological land-use. The rules are also related to environmental protection law. It often makes its proper interpretation difficult.

In this article, the study aimed to systematize information about recording ecological land-uses in Polish Real Estate Cadastre has been performed. Practical and legal solutions concerning determination of the ecological land-uses coverage have been presented. The authors evaluate an order of individual activities leading to ecological land-use disclosure in cadastral database. The consequences and constraints in enforcing the ownership to land property or its parts where ecological land-use was allocated are analyzed as well. The statistical data in the scope of number and surface area of ecological land-uses in individual provinces have also been demonstrated.

KEYWORDS

environmental protection, land-use, ecological land-use, Real Estate Cadastre

Impact of changing the sewage system on the amount of water consumption in rural households

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ABSTRACT

The paper analyzes the impact of changing the sewage disposal system from the non-outflow (cesspool) to the outflow (sewage system) on the amount of water consumption in rural households. The analysis covered water consumption in the years 2011-2015 in 34 farms located in the village of Wołowice (Małopolskie Voivodship), which were connected to the sewage system in 2014. Throughout the research period, the analyzed farms were characterized by the highest category of housing equipment in water supply and sewage facilities. It was found that the change of the sewage disposal system caused the increase of water consumption. It was visible both at the level of total consumption on the farm (5.1%) and per capita consumption (6.4%). The reasons for this state are seen in the fact that a non-outflow sewage disposal system is the least favorable solution. For it forces the user to constantly monitor the level of sewage in the tank to prevent it from overfilling. The connection to the sewage system exempts this obligation, and the user does not have to worry about what is happening with the sewage, not a remember to regularly empty the cesspool. It can therefore be concluded that the change in the method of discharging waste water to the outflow one increases the standard of living of the household members, but also influences the increase in water consumption. This fact has not only a cognitive but also a utilitarian dimension. It should be taken into account during the design and construction of not only the water supply, but also the sewage system, as water consumption is usually the basis for determining the volume of resulting wastewater.

KEYWORDS

water consumption, rural households, sewage disposal system

Study of catalytic processes for biodiesel production wastewater treatment

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ABSTRACT

Biodiesel has become very attractive as a biofuel due to its environmental benefits and it has been mainly produced from edible vegetable oils all over the world, which are easily available. The production of biodiesel purificated includes the generation of a highly polluting wastewater that needs to be treated prior to environmental discharge. This type of effluent presents high values of chemical oxygen demand (COD), oils and fats, among other contaminants much higher than allowed by legislation. The aim of this work is the study of the effect of two catalytic processes: the powerful oxidant (E^o=2,1V), potassium monopersulfate ($2KHSO_5.KHSO_4K_2SO_4$) decomposed into radicals (OH., SO^{4-}., SO^{5-}.) by means of transition metals such as Co(II), Ru(II) and Mn(II) and the Fenton process, applied in the removal of COD of residual water from the biodiesel purification stage. The utilization of the potassium monopersulfate decomposed by the transition metal Co(II) in different concentrations suggests that the catalytic combination: ([Co2+]=1.0x10-6 M; [$2KHSO_5.KHSO_4K_2SO_4$]=5.0x10-2M), can remove around of 60% of the COD of the wastewater (666,5 g/L) and complete decomposition of the oxidant was verified for contact times of 2h. The application of the Fenton reagent showed similar results. The treatments, studied in this research, have achieved high COD removal. However the final COD concentration reached is still above the emission limit value of Portuguese legislation. So this type of treatments can be considered as a pretreatment of this type of efluent.

KEYWORDS

Biodiesel production wastewater; COD, potassium monopersulfate, Fenton process

Impact of temperature and organic compounds on the ammonium nitrogen removal from wastewater by household treatment plant serving the school building

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ABSTRACT

The paper presents the results of a research on the ammonium nitrogen removal in a household sewage treatment plant with active sludge in two aspect of: the impact of temperature and the organic compounds in the wastewater flowing to the object.

In the analysis period the household treatment plant treated wastewater inflow from primary school, where attended 120 students and from teacher house inhabited by 6 persons. Mean design capacity was 3,5 to 5 $m^3 \cdot d^{-1}$ (25-30 PE), and in the study period it was supplied with 2,2 $m^3 \cdot d^{-1}$of sewage, and the real PE amounted to 7. During the research period (from January 2011 to December 2013), 42 samples of each raw and treated sewage were collected, and subjected to physical and chemical analysis, which are recommended in the current Regulation.

In the analytical part of paper the results were subjected by statistical analysis, along with calculation of the Pearson's linear correlation coefficient, what was necessary to statistical description impact of air temperature in to the sewage temperature in biological reactor. In the next part of this chapter based on the sewage temperature in biological reactor and ratio of BOD to N-NH_4 in the raw sewage, presented result of statistical analysis of partial correlation of three variables. The aim of this analysis was assessment of the impact of two independent variable (temperature and ratio BOD_5/N-NH_4) in to the dependent variable, which was ammonium nitrogen concentration in treated sewage.

The analysis revealed that relation between air temperature and sewage temperature in biological reactor in very strong, what showed Pearson's correlation coefficient Rxy=0,92. The results for statistical analysis of partial correlation of three variables showed that grater impact on

ammonium nitrogen concentration in treated wastewater had sewage temperature in biological reactor (Rc=0,57) than ratio between BOD_5 and N-NH_4 in inflows sewage (Rc=0,46).

To significance of correlation coefficients was tasted by the Student's test at the significance level of α=0,05. In both cases, the significance of the studied relation was founded.

Based on the result of partial correlation analyses, was created a nomogram, whereof possible to predict the concentration of ammonium nitrogen in wastewater treated, on the basis of sewage temperature (axis ordinates) and BOD_5/NNH_4 ration (abscissa) in the inflow sewage. The create model can be described by equation: N-NH_4_inlet =56,247 –2,2•temp. sewage. –3,7559•BZT_5/N-NH_4. The analysis revealed that the hydraulic underloading of this object, caused elongate retention time of sewage in biological reactor, which had a directed impact of the air temperature in to the sewage temperature. During the research period the temperature in biological reactor was oscillated between 6,5 - 18^{o}C. There were also large variations in BOD5/NNH4 ratio, from 1,1 to 6,4. High variability organic compounds in inflow sewage to concentration of ammonia nitrogen had impact of nitrification process, what had the directly impact of variations the concentration of ammonium nitrogen in treated sewage (4,3 do 68,9 mgN-NH_4/dm^{-3}). The household wastewater treatment plant with active sludge is very sensible of analysed indicators. To minimalist impact of this indicators its necessary to increase the amount of inflow wastewater, what will shorten the retention time and at the same time it causes the variability of organic compounds concentration in inflow sewage. This solution will directly improve the efficiency of elimination of nitrogen compounds from treated sewage.

KEYWORDS

household treatment plants, ammonium nitrogen, temperature, organic compounds

The influence of the quantity inflow wastewater on the pollution concentration contained in them in the Nowy Targ sewer system

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ABSTRACT

The aim of the study was to present results of analysis about influence of the quantity inflow wastewater on organic, biogenic and chromium ions pollution load in raw wastewater from the corporate wastewater treatment plant in Nowy Targ. The study was conducted from 2016 to 2017, in which 87 samples of raw wastewater were collected over a 24-month period and subjected to physic-chemical analysis in accordance with the reference methods. Raw wastewater samples were taken from discharged channel by auto sampler, which was programmed in relation to the flow rate of the wastewater. In addition, the measurement covered the number of discharged wastewater in each day in which wastewater samples were collected. The analytical part of the work, a statistical analysis was carried out together with the calculation of Pearson's linear correlation coefficient in order to statistically study the impact of the amount of discharged wastewater for concentrations: BOD_5, COD, total nitrogen, total phosphorus and chromium ions in raw wastewater. As a result of the analysis, it was found that in 2016, the average daily discharged of wastewater ranged from 10552 to 21683 $m^3 \cdot d^{-1}$, while in 2017 the fluctuations were from 9835 to 21100 $m^3 \cdot d^{-1}$. Based on the analysis of the correlation, it was found that in the case of the inflow / BOD dependence, the correlation factor in 2016 is Rx,y = 0.60 and in 2017 Rx,y = 0.68. The correlation factor for the inflow/COD dependence is Rx,y = 0.51 and in 2017 Rx,y = 0.52. The correlation factor for the inflow/Nog relation is Rx,y = 0.64 and in 2017 Rx,y = 0.61. The correlation factor for the inflow/Pog relationship is Rx,y = 0.58 and in 2017 Rx,y = 0.63. The correlation factor for the inflow/Cr relationship is Rx,y = 0.41 and in 2017 Rx,y = 0.43. The significance of the calculated correlation factors was tested with the Student's t-test at the significance level of $\alpha = 0.05$. In both cases, the significance of the studied relationships was found. Based on the equation of the trend line, it was found that with the increase in the quantity of

discharged wastewater by 1000 m^3 in 2016, the following values decrease: BOD^5 values by 34.1 $g•m^{-3}$, COD values by 111.7 $g•m^{-3}$, total nitrogen concentrations by 6.6 $g•m^{-3}$, total phosphorus 0.9 $g•m^{-3}$ and chromium ion concentrations 0.6 $g•m^{-3}$. In 2017, as the amount of discharged wastewater increases, the following values decrease: BOD_5 values by 34.0 $g•m^{-3}$, COD values by 94.6 $g•m^{-3}$, total nitrogen concentrations by 7.2 $g•m^{-3}$, total phosphorus 2.3 $g•m^{-3}$ and chromium ion concentrations by 0.6 $g•m^{-3}$. Based on the analysis, it was found that the average daily amount inflow wastewater to the treatment plant in Nowy Targ was unstable. As the sewer system in the Nowy Targ is partially a combined sewer system in the period of atmospheric precipitation, rainwater is discharged into the sewer system, which favors the dilution of wastewater in the sewer system, i.e. reducing their concentration. This type of phenomenon is unfavorable for the stability of biological processes and mechanical wastewater treatment. In addition, the increased discharged of wastewater raises the costs of their treatment. In order to prevent the phenomenon of large changes in the concentration of pollutants in wastewater discharging as a result of increased wastewater discharged, the sewer system in the town area should be modernize (rebuild) from the combined sewer system for the distribution system and also eliminate illegal introduction of rainwater from roof gutters on sections of the sewer system designated for domestic wastewater.

KEYWORDS

wastewater, quantity and pollutants concentration, Pearson’s correlation

Calcined eggshell as a P reactive media filter – batch tests and column sorption experiment

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ABSTRACT

The goal of the study was to assess the sorption properties of calcined eggshell (CE) as a P reactive media filter. A double stage test was performed: batch studies (kinetic and equilibrium) and small scale column experiment. The estimation of optimal mass ratio of CEs for perspective usage was the additional benefit of column experiment. Three batches of CEs were calcined in temperature of: 300, 900 and 1100°C. The short kinetic tests showed that 5 min. of contact time with solution of initial concentration of 6.020 mgP-PO_4/L is enough to reduce the P-PO_4 in 100%. The equilibrium studies were conducted with P-PO_4 solution of 6.020 to 977.7 mg/l with contact time of 30 min. The obtained data was compensated by non-linear regression using the Marquardt algorithm in the Statgraphics Centurion XVI. The eggshell calcined in 900°C was chosen for further test because of the best sorption properties estimated by the Langmuir isotherm model (S_{max} = 27.9 mg/g) and a good fit (99.9%). To choose the appropriate ratio of a sand filter to eggshells amendment, four small columns were constructed and fed with P-PO_4 solution (Cin ≈ 5 mg/L). The mass percentage (m/m) of CEs in the columns were: 0.0 (the reference one); 5.0; 2.5 and 1.0. The preliminary observation (first 10 days) of the column experiment gave a satisfactory results, characterized by P-PO_4 removal of 100% for each column with ECs amendments and 50% reduction for the reference one.

KEYWORDS

column experiment, egg shells, phosphorus, reactive materials

Conditions for the implementation and exploitation of technical infrastructure related to the transmission of media in the aspect of environmental protection

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ABSTRACT

Distribution of media in a large area requires the foundation and exploitation of appropriate transmission equipment. However, the necessity of media transmission often stands in contradiction with the protection of natural resources. This protection is implemented through activities that aim at not exceeding the technical standards of the quality of the environment and, at the same time, by limiting the emission of harmful substances and noise, or by generating electromagnetic fields. Exceeding environmental protection standards in this area may result in environmental damage. This is particularly true for devices whose implementation is included in the set of projects that may significantly affect the environment.

This article indicates the key problems related to the implementation and exploitation of technical infrastructure related to the transmission of media in the context of environmental protection requirements. As part of the study, a review of legal acts, case law and literature on the subject of mutual relations between the principles of environmental protection and the practice of implementing transmission infrastructure was carried out. Among the set of projects that can significantly affect the environment, those whose nature allows them to be classified as transmission investments have been selected and then they were briefly characterized. The possible legal and technical consequences of such projects have been synthetically presented. On the basis of practical examples, there was also indicated the important role of the local spatial management plan, the aim of which should be a compromise in development between economic, social and environmental interests. The author indicates the importance of the discussed issue, especially in the context of rational planning of transmission devices location.

KEYWORDS

transmission easement, environmental protection, spatial planning

Impact of arrangements of local spatial management plan to the transmission easement scope in the context of environmental protection requirements

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ABSTRACT

At the municipal level, the local spatial management plan is the basic act of local law shaping the manner of exercising the right of ownership. Among obligatory elements of the content of the plan, the legislature mentions, as one of the most important, principles of environmental, nature and landscape protection, and principles of landscaping. Findings of a local spatial management plan can be also crucial in the process of establishing transmission easement, in which, in the absence of statutory regulations, they can have a direct impact on determining the spatial extent of an easement. This document may therefore be of key importance in the context of the implementation and conditions of transmission equipment operation and determining the spatial extent of transmission easement in accordance with the requirements of environmental protection.

This study indicates the mutual impact of the arrangements of the local spatial management plan regarding the extent of protection zones around the transmission infrastructure and environmental protection requirements. As part of the study, the content of the text and drawing parts of selected local spatial management plans was analyzed in the field covering the subject matter. Based on selected practical examples, the possible effects of the interaction of planning arrangements were presented. The author emphasizes the wide range of possibilities that the local spatial development plan gives to the commune in relation to the rational economy, regarding transmission networks and environmental protection, which carries serious social and financial consequences.

KEYWORDS

local spatial management plan, environmental protection, transmission easement

Impact of the extension of energy infrastructure elements on the landscape

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ABSTRACT

Distribution of electricity requires the implementation of an appropriate transmission infrastructure, ensuring the possibility of delivery from the place of production to the collection points. Considering the nature of electricity, its transmission over long distances is most often carried out by ground devices in the form of power lines. This causes the necessity of significant interference in the natural environment and the landscape, consisting in the location of these devices. In addition, around energy transmission lines there are generated electromagnetic fields, the negative impact of which limits or prevents the use of adjacent terrain.

The purpose of this article is to assess the impact of energy infrastructure development on the shaping of the natural environment and its reclamation after completed works. Two cases should be distinguished in this respect: permanent change of the landscape resulting from the foundation of technical infrastructure and temporary occupation of real estate related to construction activity. The first of them, apart from the obvious negative impact of transmission devices on the environment, is closely related to the concept of location damage, which refers directly to the loss of property values and, consequently, its value decrease. The second one can be considered in the context of device construction, as well as carrying out maintenance works on them. A prominent issue discussed in the publication is not only the reclamation and remediation of land used for agriculture, but above all the economic and ecological context, considering the specificity of agricultural areas.

KEYWORDS

transmission easement, landscape, environmental protection, reclamation, agricultural real estate

North beltway of Cracow - selected elements of impact on the environment and the real estate market

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ABSTRACT

The construction of such a large road facility as the city beltway cannot have an impact on the natural environment. In addition to the obvious benefits to transport, attention should be paid to the natural environment of the area, in particular noise and air pollution. In December 2017, the Minister of Infrastructure and Construction signed the investment program for the implementation of the northern Krakow bypass road. General Directorate for National Roads and Motorways the Krakow branch has announced an open tender for its implementation into the EU. Today, in our tender for the design and construction of the northern bypass road of Krakow, 8 offers received. All tenderers give the date of completion of all works within 47 months. The length of the two-lane section of the beltway is about 12 km, each roadway will have 3 lanes. The POK (North Beltway od Cracow) will run mostly in the area of the Zielonki commune, through the towns of: Zielonki, Bibice, Węgrzce, Bosutów, Dziekanowice and Batowice. The analysis carried out show a very large increase in the value of real estate located in the northern part of Krakow and adjacent areas in recent years. According to the authors, the construction of the northern beltway and easier access to the center of Krakow through the modernization of the November 29 Avenue will contribute to even greater interest in real estate located in this area. Real estate prices will certainly increase, rather only at the beginning of the investment. Residents will gain the comfort of an alternative transport line, but there will also be an increase in noise and air pollution, which is a particularly important problem in and around Krakow. The article presents the validation of these three issues in relation to changes in the real estate market in the commune of Zielonki.

KEYWORDS

bypass road, environmental impacts, real estate market

Sustainable formation of urban development on the example of the primary real estate market in Krakow

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ABSTRACT

Due to the high demand on the housing market, it may seem that every investment will find buyers' interest and the key is its economic dimension. Meanwhile, in the Krakow real estate market, one can observe the trend of SMART market creation, in which the added value is the quality of life of residents of a given investment, especially in terms of using renewable energy sources and ensuring a well-organized space around the investment. The implementation of intelligent energy networks and the widespread use of renewable energy sources will result in more efficient energy transfer, waste recycling, faster identification of the threat and repair after a possible failure. Using, for example, the resources of the National Fund for Environmental Protection and Water Management, the implementation of ecological solutions is not related to the excessive price of such investments, and guarantees a higher quality of life for new owners.

The article presents good practices in the design of housing estates in the city of Krakow. One of such closed settlements is "Osiedle fi", whose location guarantees good public transport, additionally underground parking places a lot of green areas outside, positively affecting the microclimate of the area. The buildings are made of natural materials and the common parts of the property are illuminated from solar energy. The use of renewable energy sources favors both the environment and reduces the cost of maintaining the property. Rainwater is also used. The next smart housing estate is "Osiedle Ozon". It is a comfortable housing estate with functional land development. Among its main attributes, it is worth mentioning a lot of greenery and naturally diversified terrain. There were used plant species, which have the ability to catch harmful chemicals or dust from soil and air. In this work, a statistical analysis was conducted to compare the prices of housing properties in these two selected settlements to the prices of real estate in the area, indicating statistically insignificant differences in the economic aspect, with significant differences in the quality of life of the potential buyer.

KEYWORDS

sustainable development, spatial planning, housing market, market analysis, renewable energy, SMART CITY

Analysis of the polylactide biodegradation by *Aspergillus niger* and *Penicillum minioluteum*

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ABSTRACT

Polylactide (PLA), due to its properties, is a promising material. It can completely displace other polymers from the plastic material industry in the future. In this study, biodegradation of PLA modified and unmodified with starch was tested.Samples of PLA film were prepared – cut into small pieces, disinfected by rinsing in 70% ethanol and weighed. The influence of two microorganism, *Aspergillus niger* and *Penicillum minioluteum*, on the degradation of PLA was analyzed. Samples were placed into liquid mineral medium with spores of these molds in various combinations and incubated for 3 months in the dark at 20°C. After the incubation the degradation of PLA was analyzed by weight loss and comparison the chemical structure of samples before the incubation with samples after incubation. The chemical structure was examined by Fourier Transform Infrared Spectroscopy (FTIR). The greatest weight loss was observed in samples incubated with *A. niger*. PLA samples containing 50% of starch and additional component reached 46% weight loss in culture of this mold. FTIR analysis showed significant changes in intensity of infrared absorbance. Moreover, there were maxima in spectra before the experiment which has not occurred in spectra after the incubation. This indicate that some chemical bonds had been completely broken.

KEYWORDS

polylactide, biodegradiation, molds

The chemical and microbiological assessment for the waste water treatment systems In the VillageWaters-project partner countrie - Lithuania

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ABSTRACT

The aim of this work was to make an enviro-hygienic (chemical and microbiological) assessment for the waste water treatment systems In the VillageWaters-project partner countrie - Lithuania. There are pilot where the technological changes will be conducted during the project. The pollution of untreated wastewater flowing into the Leitgiriai, Lithuania wastewater treatment plant has been assessed by identifying the BOD_7, pH value and concentrations of suspended materials, phosphorus and nitrogen. The results have shown that during the treatment process the wastewater is treated inefficiently and vary: submerged materials 29-47%, biochemical oxygen consumption in 7 days (BOD_7) - 88-95%, it means that the BDS_7 value in the released wastewater is higher than that in the inflowing wastewater; total nitrogen (N) –4-46%, total phosphorus (P) 2-86%. During the assessment it was found that the treatment of total nitrogen and ammonium nitrogen has changed the most (%). It was found that the values of nitrate nitrogen, total nitrogen, electrical conductivity were statistically significantly higher 500 m after the wastewater discharger than 100 m before the wastewater discharger. The differences between the ammonium nitrogen and total phosphorus concentrations were not significant.

KEY WORDS

VillageWaters-projec, waste water, enviro-hygienic (chemical and microbiological) assessment

Development of the Polish geothermal sector in the light of current possibilities of financial support for a geothermal investment

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ABSTRACT

Geothermal energy is an internal heat of the Earth, that is held to be a prospective and sustainable source of renewable energy, worldwide. In Poland, despite having significant amount of low-temperature geothermal resources (i.e. below 150°C), its share in the national energy mix remains marginal – it is still one of the last among other renewables. Currently, the utilisation of geothermal resources is related primarily to hydrogeothermal resources, however, extensive researches indicating the possibility of utilisation of petrogeothermal resources, i.e. energy stored in hot dry/wet rocks, have been performed. Geothermal energy is used mainly in space heating, recreation and balneotherapy. Nevertheless, the indication of possible electricity production is under research. It is known that the utilisation of geothermal energy resources entails a plenty of environmental benefits that are particularly important in the context of the present pollution problem. Therefore, the development of the geothermal energy sector is of relevant importance and with appropriate legal and financial conditions it may have a bearing on improvement of the quality of environment and, ipso facto, living in Poland. Thus, this paper presents numerous possibilities of obtaining a financial support for investments in geothermal energy sector. Selected funding and financial backing systems currently available in Poland are discussed. Authors emphasise the importance of opportunity of obtaining a financial support for an investment as one of the crucial factors for the geothermal sector development. Moreover, examples of installations implemented (or meant to be realised) within the country in the context of obtained funding are presented.
The paper has been prepared under the AGH-UST statutory research grant No. 11.11.140.031.

KEY WORDS
geothermal energy, Poland, funding, environment quality

Application of a Detection and Attribution approach to identify the impact of anthropogenic factors on local climate change

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ABSTRACT

The change of climate observed in the last few decades is marked by anthropogenic factors. It can be noticed especially in cities in which urban development dimensions create specific microclimate and make particular urban area unique. The crucial aspect of preparing urban mitigation and adaptation guidelines is to detect the most suitable emission scenario. Research institutes worldwide provide global and regional climate frameworks that are not allowing conducting efficient analysis at local scales. In the paper, for the purpose of downscaling data to the local scale, the empirical-statistical downscaling technique was applied to detect signals of climate change for local stations in Lower Silesia, Poland. The model was used to compare the statistically downscaled data from reanalysis datasets obtained from National Centre for Environmental Prediction and National Centre for Atmospheric Research (NCEP/NCAR) with ensembles from anthropogenically forced model runs. Subsequently, the existence of anthropogenic impact on climate changes was identified with application of Detection and Attribution approach. In first phase a test for consistency was performed and showed a significant link between observed and anthropogenically forced data. Then the attribution study was performed to find the climate scenario that is in positive relationship with observed local data. Detection of the significant change in local climate is important in conducting urban development processes based on new directions determined by climate changes.

KEY WORDS

climate change, downscaling, detection and attribution

The possibilities of using the broadleaf cattail seeds (*Typha latifolia* L.) as super absorbent for removing aromatic hydrocarbons (BTEX) from an aqueous solution

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ABSTRACT

Sorption of oil-related products (including mainly the propellants) is the very basic process that counteracts spreading these types of pollution into environment. Plenty of synthetic substances (including the monoaromatic hydrocarbons) both from the surface and underground waters. The aim of this study was to present the research's results on the possibilities of using the broadleaf cattail (*Typha latifolia* L.) seeds as a sorbent of monoaromatic hydrocarbons from an aqueous solution. In order to increase sorptive capacity, the seeds biomass was submitted for the process of mercerizing in diversified time and temperature in water and the NaOH soultion. The removal of benzene, toulene, ethylbenzene, o-xylene, m-xylene and cumene was carried out by means of the "batch method". All the conducted experiments have shown a high sorption level of the analysed pollutions from an aqueous solution. The best sorptive qualities appeared in the seeds drenched in 80^{o}C water for 4 hours (W) 97 g/kg, what was 9.06% more absorbed hydrocarbons in comparison to the control sample (C) and 26.8% more than the smallest seeds drenched in NaOH for 240 min. in the temperature of 80^{o}C (N). The process of the seeds mercerizing that was conducted with the use of hot water appeared to be most effective, but seeds without mercerisation (C) is actually the material which absorbs the least amounts of energy for preparation and had quite good sorption capacity too.

KEYWORDS

sorption, broadleaf cattail seeds, mercerization, BTEX

Improving the water quality in the Alqueva reservoir with Vetiveria Zizanoides to prevent the water hyacinth reproduction

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ABSTRACT

The topic of the project is to prevent the spread of an invasive species water hyacinth (*Eichhornia crassipes*) in the Alqueva reservoir. Its occurrence in the ecosystem causes many ecological and socio-economic problems. The spread of this species is caused by the lack of natural enemies in the environment and the ability to quickly grow and a high tolerance of environmental conditions. In the project, we paid special attention to improving the quality of water in the Alqueva reservoir, aimed at preventing the emergence of water hyacinth in the analyzed area. Measures that can be used to solve this problem are a combination of wetlands and rafts that will be introduced in the Mourão area. This will help in reducing and filtering nutrients and pollutants discharged from agricultural areas around Mourão. This solution has a low cost, high efficiency and includes phytoremediation with control of soil erosion, nutrient depletion and pollution in the Alqueva reservoir. The plant that will be used for this purpose will be Vetiveria zizanioides. This system should reduce the amount of nutrients in the Alqueva reservoir, which can allow the decreasing of water hyacinth and their spreading in the Alqueva reservoir. Other beneficial effects of lowering nutrient concentrations are: decreasing the algae blooms; get established levels of nutrients in water according with national and European legislation; improve the ecological quality.

KEYWORDS

water quality, invasive species, water hyacinth, water treatment, Vetiveria zizanioides

Mesophilic versus thermophilic anaerobic digestion of food waste as bioconversion methods

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ABSTRACT

The scale of food waste production increases with each year. More than 30% of the world's food production is wasted. Currently, there are not many methods allows for cost-effective and environmentally friendly management of the discussed waste. Economic, environmental and social problem create many possibilities for biorecycling and closed circuit economy. The European Commission assumes the support for the initiatives which are based on use agri-food waste conversion to a products for energetic and feed purposes (waste into energy and waste into feed).The aim of this study was to compare the possibilities of usage food waste as a monosubstrate in the process of continuous methane fermentation in meso- and thermophilic conditions. Process dynamic and stability were determined in terms of the following parameters: volume and composition of the biogas, pH and redox potential of the digestate during fermentation, FOS/TAC ratio, concentration of SCOD, VFA and ammonia. It has been proved that continuous methane fermentation of food waste is possible in both meso- and thermophilic conditions. However, the process in only effective at low OLR. In addition, thermophilic fermentation is less stable and more susceptible to collapse. This study was performed in the frame of the IN OIL project: An innovative method for bioconversionof by-products from food processing industry that was financed by the National Centre for Research and Development within the Lider VII Programme LIDER/5/0148/L-7/15/NCBR/2016.

KEY WORDS

food waste, methane fermentation, mesophilic fermentation, thermophilic fermentation

The impact of Bacillus megaterium on the solubilization of phosphorus from the sewage sludge

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ABSTRACT

The aim of this research was to analyze the influence of Bacillus megaterium bacteria on solubilization of phosphorus in a hygienized sludge. The tests were performed for two different temperature conditions, i.e. 21 and 36ºC. The experiment lasting 23 days focused on the analysis of the changes in the pH value and in the total number of mesophilic bacteria. During the experiment the proportions of individual forms of this element, changes in the concentration of bioavailable forms in sewage sludge and the amount of phosphorus assimilated by microorganisms were determined in the sediments using the Golterman phosphorus speciation. In addition, the IR spectra of the sewage sludge were analyzed to confirm the assimilation of phosphorus by microorganisms.The obtained results allow the conclusion that the population size of Bacillus megaterium bacteria changes, with the intensity of these changes depending on temperature. Organic acids produced in metabolic processes change the pH of the environment, which affects phosphorus solubilization and its speciation. The increase in the population of bacteria is accompanied by the increase in bioavailable phosphorous forms and thus the release of phosphorus contained in the hardly soluble forms in soil is accelerated. The above fact is extremely important when considering the use of sewage sludge for environmental purposes.

KEYWORDS

Bacillus megaterium, solubilization, sewage sludge, phosphorus, speciation of phosphorus in sewage sludge

Potential use of potato starch in foaming process of ecological loose-fill packaging materials: selected physical characteristics of foams

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ABSTRACT

Physical characteristics of foams based on potato starch were tested according to variable processing conditions, as the initial moisture content of blends (17, 18, 19%), screw speed (100 and 130 rpm), shape of the forming die (circular - 3 mm in dimension and ring - external crevice of 5 mm), as well as the poly (vinyl alcohol) amount added (from 1 to 3%, w/w). Starch foams were processed with the extrusion-cooking into expanded products.

The cutting force and resistance for compression were selected to evaluate using universal testing machine Zwick type BDO-FBO0.5TH (Ulm, Germany). For determination of cutting force (N) the Warner-Bratzler's equipment was used. The samples were cut at the test speed of 8.33 mm/s in 10 replications for all blends and processing conditions. The compression test between two flat plates to 50% of the original height of sample was carried out to determine the stiffness of the material described as the Young's modulus (MPa). The test speed was set to 3.00 mm/s and measurements have been made in the transverse direction to the diameter of the produced extrudates. The samples obtained during direct extrusion process were characterized by variable physical properties. Addition of increasing amount of poly (vinyl alcohol) into recipe increased the cutting force but, in the same time, decreased stiffness of tested foams. Results of F-test showed the most significant effect of the forming die used in experiments on cutting force values. But for the Young modulus, the most significant effect was identified for variable additive level.

KEYWORDS

extrusion-cooking, potato starch, ecological loose-fill packaging materials, efficiency, specific energy consumption; extrusion-cooking, potato starch, ecological loose-fill packaging materials, physical properties, mechanical properties

Potential use of potato starch in foaming process of ecological loose-fill packaging materials: effect of extrusion-cooking process parameters on process efficiency and energy consumption

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ABSTRACT

The aim of the study was to apply of potato starch as the basic raw material for processing of new environmentally friendly packaging loose-fill foams. Potato starch was mixed with poly(vinyl alcohol) in amount of 1-3% (w/w) and moistened with water to 17, 18 and 19% of moisture content. Processing of starch foams was developed using the single screw TS-45 extruder-cooker (Gliwice, Poland) with configuration of L/D=12. Foams were processed at the temperature below 120°C with various screw speed (100 and 130 rpm) and two types of forming dies: circular (3 mm in dimension) and ring (external crevice of 5 mm).

The measurement of the extrusion-cooking process efficiency (kg/h) was based on the determination of the mass of foamed starch-based materials produced in a given. The test was carried out in 5 replicates. The energy consumption of the extrusion-cooking process was measured including engine load and efficiency obtained. Energy requirements were determined based on the specific mechanical energy (SME) calculations (kWh/kg).

The results showed that processing efficiency of potato starch foams varied depend on poly(vinyl alcohol) level, shape of the forming die and screw speed applied. Statistical analysis, including F-test, characterized the effect of screw speed and the shape of the forming die as the most significant for processing efficiencyof tested foams. The analysis of the results of SME indicated the type of the forming die and initial moisture level have had the most significant effect on specific mechanical energy requirements during processing of potato starch-based foams.

KEYWORDS

extrusion-cooking, potato starch, ecological loose-fill packaging materials, efficiency, specific energy consumption; extrusion-cooking, potato starch, ecological loose-fill packaging materials, physical properties, mechanical properties

The use of seasonality indices for low flow regionalization

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ABSTRACT

Low flows, its regime and influence on biological function and stability of water ecosystem is a very important issue in hydrology. The information about low flow, with a given warranty is essential in water resources management among other things to assess the energy production in water power plant, for water intake, for systems of fish breeding, for agricultural irrigation, for biological flow and to calculate dilution of contaminants off into the river after sewage treatment plant. In the paper we examine seasonality indices for low flow regionalization. We used the seasonality ratio (SR), which is the ratio of summer and winter low flows and a cyclic seasonality index (SI) that represents the average timing of low flows within a year. We analyzed specific low flow discharges q95, i.e. the specific discharge that is exceeded n 95% of all days at a particular site. Data from 30 subcatchments in Upper Vistula basin, ranging in catchment from 66 to 2034 km^2 were used in the analysis. The data for calculations were a series of observations of daily discharge from the multi-annual period of 1963-2000 and were obtained from the Institute of Meteorology and Water Management – National Research Institute in Warsaw. Then, we classified catchments into two and three regions based on the calculated indices. In the last step we made regression relation between specific discharge q95 and metrological and physiographic parameters of subcatchments (for analysis 13 parameters were taken). We also compared model regression for each region with a global model regression.

KEYWORDS

low flow, seasonality indices, catchment

The use of hierarchical cluster analysis for grouping atmospheric precipitation in Poland

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ABSTRACT

The aim of this study is to present the application of statistical methods to assess the possibility of grouping precipitation according to their elevation above sea level and precipitation levels in the temperate climate of Poland. The country was divided into regions with similar levels of precipitation using cluster analysis by Ward's method.

The study used meteorological data on average monthly precipitation from 53 meteorological stations from the years 1981-2010. The selection of stations was dictated by the need to consider the variability in amounts of annual precipitation throughout the country. The data obtained were used to calculate average annual precipitation totals as well as average precipitation totals in the summer half-year (May to October) and the winter half-year (November to April) for Poland in the years 1981-2010.

The following conclusions from the analysis carried out in the study are, that grouping by means of Ward's method can be used to distinguish homogeneous areas with the same levels of precipitation. Both precipitation and the elevation, at which meteorological stations are located, are the basis for distinguishing clusters in Ward's method. With use statistical method six clusters were generated, for the elevation of the stations and average annual precipitation as well as average precipitation for hydrological half-years. The average annual precipitation for the clusters ranged from 530 mm (cluster 5) to 820 mm (cluster 2). The average precipitation for the winter hydrological half-year ranged from 190.1 mm (cluster 1) to 288.8 mm (cluster 5). The average precipitation for the summer hydrological half-year ranged from 326.3 mm (cluster 5) to 605 mm (cluster 2).

KEYWORDS

hierarchical cluster analysis, atmospheric precipitation, climate change

Precipitation of sediments containing struvite from aqueous solutions

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ABSTRACT

Uncontrolled formation of struvite ($MgNH_4PO_4 \cdot 6H_2O$) in sewage treatment plants is an unfavorable phenomenon. Many factors influence its formation, and the most important include the pH and concentrations of struvite-building ions, i.e. Mg^{2+}, NH_4^+ and PO_4^{3-}. In the research it was decided to determine the minimum concentrations of Mg^{2+} ions, at which precipitation of sediments containing struvite crystals occurs. The effect of the research was to determine the model by which it is possible to define the concentration of magnesium causing crystallization depending on pH and concentration of NH_4^+ and PO_4^{3-} ions. The XPS surface analysis of sludge from sewage treatment plants showed a similar composition in terms of calcium compounds with sediments obtained in own research. The existence of struvite was suggested, but the percentage of atomic percentages of connections to which struvite was classified is small and amounts to less than 4%. This means that sediments produced on technological installations is a mixture of various compounds in which pure struvite may constitute only a small part.

KEYWORDS

struvite, XPS analysis, wastewater treatment plant

Biowaste to biogas/biohydrogen: innovative Polish real-scale installations

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ABSTRACT

The Polish biogas market is relatively small (only fewer than 300 biogas installations, where 95 are agricultural biogas plants). However, it has one of the largest development potentials in Europe. It is estimated that, based on only bio-waste and waste biomass from agriculture, the total electrical capacity of biogas installations amounts up to 3500-4000 MW. If we also take into account the use of typical field crops, e.g. silage (as it is common in case of Germany or Italy), then the electric power could reach even 8 GW.

The Polish agricultural biogas market did not develop as co-financing for energy production from renewable energy sources (RES) was very low since 2012 (at a level below EUR 60 / MWh). In this situation, existing and designed biogas plants had to focus on innovative solutions increasing fermentation efficiency, reducing costs and failure rates. Hence, extremely innovative biogas technologies appeared, such as ProBioGas or Dynamic Biogas, which can be fully defined as 3rd generation technologies. Installations operating in these technologies are adapted to processing any kind of biological waste other than wood, are on average 20-30% more efficient than typical biogas installations dominating in Europe, moreover they are very stable and resistant to disruption of the fermentation process. Furthermore, it has also turned out that the biogas plant operating in ProBioGas technology (2 MW capacity) has one of the few capacity in the world for large-scale hydrogen production in the dark fermentation process. The tests performed in 2014 showed production capacities at the level of 2000 m^3 of hydrogen per day. The substrate for the hydrogen production were various types of agricultural waste and food processing.

KEYWORDS

biowaste, biohydrogen, biogas plants, fermentation, renewable energy

Evaluation of the intensity of soil erosion processes on the surface of forest skid trail using terrestrial laser scanning and GIS tools

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ABSTRACT

The terrestrial laser scanning was used in the terms of evaluation erosion processes occurred in the mountain forest in Western Sudetas on the surface of the skid trail. The measurements were performed with scanning resolution of 3x4 mm. Obtained points clouds have been interpolated to the digital terrain models with spatial resolution of 1 cm. This allowed evaluating the erosion phenomena using the differential models methods in the period of 2011–2013. Authors aim was to determine the intensity and spatial range of erosion phenomena and the volume of soil material loss resulting by erosion processes and human activities. The research was conducted in the terms of forest soil protection function and the limitations of these functions resulting from forest works. In the study it was analysed parts of the skid trail (ca. 110 m^2, ca. 20–25% average slope). It was determined that during the entire research period the amount of soil material loss was ca. 2.3 m^3. The erosion processes occurred mainly in the form of sheet erosion. The erosion processes in the form of sheet erosion occurred ca. 46% and 68% of trail sections area, respectively. Results of the study indicate that it is efficient to use TLS for the monitoring of the erosion phenomena, qualitative and spatial range assessment, also in difficult, highly relief, forest area. At the same time, it has been proven that intensive water erosion processes occur in forest areas, and the erosion processes are related to terrain relief and human activities.

KEYWORDS

skid trail, water erosion, TLS, DTM, differential models

Pelletization process of postproduction food waste

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ABSTRACT

The aim of the study was to determinate the influence of the content of peanut production sweepings (20, 30, 40, 50%) in a mixture with „sponge flour", which is a waste ganerated in bakeries, on granulator's power consumption and on the quality of produced pellets (density and kinetic durability). The granulation process was controlled using a thermovision camera, which allowed to determine the temperature distribution in the grnaulator's working system. The elemental composition (carbon, sodium, potassium, calcium and magnesium) of used waste was tested. There was also investigated the infulence of the pelleting process on changes in water activity of the densified mixture and obtained pellets. The results of the research show that an addition of peanut to pelleted sponge flour caused a decrease in power consumption of the granulator system, however at the same time affecting the deterioration of the quality features of the granulate, among others through the decrease of kinematic strength. The best quality pellet was obtained from a mixture of 20% peanut (high density and kinetic durability). Limitation in the further use of this type of mixtures for fodder purposes is high sugar content in sponge flour, however, they can be used as baits for fish.

KEYWORDS

food waste, pelletization, sponge flour, peanut, pellet quality

Efficiency of municipal wastewater treatment with the membrane bioreactor

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ABSTRACT

Strict regulations for treated wastewater enforce the implementation of technology to reduce pollution and minimize waste production. Biological membrane reactors (MBR) offer great technological possibilities by combining the typical activated sludge process with the membrane filtration. The paper presents the operation principle of MBR in Glogów Malopolski and its efficiency. Physicochemical tests of raw and treated wastewater as well as microscopic analysis with the use of FISH (fluorescence in situ hybridization) method were carried out. In addition, the level of electrical consumption during the operation of the wastewater treatment plant was presented. Wastewater quality analysis confirmed high removal efficiency of BOD_5, COD and suspension solids 94%, 92%, 88% respectively.

KEYWORDS

activated sludge, MBR, microfiltration, ultrafiltration, electrical consumption, FISH method

Application of geoinformation technologies for development of a project of wind power plant in the vicinity of town Dobromil in the foothills of Lviv Region

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ABSTRACT

Ukraine has a significant, but not yet used, wind power industrial potential, which is about 500 billion kilowatt-hours per year. Particularly promising in this respect are the south-eastern regions and the near Carpathian region. By level of development of wind energy, Ukraine has 21st place among the countries of Europe and 30th place among the countries of the world. The project of development of wind energy designed by National Academy of Sciences of Ukraine envisaged the construction of wind power plants in Ukraine by the year 2030 with a total capacity of 16,000 MW. Almost 36% of designed capacities were planned to be placed in the Crimea and Donetsk region. It is clear that under the current political conditions, these plans should be adjusted in the direction of the western regions, in particular the Carpathian region. The subject of our study is the area around the town Dobromil in Lviv region, where the investment project for the construction of a wind power plant is being implemented. At the first stage, an allocation of land for the construction of wind power plant is foreseen. This is low-value land which is not involved in economic circulation, but located in a rather complicated landscape, near residential area. At the next stage, the geoinformation analysis of the influence of relief, forests, residential and industrial buildings on the wind flows is carried out. The analysis took into account meteorological data, the location of the existing network of power lines, the planned location of wind turbine towers. We pay special attention to the assessment of possible negative impact of operating wind power generators on the environment, taking into account the sanitary and hygienic norms of Ukraine. 3D wind power model was created on the results of the research. The model is located in the Google Earth web service with purpose to inform the public and local government.

KEYWORDS

wind power engineering, selection of sites for construction of wind power generators, landscape analysis, three-dimensional modelling of landscape development

Water emissions and their reduction in village communities – villages in Baltic Sea Region as pilots (VillageWaters)

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ABSTRACT

VillageWaters project (2016-2019) funded by Interreg Baltic Sea Region programme brings together sparsely populated areas households and village communities, local authorities, small and medium-sized enterprises as well as research institutes. The project team consists of 13 partners from five countries that are Estonia, Finland, Latvia, Lithuania and Poland. The main challenge of this project is to develop practical tool for selection of the most practical, cost-effective and environmentally friendly wastewater treatment solutions for the scattered dwelling households not connected to centralized sewage collecting systems in order to decrease wastewater emissions into the Baltic Sea. During the project lifetime, the technological, social, economic and environmental data collection and assessments was done. The project is also conducted in pilot villages where optimal technological solutions were built up for the households. Based on the obtained results the Information Tool, a practical e-service system, will be published to help find the most feasible and environmentally friendly wastewater treatment solutions for homeowners in sparsely populated areas. The tool will be available as a prototype in May 2018 and fully developed by the end of the project. The project results will be also disseminated to all target groups by seminars, trainings, workshops and materials, using social media and digital solution (project website of https://villagewaters.eu/, Facebook, Q&A-forum, etc.). It is proposed that the outcomes of project will help households avoid unnecessary investments and operating costs when shifting to improved wastewater treatment solutions, and thus to encourage them to implement the new treatment systems.

KEYWORDS

Wastewater treatment, emissions reduction, nutrients removal, sparsely populated area, information tool

Water and wastewater management in Portugal: an overview

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ABSTRACT

Portugal developed several cycles of public water policies in the 20th century and in 1976 the environment was recognized as a social right at a time when only 40% of the population was connected to water supply and 17% to a drainage system.

Portugal entered the European Union in 1986 and the influx of European funds and legislation (Directive 91/271/EE, Directive 98/83/EC and the Water Framework Directive, which aim was to achieve a good status for all water bodies by 2015), related to quality standards of protection, preservation of water and environment were beneficial for the development of the water sector. The application of such legislation, the cost recovery principle and the 'polluter pays' principle are fundamental to improve management quality and efficiency.

The aim of this paper is to presents an overview of water and wastewater management in Portugal.

The available data, shows that the population: (1) connected to water supply increased from 50% to 96% between 1976 and 2016; (2) supplied with quality drinking water increased from 50% to 98.7% between 1993 and 2016; (3) covered by wastewater treatment plant increased from 31% to 82% between 1995 and 2015. The results of the River Basin Management Plans showed a good status for surface water and groundwater of 52% and 81%, respectively.

The next challenge in Portugal is to cover the remaining 20% with appropriate wastewater treatment plants, reach a good status in all water bodies by 2027 and provide 99% of quality drinking water by 2020.

KEYWORDS

water; wastewater; management; Portugal

Floating bed performances for river restoration: A case study of Água Forte stream

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ABSTRACT

The surface water in "Baixo Alentejo" region (Portugal), are known to have excess nutrients and metals due to farming practices and mining activities, respectively. The surface water restoration promoted by floating beds (floating platforms and rooted aquatic plants) is an emerging technology, under developed in Portugal. The aim of this study is to test at a pilot scale the efficiency in removing existing pollutants in the water course of Água Forte stream. For this purpose, a pilot scale was constructed (two PVC tank with 1 m^3 each: control (without plants) and floating bed (constructed with PET and planted with Vetiveria zizanioides), both were filled with water volume of Água Forte stream).The results of Água Forte stream water quality characterization reveal that: 1) it should not be used for irrigation; 2) the stream can be classified as a "bad" ecological status; 3) the water quality can be considered as a typical acid mine drainage (AMD), because it presents high concentrations of sulphates (SO_4^{2-}), acidic characteristics (pH<3.3) and high metals concentrations. The monitoring pilot scale results shows an average removal efficiency of 8%, 38%, 28%, 12% for sulphate, thiosulphate ammonium nitrogen and iron respectively. The Vetiveria zizanioides survived and no signs of toxicity appeared, seems to be a good indicator of its ability to minimize the effects of Acid Drainage Mine in the watercourse and to improve the quality of surface water bodies.

KEYWORDS

Floating bed; acid drainage mine; Vetiveria zizanioides; restoration

Marginal cost curve of air pollution reduction as a tool of air quality management: Krakow case study

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ABSTRACT

The problem of air quality is an urgent, and widely discussed political issue nowadays. Reducing the air emissions is an expensive element of air quality management which can be reached by set of different independent means. To determine the proportion between the different alternatives the concept of marginal cost (MC) can be used. Information on marginal cost curves (MCCs) can help to compare cost effectiveness of alternatives. This approach can support the decision making, planning and financial balancing of the most beneficial activities or estimation of the expected environmental effects. The aim of the paper is to estimate the particulate matter (PM) marginal costs reduction curve for the city of Krakow. The analyzed emissions come from the typical apartment building types heated by different methods. The compared options are different heating options for different types of buildings as a function of the emission volume. Three typical buildings in the city were adopted for the analysis: a single-family house, a pre-war apartment building and a modern block of flats. As the analyzed methods of emission reduction, the modernization of the heat source, insulation of walls or replacement of windows in buildings was considered. For each of the scenarios, the costs as well as the expected effects of PM emission reduction were estimated. Then, the marginal costs of each analyzed method of PM emission reduction were calculated for the whole city, and presented in form of an ordered chart.

KEYWORDS

urban air pollution, particulate matter emission reduction, marginal cost curve

The use of biofilters in municipal economy facilities

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ABSTRACT

Composting produces several hundred different substances. Among them a considerable number of states active fragrance compounds. Composting technology and method of conducting the process are important elements.Due to the different ways of conducting the composting process, there are also areas of odor emissions. Similarly the volume of emissions. Depending on whether the process is conducted statically or dynamically, in a natural or artificial way and also in an open system (e.g. field prism) or closed (reactors, containers, encapsulated plots), the amount of odorant emitted will be uneven. One of the methods is the use of biofiltration. The biological filter for air purification is designed to remove volatile air pollutants leaving the various installations. By using a suitable filter bed, total organic and inorganic carbon, sulfur and nitrogen compounds such as ammonia and hydrogen sulfide can be reduced. They are part of odors that emerge, for example, from a composting plant. The use of biofilter eliminates polluting emissions, which in practice means reducing the negative impact on the environment and neutralizing odors.

KEYWORDS

biodegradation, biofiltration, odour, composting

Forecast of water erosion of agricultural decisions in Georgia with regarding climate change

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ABSTRACT

Prediction of the water erosion of agricultural lands in Georgia under the climate change consideration is given in the paper. Based on the implemented scientific researches in Georgia, the main challenges that are appeared against the agriculture, are revealed, particularly: for the East Georgia – it means drought, hail, degradation and erosion of lands, and for the West Georgia – distribution of crop diseases, degradation and water erosion of soils. Taking into consideration the climate change, the average indicator of Water erosion risk at the agricultural lands in Georgia, which reaches 0.55 ha and quantitative indicators of soil water erosion along regions of Georgia for the two predictive periods incl. 2021-2050 and 2071-2010, have been evaluated.

KEYWORDS

water erosion, climate chance, agricultural land, forecast

Advanced oxidation treatment of composting leachate of food solid waste by ozone-hydrogen peroxide

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ABSTRACT

Aims: The research was conducted to investigate the efficiency and possibilities of advanced oxidation process based on ozone-hydrogen peroxide. The process was used as a post-treatment step of utilisation composting leachate.
Materials and Methods: Leachate samples was collected from the typical composting plant with the aerobic biological treatment system. The samples were conditioned in "ozone reactor" without dilution. The effectiveness of the treatment process was measured by pH values (4.0-9.0), H_2O_2 concentrations (2-5 g/dm^3), ozone doses (5-20 g/h) and reaction times (5-30 min).
Results: The highest removal efficiencies were achieved 85% and 92% for chemical oxygen demand (COD) and biochemical oxygen demand (BOD_5). The optimum process parameters was at pH 6.5, 4.0 g/dm^3 H_2O_2 concentration, and 10 g/h of ozone dose. The optimal reaction time was 15 min.
Conclusions: The O_3/H_2O_2 advanced oxidation process was found to oxidize COD and BOD_5 of the composting leachate. After process noticed that the biodegradability of leachate decreased after oxidation treatment. The oxidation reaction could be used as a feasible technique for composting leachate treatment.

KEYWORDS

5 days biochemical oxygen demand removal, chemical oxygen demand removal, composting leachate, oxidation reaction

A comparison study on the catchment management on the magnitude of the total solids load conveyed by the stormwater sewer system – case study

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ABSTRACT

The paper is an attempt to establish dependence between concentration and loads of total suspended solids and individual parameters of precipitation events. That issue is related to the characteristics of two urban catchments located in the city of Kielce (one is in the city centre, and the other at the city outskirts). The runoff events observed in the period of investigations (years 2009-2016) showed a great diversity. The values of the peak flow ranged from 42 dm^3/s to 542 dm^3/s, and event duration varied from 93 min to 515 min. Additionally, the analyses performed for the study revealed substantial differences in the values of total solids concentration and loads in stormwater from the catchments of concern. The highest total suspended solids (TSS) concentration in the stormwater for the catchment located at the city outskirts was 252 mg/dm^3, whereas for the catchment in the city centre that value was almost 30 – fold higher and amounted to 7432 mg/dm^3. The analysis of the runoff first flush with respect to the mass of total solids in individual rainfall events showed substantial differences in the course of the process depending on the type of catchment management. In the densely built-up area (city centre), the initial 25% and 30% of the volume of runoff transported 25-41% and 30-48% of the solids mass, respectively. In the other catchment, with low and sparsely located buildings, the maximum values of TSS mass were considerably higher and amounted to 22-83% and 28-87% for the respective flush volumes.

KEYWORDS

urban catchment, stormwater treatment plants, total suspended solids, first flush phenomenon

Application of the theory of game against nature in the assessment of technical solutions used in river regulation in the context of aquatic plant protection

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ABSTRACT

Anthropogenic transformations of riverbeds threaten the ecological safety of water ecosystems. Therefore it is necessary to take actions to maintain the proper condition of waters and associated ecosystems. The aim of the paper is practical application and introduce possible uses of the game theory in the design of regulatory works including ecological aspects. The analyzes were based on the results of field studies carried out in growing seasons from 2008-2014 in small and medium-sized lowland watercourses in Lower Silesia. The field study included an inventory of vascular aquatic plants and the determination of the degree of their bottom coverage.Studies showed that regulatory works cause qualitative and quantitative changes in the vascular plant communities. Analysis of these changes, taking into account the range and conditions of works, allowed to assess the possibility of using in the decision-making process in the design of regulatory works the decision-making rules, such as: Savage's, Bayes's, Hurwicz's or Maximax rules.

KEYWORDS

aquatic plants, game theory, Hurwicz's rule, Maximax rule, river regulation

Evaluation of the impact of selected environmental aspects on the shaping of the land market on the example of the Wieliczka commune

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ABSTRACT

The land market is usually influenced by many factors, but the key to some of them is decisive when buying a property. These are both physical features of the property, such as the area, shape or class of the land as well as external factors related to the popularity of the area or the availability of communication. The group of factors that decide about the purchase is certainly the vulnerability of land to natural phenomena related to mass movements. They belong to factors that have a very negative impact on the price of real estate, limiting the possibility of its use, and above all buildings. In a situation where data on mass movements are available in a given area, these data directly affect the provisions of the study of conditions and directions of spatial development of the commune and, as a consequence, also local plans. The article analyzes the impact of landslide areas on property prices. The research was carried out in the municipality of Wieliczka where in 2008 a comprehensive assessment of mass movements was carried out, defining their character and making their classification.

KEYWORDS

real estate value, landslide area, valuation, environmental due diligence, classification trees

The land classification in the modernization and updating cadastre process

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ABSTRACT

Land classification is one of the processes directly related to the real estate cadastre. The class of the land together with the determination of its range are one of the main attributes of ground parcel. The class of land affects directly the amount of agricultural tax. It also has a significant impact on the prices of agricultural land and the implementation of investment processes on agricultural land. The principles of protection of agricultural land link the class of land with the possibility of qualifying the land for investment purposes both at the stage of spatial planning and obtaining a building permit. For this reason, the timeliness of the cadastral inventory in terms of classification is important for both tax and investment reasons. The article presents the legal aspects of modernization and updating of the cadastre in the field of land classification. Problems appearing in such a process and possible solutions are indicated.

KEYWORDS

land classification, real estate cadastre, modernization of cadastre, cadastral update

Development and investigation of the UAV for aerial surveying

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ABSTRACT

Scientists of the Institute of Geodesy in National University Lviv Polytechnic and manufacturers of Abris Design Group consistently designed and studied several models of UAVs, in order to create a perfect model, which makes it possible to organize aerial surveying for topographical purposes. As a result of previous experimental works, technical requirements for the creation of UAVs were defined. It is for these requirements one of the latest model UAV Arrow was constructed. To test the model of the aircraft, the technological scheme of testing has been developed in order to identify design deficiencies and obtain appropriate certified aerial photos for further elaboration: to create large-scale topographical plans and orthophotomaps. As a result of pilot works with the use of UAV Arrow, possible problems related to the UAV launch were identified and ways to eliminate them were given. As a result of the testing aerial surveying from the Arrow UAV, 132 images from 7 routes were obtained. In order to assess the accuracy of determining the coordinates of points of the locality, there were marked 57 points. The coordinates of control points were determined during the execution of the horizontal and vertical tie-in by GPS-receivers Trimble R7 in RTK mode. After the creation of orthophotomaps, in the Digitals software package, using these materials the coordinates of the above-mentioned control points were measured and the MSE were founded. MSE for planned coordinates were: m_x=0,19 m,m_y=0,11 m, which confirms the ability to create plans in scale 1:2000. To determine the operation of the aerostructure of the Arrow aircraft, an aerial survey was carried out from the Trimble UX5 UAV of the same site in Vynnyky. Comparative analysis of the angles of yaw, roll and pitch of the Arrow and Trimble UX5 UAVs on each route was made.

Efficiency of removal of impurities from surface water in a conventional water treatment system

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ABSTRACT

The article contains an assessment of efficiency of removal of impurities from surface water using the technology employed by "Raba" plant of the Municipal Water and Sewerage Company in Cracow. Research conducted by the laboratory staff shows that the functioning process system for water treatment makes it possible to obtain water with parameters corresponding to the currently applicable regulations on the quality of treated water at the outlet of the plant. Furthermore, the paper also includes an analysis of the possibility to use modern treatment methods such ion exchange, reverse osmosis and biological processes. They make it possible to limit significantly the quantities of biogenic compounds and salinity indicators which results in the stability of the supplied water being maintained. Selected microbiological indicators during the treatment process and physicochemical parameters in raw and potable water underwent statistical analysis. In the first case, only Clostridium perfringens bacteria were analysed. The other bacteriological parameters in the water production process gave a result of 0 cfu/100 ml. In the second case, the average rates of removal of impurities were calculated in order to check the efficiency of the treatment process. In the examined water, the highest efficiency of removal of impurities was observed with regard to the following indicators: nitrates(III), turbidity, colour, ammoniacal nitrogen and phosphates. The research conducted showed that the quality of treated water was affected by the degree of pollution of raw water and the use of appropriate stages of the process system which removed impurities and neutralised pathogenic microorganisms.

KEYWORDS

treatment, water pollution, raw water, potable water quality

Comparative analysis of selected water disinfection technologies with the use of life cycle assessment

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ABSTRACT

The objective of the paper is to use life cycle assessment to analyze the environmental impact ultraviolet radiation and electrolytically generated sodium hypochlorite use in the process of water disinfection at "Raba" plant of the Municipal Water and Sewerage Company in Cracow as well as in the water supply network. The analysis included water chlorination products from the group of trihalomethanes and chlorine concentration. Two scenarios are developed for water disinfection life cycle: (1) historical, in which gaseous chlorine is used as a disinfectant and (2) actual, in which UV radiation and electrolytically generated sodium hypochlorite are used for that purpose. As the results of primal analysis show, change of disinfectant quantitative changes in THMs and free chlorine in water supplied to the water supply network. The role of life cycle assessment is to determine whether the change impacts the overall environmental impact of disinfection process. Functional unit in the assessment is defined as yearly cycle of water disinfection. The assessment uses the data on flows and emissions streams in selected water treatment plant. Environmental impact is assessed with ReCiPe method and its midpoint and endpoint impact category indicators. ReCiPe indicators are calculated with the use of SimaPro software and ecoinvent 3 database.

KEYWORDS

LCA, drinking water, water disinfection, chlorination

Impact of environmental and climate conditions on the investment potential of real estate in the belt of the Gulf of Gdansk Coast

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ABSTRACT

The subject of this publication is to determine what environmental and climatic factors can significantly affect the value of real estate. As a research object, there was chosen area surrounding the Gulf of Gdansk, which, like the entire coast, is attractive for investment and constitutes an interesting object as a space with a special focus on tourism, including short-term rental. Progressing climate change is particularly affecting this sector. It is safe to assume that unfavorable environmental conditions can significantly change the attractiveness of this area. Therefore, the research hypothesis about the correlation between climate aspects distinguishing the coastal belt and the distribution of real estate prices in the selected area has been verified. The area of the Gulf of Gdansk Coast and the technical and protective belt were analyzed. The weather situation on the coast is different from that prevailing in the rest of the country. There are strong and gusty winds, local floods, but at the same time a natural landscape, proximity to the sea and clean, iodized air. Other possible climatic factors have also been tracked, i.e. temperature, sea level and possible changes that may occur over the next years. Analysis were based on the data of the KLIMAT project entitled "The impact of climate change on the environment, economy and society", and the Government Project KLIMADA and SPA analyzes. An in-depth analysis of the problem of combining planning documents for the maritime sector influencing the Study of Spatial Development of Polish Marine Areas with Local Spatial Management Plans, introduced Flood Risk Maps and Flood Risk Maps was also conducted.

KEYWORDS

investment value, climate change, environmental impacts, short-term rental

Spatial management as a factor supporting flood protection

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ABSTRACT

This publication presents the issues related to cadastre and real estate management in flood protection. Cadastral data supported by other additional data is the basis for taking action in situations of natural hazards. A real estate cadastre is an important element in the implementation of a real estate acquisition plan. It allows for preliminary assessment of the negative impact of the project, change of the concept and, as a result, expropriation and compensation regulation. In parallel with the activities related to the acquisition of real estate, it is possible to regulate the legal status of other properties. In this publication, the analysis is based on the document entitled "Plan of obtaining real estate and resettlement for the Flood Protection Project in the Odra and Vistula basin, Component 3B: Protection against Sandomierz flood and Tarnobrzeg, Contract 3B.3, flood protection Tarnobrzeg - stage 1 (Wisła 1) ". This area is the research material of actions changing the forms of land management in order to increase the safety of areas exposed to floods. The effects of carrying out this project were an important part of the work, including restrictions in the use, loss of real estate. The implementation of a flood protection project may have a negative impact on the economic status of people living in the areas where the activities were planned. These may be restrictions on the use of real estate, in particular the loss of a part or the whole of the property as a result of expropriation. Ultimately, such actions may result in the resettlement of residents. As a part of the study, the compensation for particular entities was described in detail. The results of surveys confirming the lack of a negative impact on the economic situation of people affected by the project implementation were presented.

KEYWORDS

flood protection, cadastre, expropriation, regulation of legal status, compensation

Energy analysis of building biogas plant at the poultry farm

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ABSTRACT

Because of the high request for the energy and less number of fossil fuels, we have to used more renewable sources of energy. Renewable energy means energy from the sun, wind, water, Earth and also energy from biomass. The number of waste from agro-food industry allows to use it as a substrate at the biogas plant. Moreover, in addiction to advantage connected with the environmental protection, it can also give economically benefits. The aim of this work was to made energetic calculations. Potential biogas plant will be located near the poultry farm in village called Sowno (west-pomeranian voivodeship). The research on methane efficiency of the substrates in batch culture technology was carried out in the Laboratory of Ecotechnology at the Institute of Biosystems Engineering (PULS) on the basis of internal procedures, based on adapted standards: DIN 38 414-S8 and VDI 4630, commonly used in Europe. Obtained results allowed to determine the volume of the fermentation tank being part of the proposed biogas plant – 500 m^3 and fermentations pulp storage tank with a volume of 700 m^3. Moreover, the number of estimate production of biogas is 434 677,65 m^3 with using 2 118,60 Mg of substrate. Basing on these results estimated power of biogas plant would be 112 kWe electricity and 120 kWt of heat.

KEYWORDS

biogas, poultry, energy, chicken manure

Reliability indicators of pollutant removal in one-stage constructed wetland with vertical flow in different seasons

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ABSTRACT

The paper specifies the technological reliability indicators of the removal of organic and biogenic pollutions in a one-stage constructed wetland (CW) wastewater treatment plant with vertical flow. In the above-mentioned system, common reed (Phragmites australis) was planted. The CW treated domestic wastewater, being the average flow rate 17.8 m3/d. The analyzed system is located in south-eastern Poland, where the climate is temperate transitional. The tests were carried out during the 16-year exploitation of the sewage treatment plant (1995-2010). During this period, sewage samples were collected in 4 seasons (winter - February, spring - may, summer – August and autumn - November) to be analyzed. Altogether 49 series of analyzes were carried out during the research and 98 samples of the sewage, both from the inflow and the outflow of the wastewater treatment plant, were collected. The measured parameters were: BOD_5, COD, total nitrogen, total phosphorus. On the grounds of the reliability analysis performed on the basis of the Weibull probability model, it was found that the reliability indicators of pollutions removal in the tested constructed wetland system are higher in summer and autumn (August, November) than in winter and in spring (February, May). It was shown that exceedance of the admissible values of pollutant indicators in treated wastewater is dependent on the season (air temperature) and it occurred mainly in the winter period (February). It was proved that the tested CW does not provide effective elimination of biogenic indicators (nitrogen and phosphorus), as evidenced by small values of reliability indicators. To increase the technological reliability of the tested treatment plant, it is proposed to expand the existing system and create a hybrid system consisting of two beds with vertical and horizontal flow and a special P-filter.

KEYWORDS

reliability indicators; Weibull reliability method, pollutant removal; wastewater treatment; one-stage constructed wetland

The influence of limitation of surface active agents amount in detergents on concentration and load of phosphorus in domestic wastewater in Poland

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ABSTRACT

The aim of the research was an evaluation the influence of limitation, by legislation, amounts of surface active agents in detergents on real changes of concentrations and loads of total phosphorus in domestic wastewater. The composition of raw wastewater, inflowing to three chosen treatment plants in the 13-years period of the research (2003-2016) was included. Since the year 2003 in Poland, first limitation on the content of phosphates in products used for washing and cleaning were introduced. By the year 2016 other limitations, both in Polish as well as European legislations were implemented. In Poland, there is currently lack of published research results clearly showing, whereas the limitations have caused significant changes in the concentrations and loads of total phosphorus in domestic wastewater. In the article it has been shown, that from 2003 to 2016 concentration of total phosphorus in the domestic wastewater decreased from 50 to 67% depending on the object. The consequence of the reduced concentrations of the total phosphorus is the significant change in the unit loads of this nutrient. So far, in Poland unit load of total phosphorus between 1,8 to 1,9 $mgP \bullet d^{-1}$ per capita was taken, meanwhile carried out research had shown that value of the unit load of total phosphorus should be currently taken between 0,5 to 0,8 $mgP \bullet d^{-1}$ per capita. These are values by more than 50% lower than so far taken. Obtained data show the need of verification of the parameters currently used to designing the dephosphatation chambers of biological reactors.

KEYWORDS

surface active agents, phosphorus, domestic wastewater, treatment plan

The trends of changes in nutrient pollution concentrations in the Wisłok River water at the intake of water intended for public supply, Poland

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ABSTRACT

The paper presents changes in concentrations of 7 biogenic indices in the Wisłok River water determining water treatment processes in order to obtain water intended for consumption. The investigations were conducted in 2004–2013, water samples were collected at km 67.9 of the river at the surface water intake for water supply to the Rzeszów city dwellers. Analysis of the research results allows to forecast technological and organizational changes in the abstracted water treatment processes. It was found, that only mean concentration of Kjeldahl nitrogen exceeded the value admissible for class I, which allowed to classify the Wisłok River water to class II with good potential and determined the water quality category as A3, which indicates the necessity for high performance physical and chemical treatment. Downward trends for the contents of tested nutrients occurred during the period of investigations, except for nitrite nitrogen. Statistically significant downward trends were registered for ammonium nitrogen, Kjeldahl nitrogen, total nitrogen and phosphates. The decline in nutrient concentrations in the water's Wisłok a tangible result of introducing new standards of water resources management in the catchment, compliant with the European Union legislation.

KEYWORDS

nutrient pollution, surface water, water quality, anthropopressure, trend

Influence of operation time, hydraulic loading and drying on phosphate sorption capacity of Ca based mineral filters

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ABSTRACT

Three parallel mineral filters with the volume of 2550 cm^3 each were used for phosphates removal from swimming pond water. Filters worked continuously in saturated conditions. Hydraulic loading rates (HLRs) were 15 m^3/m^2h, 15 m^3/m^2d and 5 m^3/m^2d for filter 1 (F1), filter 2 (F2) and filter 3 (F3), respectively. In the middle of the length of the filter, inspection hole was located for sampling of filtration material. Samples were collected in 55, 87 and 120 day of the filters operation. Phosphate sorption capacities of materials sampled from the filters were significantly lower than the sorption capacity of the fresh material, and their values varied between filters (different HLRs) and sampling events. In case of F3 (slow filter) decreasing P sorption capacity was observed with the time of operation. However, filtration material sampled from filters F1 and F2 had higher P sorption capacity at the end of the monitoring period (day 120th) that in time of second sampling (day 87th). This may suggests that the biofilm developed on the grains of the filter blocked the contact between reactive material and treated water and breaking the biofilm due to the faster flow (F1 and F2) resulted in increased filter sorption capacity. The remaining material sampled from F1-F3 has been dried and also tested for P sorption capacity. Results showed that air drying increased P sorption capacity of material, what makes periodic drying of filters a simple option of filtration material regeneration

KEYWORDS

mineral filters, phosphates, sorption capacity, swimming pond

Phosphates removal from treatment wetlands effluent by selected adsorbents

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ABSTRACT

Nowadays, popularity of treatment wetlands (TWs) is increasing as alternative solution for rural areas and small town. Conventional wastewater treatment plants (WWTPs) in such places have not economic grounds and septic tanks used in households usually are cause of leaking of contamination to groundwater. Thus TWs are finding as low-cost and also effective system to treat domestic wastewater. The aim of this study is to find suitable adsorbing material for application in an additional treatment unit where treatment wetlands do not provide sufficient PO_4^{3-} reduction level.

Material M1 is a fine-grained by-product of thermal treatment of carbonate-siliceous rock (opoka) with high content of calcium carbonate $CaCO_3$ in temperature 700°C. Particular disadvantage of material M1 can be very high level of pH (11-12) and causing alkaline solution. Material M2 is lanthanum-modified bentonite (LMB) and was already used for reducing content of phosphorus compounds in lakes and other water bodies to treat effects of eutrophication process. Lanthanum-modified bentonite consists mostly SiO_2 and Al_2O_3 (~80%)

The study was conducted on effluent from small (60 pe) treatment wetland (TW) in northern Poland where Hybrid Treatment Wetland (HTW) system was provided. Sorption capacity of material M1 was low and equal 0.9 mg/g. For material M2 this parameter was equal 2.1 mg/g.

Lanthanum-modified bentonite has shown better abilities to reduce phosphates from wastewater that material M1. Also performed study revealed that presence of others contaminations in wastewater are causing difficulties in phosphates removal.

KEYWORDS

lanthanum-modified benthonite, phosphorus removal, wastewater, treatment wetland

Light-emitting-diode (LED) phyto-installations for selected plants species

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ABSTRACT

The effective use of light energy in the crop-growing in sheltered ground depends on the spectral composition of the LED phyto-installations, the amount of illumination (irradiance), and the duration of the daily plant irradiation (photoperiod). To increase the plant productivity in sheltered ground conditions, it is necessary to learn how to manage its photosynthetic activity. In the open ground, the process of photosynthesis is primarily affected by solar radiation, temperature, the content of CO_2 in the air, availability of water, etc. In the sheltered ground, many parameters are controlled and maintained within the required limits. Taking into account the fact that up to 95% of the crop yields are generated from the assimilated photosynthetic active radiation (PAR) energy, it is necessary to ensure that the plants use the energy of this range from the LED phyto-installations as efficiently as possible. A plant is an accumulative bio-object, i.e. its development depends on the accumulated dose of the spectral components of the RAR zone.

The article presents the results of experiments on the use of LED phyto-installations for irradiating meristem some species of plants. The offered LED phyto-installations are assembled from different in colour LEDs. The research is based on the hypothesis that in order to increase the productivity of a culture of foreign origin, it is necessary to simulate the conditions of its genetic homeland. By using the instrumental software package of industrial automation “CoDeSys”, we implemented doses of the spectrum of zones of PAR for the genetic homeland of potatoes. For this purpose, we have developed special programs for programmable logic controllers (PLCs) that control the operation of colour LEDs in the LED phyto-installation and allow simulating the dose of the spectral components of the PAR zone in any geographic area during the required period of time.

KEYWORDS

light-emitting-diode phyto-installations, LED phyto-installations, spectral density of radiation, plant meristem, photosynthetic active radiation (PAR)

Dam reservoir bottom sediment as a ground seal in embankments - filtration and stability

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ABSTRACT

The paper presents an analysis of possibilities of using dam reservoir sediments as a material for building sealing elements in embankments. As research material bottom sediments from Rzeszow Reservoir were used, which according to geotechnical standards are classified as multi-fraction silt, low permeable, with high organic content. Based on the carried out usability analysis it was stated that the tested bottom sediments can be allowed for use as construction material for sealing elements of hydraulic engineering embankments. In order to verify the suitability of this material, calculations were carried out for stability and filtration through embankments with a seal in the form of a core made of the sediments. These calculations confirmed the suitability of the tested sediments for this purpose. By using a core made of bottom sediment, the volume of seepage on the downstream side during a continuous or variable backwater was significantly lower in relation to an embankment without a core, and the filtration curve did not extend to the downstream slope. The tests and calculations carried out allowed to determine the possible use of sediments in civil engineering. As a result, the sediments could provide an alternative to natural soil whose resources are limited and non-renewable.

KEYWORDS

soil core, levee, stability analysis

Conditions spatial and social of construction of agricultural biogas plants

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ABSTRACT

Agricultural biogas plants raise much controversy in Poland. On the one hand, they are an opportunity for agriculture, on the other hand, they become a source of problems for the environment, due to the protests of the local population. Residents do not agree to build biogas plants near their homestead, because they are afraid of nuisances related to its functioning. The place for the location of the biogas plant must be carefully selected taking into account technical and social aspects. The work is a case study of the assessment of the area of a selected rural commune in terms of the possibility of locating an agricultural biogas plant. The potential of substrates located on the territory of the commune was found: 7 large farms, enterprises producing and processing soft fruits, which can be counted among potential suppliers of substrates for biogas plants. The analysis regarding the selection of the appropriate location for the agricultural biogas plant has been assigned to the places designated in the Spatial Development Study as areas with the possibility of locating devices generating energy from RES. These areas underwent a detailed analysis, thanks to which one location was selected for a biogas plant that met all the given criteria. Surveys have shown that the main concern of residents regarding the construction of a biogas plant is the unpleasant smell, but also noise, pollution and the danger of an explosion. Many of people expressed their satisfaction with the possible construction of biogas plants and the will to cooperate, mainly through the supply of substrates, as well as the purchase of energy.

KEYWORDS

biogas plant, nuisance, location, substrates, social awareness

Emissions of pollutants due to the biomass combustion of various plant species

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ABSTRACT

Biomass is treated as an ecological, environmentally safe source of energy. However, its combustion involves the emission of various pollutants into the air. Most of the substances that are emitted to the atmosphere during the combustion of biomass were taken earlier by plants during their growth. Biomass in comparison with hard coal is characterized by lower calorific value, lower content of carbon element, and at the same time high humidity and high diversity depending on the origin. The paper presents the results of research on the emission of selected pollutants (CO_2, CO, NO_x, SO_2, dust) that may arise during the combustion of several plant species, treated as energy plants (Miscanthus, prairie cordgrass, Virginia mallow, multiflora rose, Jerusalem artichoke, etc.). The size of the emission was related to the unit of mass, yield obtained from the cultivation area, as well as the equivalent of hard coal of the same energy value. The results of the research is that the combustion of biomass is not neutral for the environment, and the diversity of its composition shows the appropriateness of creating mixtures of biomass of various origins.

KEYWORDS

biomass, combustion, pollutants emissions, chemical content

Energy potential of hydrotechnical constructions on the Włodawka River

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ABSTRACT

The increasing of electricity demands the search for its alternative sources. One of them is hydropower, and in particular underestimated energy production in small hydropower plants. Hydroelectric potential in Poland is used only in a dozen or so percent, which obliges us to look for facilities useful for the location of small hydroelectric plants.

The article contains the results of research aimed at estimating the amount of energy that can be produced in the case of construction of small hydropower plants on existing hydro-technical structures on the Włodawka River. Theoretical power potential in each of the objects was calculated on the basis of the damming height and the flow rate. The technical capacity of the power was calculated assuming the efficiency of the power plant at the level of 88%. The superior functions of weirs were also taken into account: economic, retention and flood control, reducing the potential amount of energy possible to produce.

In its part, the river flows through areas involving various forms of protection. This can be a serious limitation for the construction of hydroelectric plants. However, the placement in the protected area does not eliminate such a location, especially when using technology that has a minimal impact on the environment. Such a solution may be the construction of a hydropower plant equipped with an Archimedean screw turbine.

KEYWORDS

hydroenergy, small hydropower plant, water-damming device

Potential of biogas production from animal manure in Poland

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ABSTRACT

The intensive development of technologies in agricultural and new investments in farms contribute to increase of energy demand. One of the solutions to this problem can be electricity and heat production in installations, which using renewable sources e.g. biogas. The substrates to production of this gas in anaerobic digestion, except plant materials, can also be animal feces and manure. It needs to be highlighted that Poland is one of the leader in European Union in animal breeding. However, there is no precise data in the literature on the potential of biogas production from animal feces in this country.The aim of paper was analyses of the biogas production potential from animal feces and manure in Poland. The scope of work included conducted of anaerobic digestion research following materials: cow manure and slurry, pig manure and slurry, poultry manure, poultry droppings and sheep manure. The next step, based on the obtained results of biogas efficiency, energy calculations were made. The methane efficiency for the investigated feedstock materials in the batch culture technology was performed in the Laboratory of Ecotechnologies at the Poznan University of Life Sciences. On a base of achieved results it was concluded that tested substrates have a high energy potential. It was also shown that rational waste management generate economic profit resulting from the sale of energy production, but also in the avoidance of costs of proper waste utilization. Additionally, the by-product of the anaerobic digestion process is digestion pulp, which can be a good quality organic fertilizer.

KEYWORDS

animal waste, anaerobic digestion, methane, biogas potential

Determination of the possibility of using selected composts for the purification of aqueous solutions from zinc ions in concentrations up to 1000 mg/dm^3

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ABSTRACT

The growing demand for cheap and effective sorbents capable of removing various pollutants from water and wastewater causes that multidirectional researches on the quality and efficiency of new adsorptive materials are carried out. Described in the literature high sorption capacity of compost suggests that they can be a cheap alternative to currently used sorbents, also in relation to heavy metal ions. Four composts were selected for the research, differing in their initial composition and production technique. The sorption of zinc from aqueous solutions on selected composts was carried out using batch method under constant contact conditions liquid (100 cm^3) - solid (5.0 g) for 100, 250, 500, 750 and 1000 mg/dm^3 concentrations of Zn^{2+}. It was found that the tested composts were characterized by a satisfactory sorption capacity in relation to zinc ions. The efficiency of the process decreased with increasing Zn^{2+} concentration and was strongly dependent on the quality of the compost and the composition of the initial compost mixture. For the highest concentration of zinc, the best efficiency (nearly 70%) was obtained for commercial compost, while the lowest (only 25%) for compost made only from garden plants waste and prepared in a garden compost bin. The experimental results are described using the Freundlich isotherms; obtained equation coefficients indicate on the adsorption process. On the basis of analyzes and calculations it was found that the compost can be effective sorbents for zinc ions. This is especially important in those cases where, regardless of the composting technique and composition of the substrates, a worse quality compost is obtained, which should not or can not be used for fertilization.

KEYWORDS

compost, sorption, adsorption isotherms, zinc in aqueous solutions

Variability of pollution concentration in sewage inflowing in the aspect of unevenness of the amount of sewage in small sewage system – case study

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ABSTRACT

The paper present the analysis of the impact of hydraulic load on the changes in the concentration of pollution indicators in raw sewage in years 2009-2014. Qualitative analysis for raw sewage was included three parameters: total suspension solid, BOD and COD. The study was based on the records of daily sewage inflows volume to the wastewater treatment plant. In the analytical part of work determined the average daily volume of inflowing sewage, the daily irregularity coefficient of sewage inflow, changes in the sewage volume depending on specific month and the intervals with the greatest frequency of occurrence was designated. The characteristics relation between the concentration of pollution indicators in raw sewage (depend variable) from the hydraulic load (independ variable) was presented by the Pearson linear correlation. The statistical significance of correlation was determined by t-Student's test at the significance level of $\alpha = 0.05$.In the 6-years of research was collected and analysed around 32 samples of raw sewage in according with the established reference methods. The statistical verification revealed that the volume of sewage inflow to the wastewater treatment plant was the most often occurring in the interval between 150 and 194 $m^3 \cdot d^{-1}$. Moreover, the sewage volume, which flowed into the wastewater treatment plant was the largest in spring and summer. Based on the result of linear regression analysis, concluded that with the increasing amount of raw sewage in flowed to the wastewater treatment plant, the concentration of pollution indicators decrease in raw sewage. The correlation coefficient between amount of raw sewage and total suspension solid was equal $r_{x,y}$= 0,53 $g \cdot m^{-3}$. For the relation between amount of raw sewage and BOD and COD correlation coefficient was respectively $r_{x,y}$= 0,75 $g \cdot m^{-3}$ and $r_{x,y}$= 0,66 $g \cdot m^{-3}$. Based on the equation describe the trend line, it was founded that for

total suspension solid, increase by 1 m^3 of amount raw sewage flow into wastewater treatment plant, causes a decrease in the concentration of this indicator by 0,53 $g \bullet m^{-3}$ in raw sewage. For the both organic indicators (BOD and COD), the was found that an increase of 1 m^3 the amount of raw sewage inflowing to wastewater treatment plant, caused a decrease of 0,75 $gO_2 \bullet m^{-3}$ BOD value and 0,66 $gO_2 \bullet m^{-3}$ COD value in raw sewage.

KEYWORDS

sewage, amount of sewage, concentration of pollutions, Pearson's linear correlation

Effects of cycle-frequency and sludge concentration on the performance of anaerobic sequencing batch reactors treating dairy wastewater

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ABSTRACT

Dairy processing belongs to major directions of agricultural production in Europe. The amount of industrial wastewater depends on the size of the factory and type of production. A typical Polish dairy plant discharges 450÷600 m^3/d of wastewater, containing on average 200÷700 mg/dm^3 BOD (max. 3000÷5000 mg/dm^3). In general, chemical oxygen demand (COD) in dairy wastewater ranges from 1150 to 9200 mg/dm^3. The study examined industrial wastewater from one of the biggest dairy factories located in the Świętokrzyskie Voivodeship in Poland. The aim of the conducted research was to determine the influence of cycle-frequency and sludge concentration on the efficiency and toxicity of dairy industry wastewater treatment in the ASBR reactor. In the research, the reaction time was from 12h to 48h. The concentration of anaerobic granular sludge was changed in the range of 10 to 40 g/dm^3. It has been found that the most preferred anaerobic process carried out at a sludge concentration of 10 g / dm^3 and a reaction time of 24 h. The anaerobic process obtained a considerable degree of the removal of organic pollutants from raw wastewater designated as COD (72.1%), BOD (76.2%) and TOC (74%). Generated biogas in the methane fermentation process of wastewater from dairy wastewater was characterized by high methane content (80.5 % vol). However, it was found that dairy wastewater treated in the anaerobic process still showed a phytotoxic effect on algae. Resulted in inhibition rate of algal growth of undiluted wastewater (100% treated wastewater) at 148%.

KEYWORDS

dairy wastewater, ASBR reactor, anaerobic process, toxciticy wastewater

The hierarchization of needs related to land consolidation and exchange in rural areas in the villages of the Leżajsk poviat

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ABSTRACT

Rural areas in Poland are characterized by differentiated spatial structure. The spatial structure of rural areas can be improved through the consolidation and exchange of land (Art.1, Act of 26 March 1982 on consolidation and exchange of land) aiming to create more favourable management conditions in agriculture and forestry by improving the territorial structure of farms, forests and forestland, reasonable configuration of land, aligning the limits of real properties with the system of water irrigation facilities, roads and terrain. In connection with such a requirement for the consolidation and exchange of land, a hierarchy of needs and their urgency must be established. Such an approach makes it possible to secure funds for liquidating the spatial structure of agricultural land according to the urgency ranking. The studies were carried out in the rural areas of the Leżajsk poviat.

KEYWORDS

land consolidation, water melioration devices, agricultural land, defective spatial structure

Impact of silver nanoparticles on wastewater treatment in the SBR

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ABSTRACT

Nanotechnology is one of the most important modern branch of science that allows to produce structures about the dimensions between 1 and 100 nm. The most widely used engineered nanomaterials are currently the silver nanoparticles. These nanoparticles due to its excellent antimicrobial activities, are widely may be utilized into many consumer products, such as paints, bandages, cosmetics, socks, and food containers. The widespread utilization of nanoparticles (NPs) in commercial and industrial products inevitably increase the release into the natural environment what threatens human health and ecosystems.A last study on the nanoparticles in wastewater treatment showed that most of all NPs are retained in equipments for biological wastewater treatment. The some nanoparticles may reduce or inhibit biological activity, therefore nanoparticles retained in the activated sludge flocs could fall the effectiveness of wastewater treatment. The aim of the study was to determine the effects of silver nanoparticles (Ag NPs) on wastewater treatment in the SBR bioreactor. The effluent from the SBRs was analyzed for soluble TOC, SS, pH and total silver. Microbial observations of activated sludge were made and, on this basis the Madonia biotic index was determined. The efficiency of the effluent treatment measured by the concentration of TOC removal showed that Ag NPs were found to have remarkable effects on TOC removal in the SBR. The obtained results showed that treated wastewater included a low concentration of Ag nanoparticles. The main removal pathway of Ag NPs was via sorption as well as possible aggregation and sedimentation onto the sludge.

KEYWORDS

wastewater; activated sludge; treatment; sewage sludge; nanoparticles; silver

Climat Change

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ABSTRACT

Climate change in the world can be caused by various activities. When climate change occurs; temperatures can increase a dramatically. When temperature rises, many different changes can occur on Earth. For example, it can result in more floods, droughts, or intense rain, as well as more frequent and server heat waves. Oceans and glaciers have also experienced some changes: oceans are warming and becoming more acidic, glaciers are melting, and sea levels are rising. As these changes frequently occur in future decades, they will likely present challenges to our society and environment.

Climate change is one of the ecological, social, and financial dangers that the world confronts today. With 160 million individuals, Bangladesh is one of the biggest deltas on the planet which is exceptionally powerless against natural disasters. Besides, the unfavorable impacts of climate change-particularly high temperatures, sea-level rise, cyclones and storm surges, economic improvement situation of the nation.

Climate Change Impact on Bangladesh:

Bangladesh with its geographical area, always encounters some sort of natural disaster consistently due to Global Warming and Climate Change.

Bangladesh is known to have six seasons however because of Climate Change, It has become difficult to identify all of them. With the hot summer and monsoon season dominating most of the year, the winter season has also decreased in terms of intensity and number of months. Almost 80% of the total area of the country is prone of flooding. As indicated by Intergovernmental Panel on Climate Change (IPCC), THE ocean level of the Bay of Bengal will rise around one meter by this century. Therefore a tremendous measure of coastal area of Bangladesh will be submerged. Common disasters, for example, flood, cyclone, drought, river bank erosion and so forth will increase and strengthened because of the change in climate patterns. Global temperatures are expected to increase up to 2 degree Celsius

by the year of 2050 and Bangladesh will face a lot of challenges. This will decrease rice production up to 10% and wheat up to 30% because of the lack of clean water.

The impacts of climate change at first glance will be extremely serious and disturbing for the ground water assets. There will be an enormous emergency for fresh water. Irrigation, Fishery, industrial production, navigation will also be affected to a great extent. Different health problems and diseases will increase because of climate change. The frequent flooding and cyclone-related disasters, are leading to a lot more water borne infections, for example, cholera, diarrhea and so on. Just one meter ocean level rise in Bangladesh will prompt 15% loss of its aggregate area range and will displace around 30 million individuals living in the waterfront territories.

Climate change is not a national issue rather a worldwide issue and will impact the general population and the planet. It is us, who wrecked the earth purposefully. As such, Bangladesh being one of the countries hit hard with climate change, let us not waits for the world and raises our voice to make an impact. In conclusion, we need to take part and try to stop Global warming and other effects on climate change. If the earth's temperatures continue to rise in the future, living things on earth would become extinct due to the high temperatures. If humans contribute to control Global warming, this world would be cooler and the high temperatures we currently have would decrease. If everybody as one take stand and try to end most of the climate changes that are occurring, this world would be a safer place to live on.

KEYWORDS

environment, sustainable development, climate change

Microwave disintegration of sludge as a method of acceleration aerobic stabilization process

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ABSTRACT

The process of traditional aerobic stabilization of sewage sludge for small and medium wastewater treatment plants (up to 15 000 ENI) is a very energy-consuming and long-term process. It requires large amounts of oxygen for at least 15 days at 20°C. The use of sludge microwave disintegration can accelerate this process by breaking up sludge flocs into fine particles along (hydrolysis) with the breakdown of cell membranes. Disintegrated sludge is more susceptible to biological decomposition in the process of aerobic stabilization. The paper presents results of research of sludge aerobic stabilization, which is a mixture of non-disintegrated and microwave disintegrated sludge from a municipal sewage treatment plant in different volume proportions. For selected proportions of mixed sludge, required times of aeration were determined to achieve their stabilization determined by a 38% reduction in the dry organic matter concentration. The most advantageous mixed proportions for which the aerobic stabilization time is shorter has been established, which consequently contributes to the reduction of operating costs of sludge treatment at the sewage treatment plant.

KEYWORDS

microwave disintegration, aerobic stabilization, dry organic matter

Impact of adding digestate waste from a biogas production on aerobic biostabilization of undersize fraction from municipal solid waste

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ABSTRACT

The mixed municipal solid waste (MSW) collected from households is sent for processing in the mechanical-biological treatment plants (MBT). MBT integrate mechanical (grinding, separation, screening, pneumatic classification, etc.) and biological processes (occurring under aerobic and anaerobic conditions). Biological methods of processing biodegradable municipal waste, which are dedicated mainly for the undersize fraction separated from MSW, play also an important role in reducing microbial activity, decreasing CO_2 and CH_4 emission in the case of storage and landfilling of waste, as well as in alternative fuels production. Aerobic biostabilization is a process in which organic matter is biodegraded by microorganisms in aerobic conditions. The process is conducted in order to limit the landfilled waste mass (particularly biodegradable waste) and to reduce greenhouse gases emission from landfills. Current research works are aimed at shortening the duration of the waste biostabilization process as a result of the addition of various chemical substances (such as biochar) or due to changes in air flow distribution. The paper presents the results of a new approach in this matter: applying digestate waste from an agricultural biogas plants as an additive to the biostabilization process of the undersize fraction separated from MSW. Currently, digestate waste is mainly landfilled or used as liquid fertilizers, there are also some attempts of its conversion into solid fertilizers. The aim of the study was to evaluate the effect of adding digestate waste to the process of aerobic biostabilization of undersize fraction (derived from MSW in MBT process) on selected parameters of stabilized waste. Five different input compositions were analyzed (without digestate and with addition of 2,5; 5; 7,5 and 10% of digestate). The goal of the aerobic biostabilization process is stabilizing and hygienization of wastes, so the aim of the experiment was to determine the number and species composition of

vegetative and endospore bacteria, mold fungi, actinomycetes and selected pathogenic microorganisms before and after process. The tests were carried out using the BKB 100 reactor designed for biological treatment of waste, total reactor capacity was 116 dm^3. The analyses focused on selected technological properties of waste (before and after process) and included morphological composition, density, dry mass, total organic carbon, loss on ignition, respiration activity AT4 and others. The changes in temperature in 9 different points (Pt 1000 temperature sensors) in the reactor during the process were also recorded. Furthermore, the composition of gases emitted in the process were determined (before they reached biofilters). The air for the process was constantly supplied from the outside of the reactor. Flow of the supplied air with temperature of 19.9±3.6^oC was regulated depending on the average indication of all temperature sensors. The research covered a 28-day period of the intensive phase. 35.4±0.6kg of waste with density of 488.3±17.2kg•m^{-3} and the biodegradable fraction content of 43.3±2.9% was placed in the reactor. As a result of the research it was stated that only in the case of 5% additive of digestate the period of 28 days is sufficient for processed waste to meet the standards for the stabilized waste (AT4<10 mgO_2, loss of ignition <35%). It was observed that only at the 5% addition of digestate, decreased number of pathogenic microorganisms.

KEYWORDS

waste, biostabilization, digestate, stabilized waste

Improvement of adsorption - ion exchange processes of sewage and mine water treatment

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ABSTRACT

The current state of the level of environmental safety of waste and mine water in a number of industries (light, mining) was studied, which are not only highly mineralized and contain significant concentrations of high-molecular compounds as well as an increase of level of ecological safety of the hydrosphere by improving the adsorption processes of purification from pollution using natural sorbents and desalting processes using electrodialysis to clean wastewater and mine water. It is shown that the dependence of the mass transfer coefficient β from hydrodynamic conditions allows to predict the intensity of the process of adsorption of high-molecular compounds, and radioactive constituents (cesium and strontium) on the fine particle fractions of natural sorbent, which made it possible to ensure the environmental safety of of liquid media purification due to the reasonable estimation of the adsorption processes. The parameters of improvement of sorption processes by natural sorbents and the parameters of the electrodialysis with membranous backfilling ionite for demineralization of wastewater and mine water were suggested. An expanded three-wire model of the conductivity of ion-exchange resin KU-2 in different ionic form was studied, which allowed to predict the demineralization process of wastewater and mine water by electrodialysis method with intermembrane ion filling.

KEYWORDS

environmental safety, electrodialysis, natural sorbents, sorption, wastewater and mine water, membrane filling

Management of ecological safety of country territories in conditions of development of landslide processes (on an example of the Kiev industrial-city agglomeration)

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ABSTRACT

The analysis of development of research of problems of landslide processes and application of anti-landslide measures and constructive and regional features of realization of anti-landslide measures. The prospects for using multi-tidal ash-slag waste TES as perspective materials for practical implementation of engineering anti-landslide measures are analyzed. The methodological bases of ecological safety in the conditions of development of exogeodynamic processes are considered. The proposed methodology of ecological hazard research from the development of exogenous geological processes, the structure of natural and man-made factors of origin and development of exogenous geological processes is considered. The classification of environmental hazards of the geological environment is presented. The proposed strategy for assessing the effectiveness of engineering measures to minimize environmental hazards from exogenous geological processes. The monitoring of the state of the geological environment of the Kyiv industrial and urban-agglomeration and the Middle Prednieper from the standpoint of the development of landslide processes has been carried out. The development of landslide processes in the city of Kyiv, on areas of the Kiev reservoir area, in the area of Kaniv reservoir is analyzed. The dynamics of development of landslides and degree of defeat by landslides of the territory are studied. The methods of engineering protection of anti-landslide measures processes and application of industrial waste for their realization are considered. The analysis of stability of the geological environment to natural, technogenic and natural-technogenic factors of landslide processes has been carried out. The prospect of the use of ash-slag mixes for the implementation of anti-landslide measures engineering measures is considered: in the composition for the construction of

counterfoils holding prisms or retaining walls and the use of ashes for removal of soils. A theoretical substantiation and an example of the practical application of the general geophylographic model for predicting the change in the hydrogeological conditions of the investigated area in connection with the implementation of anti-slip measures - the location of solid walls under the foundations of the contour of buildings or deep-immersion piles.

KEYWORDS

ecological safety, landslide processes, engineering collisional measures, ash-slag wastes, barrageous effect

The research on effectiveness of the selective electronic and electrical waste collection system in Lublin city, Poland

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ABSTRACT

The development of modern societies strongly influences on waste electrical and electronic equipment (WEEE, e-waste) creation. If the most developed countries have successfully introduced effective WEEE management by effective legislation, logistics and recycling, the developing countries have still the big problems in this area because the disposal and landfill are still dominant. The aim of this study was to determine the dimension of the improper disposal of e-waste by the Lublin inhabitants (the biggest city in Eastern Poland). The study presents the results of the research and attempt to find the causes of society misconduct and indicates the measures which should be taken in order to achieve improvement. During 2 research steps, there were 347 pieces of e-waste with the total mass 77.218 kg (0.33% of analyzed urban waste samples). This means that the mechanisms of selective e-waste collection still do not work correctly, even more than 10 years of Poland presence in EU which was related to implementation of European legislation in this area. Throwing out the electric waste by the residents into municipal mixed waste causes serious problem for proper waste management – even only part of the e-waste is managed by this illegal way. This indicates the necessity of waste collection improvement (more frequent waste reception, continuous presence of e-waste containers, raising public awareness etc.).

KEYWORDS

e-waste, selective collection system, waste management

The efficiency and reliability of pollutants removal in a hybrid constructed wetland with Giant miscanthus and Jerusalem artichoke

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ABSTRACT

The paper presents results of a six-year study of the efficiency and reliability of pollutants removal in a hybrid constructed wetland (HCW). The investigated facility is located in Skorczyce, Poland (51°00′36″N, 22°11′51″E). The treatment plant is to secured treatment of domestic wastewater from a multi-family residential building. This installation had been in operation since 2011 with the flow capacity of 2.5 m^3/day. The installation consisted of a three-chamber septic tank and two soil–plant beds. The first bed was with vertical flow of 0.8 m deep, with a surface area of 96 m^2, and the second was a bed with horizontal flow of 1.2 m deep, with a surface area of 80 m^2. The vertical bed had been planted with Giant miscanthus (*Miscanthus x giganteus* Greef et Deu.) and the horizontal with Jerusalem artichoke (*Helianthus tuberosus* L.). The receiver of the treated wastewater was the river Urzędówka.The experiments on the efficiency and reliability of pollutants removal in the analysed facility were carried out in the years 2011-2016. Wastewater samples for the analyses were collected four times a year, in winter, spring, summer and autumn. The wastewater samples were collected: after mechanical treatment upstream of first bed, downstream of first bed (the VF-type bed with Giant miscanthus), and downstream of second bed (the HF-type bed with Jerusalem artichoke) which is outflow from the plant. The analyses of wastewater samples were performed to determine the following parameters: total suspended solids, BOD_5, COD, total nitrogen and total phosphorus. The analyses were carried out according to the reference methodology, specified in the Regulation of the Polish Minister of Environment of 2014. On the basis of the results, minimum, maximum and mean values, median, standard deviations and coefficients variation were determined. Based on the average values of the

analysed pollution indicators in influent wastewater and in the treated wastewater the average efficiency of pollutants removal was calculated as well as the mas removal rates.

The operation reliability of the wastewater treatment plant was determined with the Weibull method. In order to assess the reliability of operation the results of tests of treated wastewater discharged from these facility into the environment were used. The Weibull distribution parameters were estimated by the maximum likelihood method. The goodness-of-fit of the Weibull distribution to the empirical data was evaluated with the Hollander-Proschan test. The analysis has been carried out using Statistica 13. Reliability was determined from cumulative distribution plots, taking into the limit values of indicators for wastewater treatment plants of <2000 p.e. Research has shown a high, over 90 percent. efficiency and reliability of removing total suspended solids and organic pollutants expressed in BOD_5 and COD. The efficiency and reliability of the removal of biogenic compounds was clearly lower and did not exceed 70%.

KEYWORDS

reliability of pollutant removal; efficiency; Weibull reliability method, wastewater treatment hybrid constructed wetland

Surface and subsurface runoff of water and selected matter components on a loess slope used for agricultural purposes

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ABSTRACT

Agricultural production causes an inevitable interference with the environment and together with anthropogenic and natural factors, it can lead to the activation of erosion processes. Upland loess areas, such as in the south-eastern Poland, are particularly vulnerable to soil erosion. The detailed literature on erosion studies carried out in the loess areas of the Lublin Upland lacks research concerning quantitative and qualitative surface and subsurface runoff of water, its chemistry and the amount of soil eroded from the slopes.

The research was carried out in the 2008-2011 period in the village of Wielkopole, located on the Lublin Upland. The paper presents the quantitative and qualitative results of erosive research on surface runoff and outflow of water, its chemistry and soil. The research was carried out in the field used as an arable land, located on a loess slope with a gradient of about 11% (similar to the average catchment value). The field is in the shape of a rectangle, and the long-term direction of conducting agrotechnical treatments and cultivation is typical for upland areas of the Lublin region. In 2008, at the base of the slope, a surface and intra-depth surface catcher was mounted, the task of which was to capture flowing waters from the depth of: 0 m (surface runoff), 0.00-0.25 m; 0.25-0.50 m; 0.50-0.75 m and direct them to calibrated tanks. After each runoff, samples of outflowing waters were analysed in laboratory. Erosion studies were carried out with of meteorological, agro-technical and soils conditions taken into consideration. The obtained research results broaden the state of erosive knowledge and contribute to a better recognition of the functioning of the conical fluvial system and the influence of various factors on this system.

KEYWORDS

water soil erosion, loess areas, surface runoff, conservative fluvial system

The intensity of water soil erosion on the sodded loess slope

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ABSTRACT

Erosion studies conducted on loess lands of the Lublin Upland lack data on the quantitative and qualitative surface runoff and outflow of water, its chemistry and soil eroded from the slopes. Water chemistry and transport of soil suspensions are most often studied in permanent watercourses. However, determining the intensity of erosion on the basis of bed research solely gives a certain picture of the denudation taking place in the catchment, but does not show the actual threat of water erosion in the catchment itself. Ultimately, the aim should be to conduct research in a geomorphological slope environment, because it reflects the actual threat of water erosion.

The research was carried out in the 2008-2011 period in the village of Wielkopole located on the Lublin Upland. The paper presents the quantitative and qualitative results of erosional research on surface runoff and outflow of water, its chemistry and soil. The research was carried out on a sodden loess slope used as a meadow. In 2008, at the base of the slope, a surface and intra-depth surface catcher was installed, the task of which was to capture flowing waters from the depth of: 0 m (surface runoff), 0.00 - 0.25 m; 0.25 - 0.50 m; 0.50 - 0.75 m and draining them to calibrated tanks. After each runoff, samples of outflowing waters were analysed in laboratory. Erosion studies were carried out with meteorological, agro-technical and soils conditions taken into consideration. The obtained research results should broaden the state of erosive knowledge and contribute to a better recognition of the functioning of the conservative fluvial system and the influence of various factors on this system.

KEYWORDS

water erosion,surface runoff, subsurface runoff

The assessment of the amount of soil material deposited on the bottom of a dry erosive-denudation valley

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ABSTRACT

The bottoms of erosion and denudation valleys are classified as places that are intensively modelled as a result of water erosion processes. There are both accumulation and leaching processes that contribute to changes in the formation of the valleys. Quantitative tracking of these changes requires conducting geodetic height measurements. In the past, these measurements were made using the longitudinal and transversal cross-sections, which is a quite labor-intensive method. Currently, modern measurement technologies, such as: laser scanning, GNSS, single-person tacheometry, come with the help. They allow for quick and accurate measurement.

The paper presents the results of height measurements of the bottom of a dry, loess, erosive-denudation valley in Elizówka near Lublin. The measurements were carried out in 1958, 1970 (longitudinal and transverse method) and 2016 (GNSS Topcon HiPer V receiver and Leica Nova MS 50 total station were used for measurements). Analysis of the obtained results allows to conclude that the bottom of the valley is prevailed by accumulation processes over leaching. In 58 years, the average bottom has increased by 47 cm and a maximum of 81 cm.

KEYWORDS

water erosion, bottom of the valley, soil material, geodetic measurements

Assessment of methods for lignocellulosic biomass pre-treatment/hydrolysis to produce liquid biofuels

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ABSTRACT

Various technologies and their combinations for production of high value chemicals, including liquid biofuels (bioethanol, biobutanol), from lignocellulosic biomass have been extensively developed over the years. High fermentable sugar and final product yields have been achieved with chemical and/or physical biomass pre-treatment/hydrolysis techniques. However, many of the technologies are too expensive to be transferrable to industrial scale. Moreover, the importance of many technological aspects, like, biomass weight to volume ration, end-product recovery, enzyme recirculation are not fully understood and explained. The research activities included, the selection of the most appropriate biomass pre-treatment method that could be combined with enzymatic hydrolysis. In house production of hydrolytic enzymes from fungi was introduced to minimize the external impact and production dependency on raw chemicals. Conversion yields were evaluated based on biomass amount and fraction size. Fermentable sugar purification, inhibitor removal and enzyme recirculation was performed with membrane technologies. The results showed that for grass and hay biomass prior enzymatic hydrolysis it is sufficient to perform simple mechanical milling (fractions < 0,5 cm) in combination with boiling (1 atm). Fungal enzymes produced comparable activities to commercially available products and use of elevated biomass concentration tend to decrease the efficiency. Introduction of membrane system allowed to concentrate the enzymes more than 4 times to generate enough sugar for fermentation. Overall biomass conversion rates increased 80%. Thus, it was possible to demonstrate an environmentally friendly and efficient technology for lignocellulosic biomass conversion.

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KEYWORDS

biofuel, lignocellulosic biomass, enzymatic hydrolysis, pre-treatment

The condition of sanitary infrastructure in the Parczew district and the need for its development

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ABSTRACT

The aim of this paper is to present the current state and need for development of sanitary infrastructure in the communities on the area of Parczew District. The district is situated in Lubelskie Voivodship. In the territory of Parczew District seven communes are located: Parczew, Dębowa Kłoda, Jabłoń, Milanów, Podedwórze, Siemień, Sosnowica. The paper uses data from surveys conducted in these communities in 2016. On average, 88% of the population used the water supply system in the communities surveyed, while 48% of the inhabitants had the possibility of discharging sewage to the sewerage system. In the area of the communes, there are 12 collective, mechanical and biological wastewater treatment plants with a capacity excceeding 5 m3/d. The households which are not connected to the sewage network discharge wastewater mainly to non-return tanks. In the communities surveyed 1115 household sewage treatment plants were located. All of them were systems with infiltration drainage, which do not ensure high efficiency of removing pollution and may even contribute to the degradation of groundwater quality. In order to solve the existing problems of sewage and water management occurring in the communes where the Parczew District is located, it is necessary to further develop collective sewage systems and equip the areas with dispersed buildings with highly efficient, household treatment plants, e.g. constructed wetlands.

KEYWORDS

sanitary infrastructure, community, water supply, sewerage system, wastewater treatment plant, septic tank

Technological conditions of cosmetic wastewater coagulation

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ABSTRACT

Coagulation process is often used for the pre-treatment of cosmetic wastewater with effectiveness strictly dependent on technological conditions. This study aimed to determine the technological parameters of coagulation of cosmetic wastewater to achieve the highest efficiency of clarification. The dosages of reagents, the sequence of dosing as well as the one and two-stage process were investigated. The samples of raw wastewater from cosmetic manufacturing plant were collected. Jar-test experiments were carried out to determine the optimum conditions for turbidity and total organic carbon (TOC) removal. FeCl3 (PIX 111) for coagulation and NaOH for pH adjustments were used. Wastewater was very susceptible to coagulation and efficiency of clarification was high (90-99%) in a wide range of pH (6-9) and dose of coagulant (96-240 mg Fe/L). It is important that the dose 108 mg/L of coagulant provides 97.6 % clarification efficiency without alkali addition. It was associated with almost complete consumption of wastewater alkalinity. In all samples, the efficiency of removing TOC was lower than that of turbidity because some of the organic carbon were non-coagulating dissolved compounds. The introduction of the coagulant as the first one before alkali gave better wastewater clarification effects than the reverse order. Single-stage coagulation with optimal doses of reagents allowed to clarify wastewater to a level of 10 NTU. On the other hand, the two-stage process made it possible to achieve turbidity of the supernatant liquid at the level of 1 NTU.

KEYWORDS

industrial wastewater, pre-treatment, coagulation, pH adjustment

Study on type of distributions of the annual maximum precipitation over Upper Vistula basin, Poland

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ABSTRACT

The Upper Vistula Basin is located in south part of Poland and occupied approx. 15% total area of Poland. This area is characterized the most water resources in Poland (approx.. 25% total water resources is created in this region). Because the Upper Vistula Basin has complicated topography (mountain, highland and lowland), hydrological regime is variable and precipitation has very important influence on extreme events like droughts and floods. So, analysis type of distribution of the maximum annual precipitation have crutial role for design the hydraulics structures to protect again flood. Also interesting is question: if type of distribution is stable when multi-year will change? So the aim of this work is study on stationarity of time series of annual maximum precipitation and shape of them distribution. Study was performed for almost 100 rain gauges over Upper Vistula basin for two multi-years: 1975-1995 and 1996-2015. Stationarity time series of precipitation was detected by Mann-Kendall test and coefficient of autocorellation. We tested following type of distribution Gumbel, Weibull, log-normal, Pearson type III, GEV. Parameters of distribution was estimated by likelihood maximum method. Analysis showed that more rain gauge stations have stationarity time series of precipitation with no monotonic trends. GEV was the best distribution for more number of rainfall gauge stations.

KEYWORDS

precipitation, distribution, GEV, stationarity

Two-stage landfill leachate treatment in aerated lagoons and at a municipal wastewater treatment plant

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ABSTRACT

The two-stage technology of treatment of the leachates of the municipal solid waste (MSW) dumps in aerated lagoons and at municipal wastewater treatment plants (WWTP) has been studied. The study objective was to develop a technology that can be implemented at existing MSW dumps and landfills. Static and dynamic modes of implementation of both stages of the technology were investigated on the model units. Static 16-day mode was experimentally studied in the aerated lagoon conditions. As a result, we have managed to achieve almost a 2-fold reduction of COD and more than a 3-fold decrease in concentration of ammonium ions.

KEYWORDS

leachate of municipal solid waste dumps; aerated lagoon; biological treatment; immobilization of biocenosis

Laboratory model investigation for sedimentation of river load in a fishway

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ABSTRACT

The so called fish passes (or fishways) i.e. special passages for fish built next to water engineering structures, are intended to ensure ecological river continuity. Unfortunately, a great many fishways built to date demonstrate all sorts of exploitation problems, which either limit their correct operation or even make it completely impossible. Fish passes are highly sensitive to any changes in the hydrological conditions. The transport of river bed load, which also takes place in a fishway, is another important source of problems (muddying, silting up, sedimentation, potholes, etc.).In the Water Laboratory at the Institute of Environmental Engineering (Wrocław University of Environmental and Life Sciences), the physical model of vertical slot fish pass was conducted. On the fishway a device used for sediment dispense was installed. The sediment was dispensed to each chamber. Measurements of approx. height of the water table, measurements of flow rate, observation of line streams in chambers were carried out during the studies. The flows of sediment and hydraulic parameters inside designed fish pass, single compartments and their connection with sedimentation process in individual chambers were also studied. The obtained research results constitute starting point for experimental analyses and research analyses. Based on the observation and measurements it is possible to state that the constructed physical model reflects the activity conditions of the vertical slot fish pass. During the studies a place of deposition in sediments of individual fish pass chambers were determined.

KEYWORDS

rivers, fishways, sedimentation, ecological river continuity, water environment protection, ecological engineering

Effect of sodium percarbonate dose on the reduction of organic compounds in landfill leachate

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ABSTRACT

Landfill leachate is infiltration water percolating through the landfill body together with waste ingredients that were washed out and dissolved, and also the products of biochemical reactions that occur in stored wastes. The choice of sewage treatment technology should take into account, among other things, the changing chemical composition of the leachate and its amount. The aim of the research conducted by the authors was the check the effect of sodium percarbonate doses on the decrease of organic compounds and the optimization of process for the treatment of landfill leachate on the example of landfill in Janczyce. The facility is technically representative for the management of municipal waste and landfill leachate. This object was qualified to specific tasks after previous reconnaissance of other objects. The plant serves about 150,000 inhabitants and is composed of a mechanical waste treatment plant and a composting plant. The collection of leachate samples as well as their storage and chemical composition tests were carried out in accordance with the current standards of PN-ISO 5667-10:1997. Reaction was performed for sodium percarbonate at the temperature of 20°C±1°C. The tests were carried out for the different doses, pH and duration of the process. In leachate, prior to and after the treatment process, the following were determined: COD, TOC, pH, electrolytic conductivity, absorbance at the 254nm wavelength, colour, temperature. All analyses performed were compliant with the binding standards.

KEYWORDS

landfill leachate, sodium percarbonate, organic compounds, COD, TOC

Effects of heavy metals on selected physical and physico-chemical properties of bentonites

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ABSTRACT

The purpose of this study was to determine the effect of heavy metals, especially Cu^{2+} or Zn^{2+} ions, absorbed by soil on its physical and physicochemical properties. The change in these properties may reduce the soil usefulness as a mineral protective barrier, for example, on hazardous waste landfills. Parameters such as granulometric composition, effective particle size d10, empirical hydraulic conductivity, Attenberg limits, colloidal activity, specific surface area, sorption moisture content, and montmorillonite content were determined. The tests were carried out on model Na^{+} or Ca^{2+} samples of American bentonites (SWy-3, Stx-1b) and Slovak bentonite from Jelsovy Potok, subjected to ion exchange for Cu^{2+} or Zn^{2+} ion. The content of heavy metals was determined using inductively coupled plasma optical emission spectrometry (ICP- OES). Regression analysis showed a significant effect of Zn^{2+} ions on the reduction of sorption moisture content w95 and the increase in the hydraulic conductivity. In addition, the Zn^{2+} ion content was observed to increase with the increase in the particle diameter d10. Nearly complete correlation was obtained between the Cu^{2+} and Cr ions content and the specific surface area, sorption moisture content w50, and montmorillonite content (R = -0.99). The above observations of Zn^{2+} or Cu^{2+} saturated soils may indicate a different behavior of these soils in a clay-water system during freezing, affecting unfrozen water content, the knowledge of which is needed for building frost heave models. Research shows that Cu^{2+} or Zn^{2+} ions limit the specific surface area of bentonites to specific ranges depending on the type of dominant metal but regardless of its initial Na^{+} or Ca^{2+} form. In addition, most heavy metals were absorbed by Na^{+}/Ca^{2+} form of SWy-3 with the smallest specific surface area and the lowest montmorillonite content. In this regard, these criteria when used for the selection of sealing materials are controversial and require a wider soil characterization. Colloidal activity appears to be a more suitable parameter.

KEYWORDS

properties of bentonites, mineral protective barrier, heavy metals, hydraulic conductivity

Assessment of heavy metals influence on microstructural parameters and hydraulic conductivity of bentonites in the basis of SEM tests

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ABSTRACT

The aim of this study was to determine the influence of heavy metals, in particular Cu^{2+} or Zn^{2+} ions, on microstructural parameters of bentonites. These, in turn, may determine the physicochemical properties of soils in terms of their suitability as mineral sealing barriers. The following parameters were analyzed: the number of pores, the pore total surface area and circumference, the mean surface area and circumference of mesopores, micropores (0.1-2; 2-4; 4-10 μm), and ultrapores, interplanar spacing d001 (XRD), empirical hydraulic conductivity. The research was carried out on the model samples of American clays (SWy-3 and Stx-1b) and Slovak bentonite from Jelsovy Potok, which were modified by introducing Cu^{2+} or Zn^{2+} ions into the structure. The content of heavy metals in the samples was determined using inductively coupled plasma optical emission spectrometry (ICP- OES) and microanalysis of the area from SEM photographs (% by weight). The microstructural parameters were evaluated in Photoshop CS4 with the digital image analysis (NIA) overlay. Regression analysis showed a decrease in interplanar distance d001 in bentonites after the exchange for the Cu^{2+} ion, which will probably affect the physicochemical parameters of these soils, such as sorption moisture content and surface area. A significant dependence was observed between the increase in the Cu^{2+} ion content in the sorption complex and the increase in the total pore area, pore mean area and circumference. In this regard, the value of the hydraulic conductivity was estimated based on the relation between the pore area and pore hydraulic radii with the use of the equation proposed by Kozłowski et al. Statistical analysis showed a significant influence of the dominant cation (Na, Ca, Zn, Cu) on hydraulic conductivity kSEM. In the case of dominant Cu^{2+} ions, hydraulic conductivity increased. It was surprising to obtain identical Cu^{2+} ion correlation obtained by ICP-OES and SEM microanalysis with the soil microstructural parameters, which confirms the suitability of this method for

determining heavy metal content for statistical purposes. The effect of Zn^{2+} ions appears to be significant only in the case of the reduction in the 4-10 μm micropore mean area. Most likely, the behaviour of bentonites saturated with Zn^{2+} ions is more closely related to physical parameters, e.g., granulometric composition, than to physicochemical parameters dependent on the microstructural ones.

KEYWORDS

microstructural parameters of bentonites, heavy metals, mineral sealing barriers, hydraulic conductivity

Environmental turmoils an effect of lack of sustainability

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ABSTRACT

Mother earth was given to us as a gift to God but our sustainability towards keeping it for the future is our gift to God. Due to the effects of unsustainability the environment has declared world war 3 against humanity.

KEYWORDS

sustainability, world war 3, future generation

Research on the process of thickening coffee grounds

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ABSTRACT

The purpose of the work was to carry out research on the pressure agglomeration process of coffee waste (grounds) and to determine the impact of construction, material and process parameters on the course of the compaction process and the quality of the obtained product. The experiment was carried out on the SS-3 test stand, which was a press with an open compaction chamber provided with a compaction temperature control system. The independent variables in the study were: the length of the thickening chamber (37, 42 and 47 mm), the humidity of the coffee grounds (12, 16 and 20%), the mass of grounds entered into the chamber (0.4, 0.6 and 0.8 g), and the process temperature (50, 70 and 90°C). The influence of the above variables on the maximum thickening pressures and the density of the obtained granulate (as an indicator of the quality of the obtained granules) was investigated. On the basis of the conducted tests, it was stated, among others, that with the increase of waste moisture from 12% to 20%, the maximum compaction pressures increase. At the same time, it was found that an increase in the process temperature from 50°C to 70°C also resulted in an increase in the maximum compaction pressures. The most favorable temperature of the coffee grounds densification process, from the point of view of the obtained granules quality as well as the energy consumption of the process, was the temperature of 70°C. The increase in the length of the die affects the increase in density of the obtained granules. Granules with the highest density of 1068.89 kg•m^{-3}) were obtained with a moisture content of 12% at a temperature of 90°C. The conducted research allows to state that coffee grounds in the form of granules can be used as a future ecological solid fuel.

KEYWORDS

agglomeration, coffee grounds, pellet quality

Evaluation of the possibility of using laser scanning for estimation of biomass production in hybrid constructed wetland

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ABSTRACT

Estimation of a crop yield quantity requires measurement of collected plant samples. The goal of this work was an evaluation of an application of a ground-level laser scanning to assess a quantity of biomass of a two perennial plant species: giant miscanthus (Miscanthus giganteus) and basket willow (Salix viminalis). They are energy crops mainly, but one of the alternative uses is planting them on hybrid constructed wetland systems, where their abilities of biogenic absorption and resistance to varied moisture conditions are useful. The research was conducted in the constructed wetland in the village of Poizdów, south-eastern Poland. It has been built in 2016 to treat wastewater from a school building and has a daily efficiency of 4.5 m^3. The system consists of three-chamber primary settling tank and two vertical and horizontal flow beds planted with the mentioned species. The receiver of a treated effluent is the infiltration pond. To estimate the plant biomass a laser scanner Topcon GLS-2000 has been used. It is the impulse scanner with a 3.5 mm measurement precision of a single point on a distance of up to 150 meters. The gathered data were post-processed in the ScanMaster software. The coordinates of scanning locations were obtained with the use of the GNSS Topcon HiPer V with the FC-2600 controller.The locations were set 3 meters away from a brim of the bed. Plants, after being scanned, were cut off on the rectangular area 2x0.5 m. Scanning from one location and collecting samples was repeated till 2-metres wide transect has been cut off. The number of laser cloud points per each rectangular sample field was calculated in the ScanMaster software. The results were correlated with the weight of corresponding plant samples. Biometrical measurements of plants were conducted too (height of a plant, branches thickness, number of branches per one cutting), as well as energy biomass value. The research proved laser scanner to be an effective tool in the assessment of crop yield biomass. Moreover, laboratory tests can help estimating energy value per planted area. The laser scanning method can successfully be used as a non-invasive method of crop yield estimation.

KEYWORDS
laser scanning, biomass, constructed wetland, giant miscanthus, willow

Combined effects of irrigation management and nitrogen fertilization on soft wheat productive responses under Mediterranean conditions

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ABSTRACT

Wheat yield responses to water and nitrogen vary widely among different environments and they can be shifted due to technological, environmental, or economic factors. In regions with a Mediterranean-type climate, the balance between the key climate variables and the most critical stages of wheat grow implies that the success of the crop depends to a very large degree on the knowledge of proper water management combined with suitable fertilization strategies. For this purpose, we studied the productive responses of soft wheat to the interactive effects of irrigation and nitrogen (N) fertilization. Two trials were carried out during 2016/2017 in Beja (Southern Portugal). In both experiments, wheat responses were assessed under two water supply regimes: D1 (100% of full irrigation throughout the cycle) and D2 (100% of full irrigation at four stages: stem extension; booting; heading; grain filling). In the first trial, 165 kg of slow-release and stabilized N fertilizers were applied through 6 splitting treatments, five of them (A1 to A5) with a slow-release N fertilizer (A1 – 100% at sowing; A2 – 50% at sowing and 50% at booting; A3 - 50% at sowing, and 25% at stem extension and at heading; A4 – 75% at sowing and 25% at booting; A5 - 75% at sowing and 25% at stem extension) and another one (A6) with a stabilized N fertilizer 100% applied at sowing. In the second trial, 165 kg of conventional N fertilizer was applied through 5 splitting treatments (A1 – 33% at sowing, at tillering and at stem extension; A2 – 25% at sowing, at tillering, at stem extension and at heading; A3 - 25% at sowing, at tillering, at stem extension and at booting; A4 – 50% at tillering and 25% at booting and at heading; A5 - 50% at sowing and 25% at stem extension and at booting). In the first trial,

only the number of heads per square meter showed significant influence of the irrigation regime, the highest values being registered in the D1 treatment. In the trial with conventional fertilizer, significantly higher yields and weights of 1000 grains were obtained in the D1 irrigation treatment. Significant effects of split N fertilizer application occurred only in the first trial: yield was higher in the A5 treatment, showing that early N applications with this type of fertilizers do not compromise N availability throughout the wheat grow cycle and therefore the grain production; grain protein content was higher in the A2 treatment, indicating the importance of N availability at the booting stage in order to obtain grains with desirable quality traits.

KEYWORDS

enhanced efficiency fertilizers; water uptake; grain yield; grain protein content; Triticum aestivum L

Analysis of soil moisture conditions in lowland area using spectral data form Sentinel-2 and GIS data

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ABSTRACT

Droughts is a climate phenomenon associated with the lack of water, which affects the condition of plants and causes them to wither. Agricultural drought research mainly focuses on long term atmospheric data, temperature, precipitation and evaporation measurements. Connecting the reflection of light with the biophysical characteristics of plants allow to use the spectral indicators for assessing the plants' condition, biomass production (including forecasting of yields) and susceptibility of plants organisms to the influence of stressors such as water shortages in the soil. Paper shows the analysis of the soil moisture in soil-plant environment in the lowland catchment area using the spectral data. Spectral data were obtained from the Sentinel-2 European Space Agency satellite for 8 episode from period February-November 2016. Based on spectra data Normalized Differential Vegetation Index (NDVI) were calculated for 22 areas in the study catchment area with surface larger than 150m^2. The water management of plants on the study area is based mainly on the use of water from precipitation. The value of NDVI index obtained information about plants condition and soil moisture. The information obtained in this way from the spectral analysis was compared with the data obtained from the field investigations. The analyses have showed the spatial and temporal variability of moisture conditions in the soil-plant environment determined based on spectral indicators and the existence of some dependences between climatic and spectral indicators characterizing soil-plant environment.

KEYWORDS

NDVI, drought, spectral analysis, vegetation, Sentinel-2

Spectroscopic analysis and evaluation of physical properties of the selected starch-based thin-films

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ABSTRACT

Various materials derived from crude oil are usually non biodegradable or their biodegradation is difficult and time-consuming. This fact, together with a constant and rapid decrease in crude oil availability has recently become a major driving force in the development of new sources of environment-friendly and easily biodegradable materials. In contemporary industry, there is a great demand for such biodegradable materials, which may be used for packaging and wrapping of wide variety of commercial products.

This work focuses on an investigation into influence of various functional additives such as PLA, PVA, and creatine on physical properties of biopolymer-based thin films. The TPS starch granules were obtained by use of TS-45 extruder with L/D = 16. The thin films were obtained using the extruder with L/D =36 and a blow molding module. An influence of type and quantity of the functional additive on yield and embodied energy of the extrusion process was determined. Also, the selected physical properties such as thickness, basis weight, and colour of thin films obtained were studied in dependence of type and quantity of the functional additive used. FTIR spectroscopy was applied for identification of functional groups present in modified thin films as well as for the tentative assessment of the physical properties of biopolymers obtained.

The results obtained from FTIR measurements of PVA-, PLA-, and SGK-modified thin films revealed the intensity changes of bands characteristic of -OH stretching vibrations. These changes were attributed to the presence of either intermolecular or intramolecular bound -OH groups.

Secondly, a significant changes in the IR bands assigned to glycoside bonds of starch allowed the assumption that these moieties underwent notable alteration. Moreover, the UV-Vis spectroscopy revealed a significant increase in absorbance, associated most likely with the colour change and decreased optical transmittance of the biopolymers. In a conclusion, the use of functional additives had major influence on the structures of starch-based thin films obtained.

KEYWORD

thermoplactic starch, extrusion, biodegradable film, biopolymers, molecular spectroscopy, UV-Vis, FTIR

Selected properties of corn straw processed with the extrusion-cooking as modified raw material to biogas plant

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ABSTRACT

The main subject of the study was determination of selected properties of corn straw processed with the extrusion-cooking. Corn straw was ground and moistened for the final moisture content of 25 and 40%. Corn straw was processed with various screw speed (70 and 110 rpm) using a single screw extruder TS-45 (Z.M.Ch. Metalchem, Gliwice, Poland) with L/D=12 configuration. Treatments were carried out at the temperature ranged at 100-140°C.

The effect of moisture level and screw speed on selected properties of extruded corn straw was tested according to the possibility of its application as the substrate in methane fermentation. For the evaluation of extrusion-cooking intensity water absorption index (WAI) and water solubility index (WSI) have been tested. WAI was calculated as gel weight per dry mass of the sample and WSI was calculated as the amount of residues dissolved in supernatant after evaporation. Processed samples were analyzed for biogas formation efficiency through anaerobic digestion in a multichamber biofermentor according to standard methodologies (DIN 38414/S8 and VDI 4630). Biogas efficiency of the substrate (m3/t organic dry matter) was calculated.

The extrusion-cooking application changed the water absorption and water solubility of the corn straw make it more applicable in bio-gas plant. After the extrusion-cooking the fibrous structure of treated material is broken, cellulose fractions are destroyed by thermomechanical treatment and thus can be easily accessible for fermentation bacteria. The most effective biogas production was reported for corn straw pretreated with 40% of moisture content at 110 rpm.

Prospective of geothermal energy using in Podhale basin (South Poland) based on environmental and hydrogeological conditions

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ABSTRACT

The possibility of using hydrothermal energy in Poland is practically available throughout the country, but operational use of hot groundwater must be profitable for investors. From the another point of view: the environmental impact of such investments should be minimized. Geothermal waters should feature the highest possible temperature in the outflow, low mineral content, high capacity and low deposit depth. The Podhale Basin in the Inner Carpathians region is regarded the most promising. This paper is concerned with the environmental conditions and the special variety of temperature of geothermal waters extracted. The Polish national law includes a number of conditions specified for areas under protection of the environment, fulfillment of which may prove impractical or exceptionally difficult, thus eliminating the possibility of construction of geothermal borehole. There is a number of additional procedural regulations in Poland that may block investment, even in the conditions when its execution would be possible technically and economically. Execution only of these installations is especially important that are consistent with sustainable development. This work analyses spatial distribution of geothermal step under conditions of the currently conducted exploitation in the Podhale Basin. The mutual relationship is immensely important of the depth of the intakes and the expected water temperature at this depth. For this purpose, the value of the geothermal step was calculated and the map of isolines of this parameter was created. The completed analysis and the resulting map of distribution of geothermal step allow to make the preliminary assessment of the current possibilities of using resources of geothermal waters of the Podhale Basin and selecting the places that are potentially optimum in terms of temperature. The natural expected temperature of waters in the deposit and at the outflow is usually the first criterion decisive for further concept work.

The presented analysis may be implemented in other areas of Poland, where projects of abstraction of geothermal waters are planned. The comparison of the main prospective areas (based on the geothermal step) with the sustainable development idea (based on the map with protected areas) would bring the best geothermal boreholes location with the highest economical benefits and the lowest risk of blocked the investment.

KEYWORDS

geothermal aquifers, Podhale Basin, geothermal step, protected areas, prospective areas

Possibility of the modelling of electricity production from hydropower

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ABSTRACT

In hydropower plants benefits depends on available flow. The paper presents a hybrid model for forecasting the operation of a hydropower plant, including the production of electricity. The possibility of mathematical modeling was chosen to show connections between observed in the past hydrological conditions (available flow) and energy deliver in the future. The available flow which is not enough for start turbines was forecasting by logistic regression model. The opposite situation when the flow starts turbine to produce energy, regression models (the support vector machines SVM, random forest RF, k nearest neighbour k-NN) were used. Results from hybrid model were compared with chosen data-mining methods. The possibility of forecasting of the length of periods when hydropower plant will be working could be very useful. It provides the prognosis of energy value which could be produced from hydropower plant. From the investors' point of view the economic justification for the execution of the project based on the future energy producing could be a main criteria to realize or buy/sell hydropower plant. Also the secondary importance could be a possibility of planning review and maintenance work when the power plant exist. Knowledge of power plant working periods could be a base for assessing a potential production from hydropower plant

KEYWORDS

hydropower plant, energy production, hybrid model, forecasting

Ecotoxicological risk assessment of tributaries to the Alqueva Reservoir (Southern Portugal)

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ABSTRACT

The Alqueva reservoir constitutes the most important water supply source in Southern Portugal, a Mediterranean region, affected by water scarcity and where agriculture is one of the main activities. The aim of this study was to assess the usefulness of ecotoxicological endpoints to detect chemical alterations in the tributaries to the Alqueva reservoir, that may affect its water quality. Water and sediment samples were collected during 2017 at four tributaries (Zebro, Álamos, Amieira and Lucefécit streams), which were analyzed for: (i) physicochemical support parameters; (ii) hazardous substances (pesticides), and (iii) ecotoxicological endpoints. The results for Zebro and Lucefécit, presented a 5-day biological oxygen demand (BOD_5) (Zebro: 4.0-35.5 mg L-1; Lucefécit: 2.3-7.5 mg L-1), and total phosphorus (Zebro: 0.18-6.23 mg L-1; Lucefécit: 0.02-1.92 mg L-1), concentrations that may compromise the support of life, with regard to nutrient and oxygenation conditions. Concerning pesticides, the concentrations detected were low, being bentazone the compound quantified at highest levels at Lucefécit (1.94 µg L-1). As for the ecotoxicological characterization, samples from Zebro and Lucefécit streams were identified as toxic when using sublethal endpoints (e.g., reproduction, feed inhibition or growth inhibition). In conclusion, the ecotoxicological characterization identified the streams which promoted a higher negative impact in the reservoir, which is essential to delineate specific management actions to improve its ecological status and the balance of the respective ecosystems.

KEYWORDS

Alqueva tributaries, pesticides, ecotoxicological assessment, ecological status

Evaluation of energy production through solar photovoltaic technology for self-consumption in the Parish Council of São Bartolomeu de Messines, Portugal

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ABSTRACT

Human survival depends on the continuous supply of energy whose demand has been steadily increasing. Sharp rises in fuel prices have had major repercussions on the economies of the countries with the greatest energy dependence, and make it imperative to change attitudes and practices in business and social circles. Today, the problem is how to meet energy needs without negatively affecting the environment, as well as ensuring the well-being of current and future generations (sustainable development).The promotion of alternative energy is one of the priorities of the energy and environmental policy of European Union, since it is a decisive factor in reducing greenhouse gases, thus enabling compliance with the Paris agreement.In this work an evaluation and design of a system of production of electric energy through photovoltaic solar systems of self-consumption using the cells of monocrystalline silicon is made for a particular building (parish council of São Bartolomeu de Messines). The payback period was calculated. It has been found that the required installation power is 6 kW with a minimum cost of 10 000 €, estimated to be recoverable by 6.7 years, reducing the annual cost of the building by 60%.

KEYWORDS

Photovoltaic solar technology, Electric power, Public buildings, Sustainability, Self-consumption

Can analyses of pharmaceuticals and personal care products mirror microbial source tracking of faecal water contamination?

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ABSTRACT

Faecal contamination of water occurs from various point and nonpoint/diffuse sources, which mainly comprise discharges of industrial, municipal and domestic wastewater as well as storm-, urban- and agricultural water run-offs. It is normally likely to identify most of these pollution sources, whereas it is not entirely easy to identify their anthropogenic and/or zoogenic origins. An identification of the primary origins of faecal water contamination is of an emerging importance due to the health risks associated with enteric pathogens and in particular those causing waterborne zoonoses. It is therefore essential to implement efficient measures to detect and identify the dual origin of multiple faecal pollution sources simultaneously as to act upon reduction of potential health risks of water-related infections and diseases to humans and animals. Tracking of faecal water contamination can be performed through chemical and microbial methods, and this article evaluates applicability of microbial source tracking (MST) using Escherichia coli and Bacteroidales 16S rRNA genetic markers in discriminating anthropogenic- and zoogenic-originated pollution sources and their associations with chemical compounds represented by selected pharmaceuticals and personal care products (PPCPs). Microbial, molecular and chemical analyses were conducted throughout a two-year study period in water samples collected from tributaries to the lake Gjersjøen, a drinking water reservoir bordering nearby Southeast Oslo, Norway. The results revealed seasonal variations in faecal water contamination and wide varieties of PPCPs and their concentrations. In addition, the study disclosed cases in which outcomes of PPCPs analyses do not mirror consistently the findings of MST.

KEYWORDS

Bacteroidales, Escherichia coli, faecal contamination, genetic markers, pharmaceuticals

The first implementation of green wastewater technology to agro-tourism business in Romania

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ABSTRACT

This article describes the first implementation of green technology for wastewater treatment from agro-tourism facilities in Romania. The general concept was based on the principles of nature-based treatment system (NBTS) developed, tested and successfully operated under cold climate conditions in Norway. One of the most efficient NBTSs with respect to removal of organic matter, nutrients and microbes can be characterised by systems equipped with filter bed or constructed wetland (CW). The removal efficiency of the main pollution parameters in these systems is relatively high (>90% BOD, >50% N, >90% P and >99% bacteria). The proven high-performance was the key selection factor for Northern Romania, as the green wastewater technology was meant to be implemented in the cold region of Eastern Carpathian Mountains. A proposal of such technology was designed with regard to the Norwegian guidelines for construction of system equipped with septic tank, pre-treatment section and filter bed/CW, as well as with consideration to the strategic planning and data characterising the Romanian sites. Following the design criteria, two NBTSs were constructed and set in full operation to treat wastewater from agro-tourism facilities located in Mara and Vadu Izei villages in the Maramures County. Overall, both systems fulfil their intended purification tasks in which the common wastewater pollution parameters do not exceed their permitted values in effluents discharged to water bodies in Romania. In addition, the NBTSs play secondary role in the green technology as both represent "treatment gardens" perfectly adapted to the cultural landscape of traditional rural Maramures region.

KEYWORDS

agro-tourism, constructed wetland, pollution, wastewater treatment

Environmental bio-indicators: ants as a tool for monitoring urban green in the south of Portugal

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ABSTRACT

Ants contribute to the regulation and survival of many organisms as a result of being involved in numerous interactions through herbivory, predation and/or mutualism with other organisms, such as bacteria, plants, fungi, arthropods and vertebrates. Until recently, it was thought that urban areas were not interesting for biodiversity studies. However, there is much research on ant diversity in green areas within urban landscapes worldwide. In fact, urban ecosystems can ensure a high diversity of native ant species and contribute to their preservation. The present study was aimed at providing a baseline data on ant species diversity in Polytechnic Institute of Beja Campus and evaluating the disturbance level of habitats exposed to different anthropogenic pressure, using ants as bio-indicators of ecosystem health. Each species was classified according the functional groups used for Iberian Peninsula. Sampling was carried out from May to August, by installing 12 pitfall traps in three different habitats. In total, 17 ant species were identified. The results showed that although all the plots are disturbed, since they are ecosystems strongly managed by man; the average value of disturbance index is 53%, but the Disturbance index in each plot ranged from 60 to 75.

KEYWORDS

Disturbance, functional groups, habitat, pitfall

Arthropods biodiversity in a landscape mosaic dominated by organic olive groves in Alentejo (Portugal)

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ABSTRACT

Farming and the need for increased production has given rise to more simple and homogeneous landscapes. An example is the extensive olive plantations with intensive and super intensive systems, across the Mediterranean basin. The group of arthropods represents an important part of the biodiversity in olive groves, where they can provide multiple ecosystem services, such as biological control of crop pests. This service helps maintaining agricultural productivity and reduces the need of pesticide inputs. The objective of this work was to study the abundance and diversity of arthropods in a landscape mosaic dominated by organic olive groves in Alentejo, Portugal. We selected two landscapes consisting of four olive groves plots in organic production and a contiguous plot of Holm oak woodland. Olive grove plots were covered by spontaneous and / or sown vegetation and the Holm oak woodland plot was dominated by spontaneous vegetation. Three passive traps for interception of flying insects were installed in each plot, except for the third plot, was only placed one of these traps. These traps consist of two plexiglas plates (52 cm x 32 cm) arranged crosswise and placed vertically on a bright yellow plastic funnel (ø 34 cm) placed about 70 cm above the ground. In the funnel was placed 2.5 L of water and detergent. The collection of arthropods was held on the 3, 11 and 18 of June, and on the 9, 16 and 23 of October of 2014. The samples were collected with 7 days apart from each other.

KEYWORDS

Holm oak woodland, predators, ecological infrastructures, functional biodiversity

Combining lacasse and biogas production: use of cerrena unicolor as pretreatment for anaerobic digestion of sugarcane bagasse

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ABSTRACT

The present paper aims to report the combine production of laccase from sugarcane bagasse (SCB) with posteriori use of the biomass residue to produce "green energy" in form of biogas. SCB is a residue product from the sugar and alcohol production, with a figure of 186.711 million tons of bagasse produced only in Brazil at the year of 2016. The technology here presented has the capacity to aggregate value to final by product of the sugarcane sector. Initially, strain of white-rot fungus Cerrena unicolor was cultivated on sugarcane bagasse (SCB) with addition of medium or tap water. As result, we observed, a continuous increasing production of laccase during 63 days after inoculation. Subsequently the confirmation of the potential use of SCB, a second experiment was set to evaluate the laccase activity for 96 days. The treatments consisted: SCB + Medium; SCB + Microelements; SCB + Water and only medium. The treatment of SCB + Medium presented a production 455% higher than the traditional method using medium. The production reached 4241 units/L while the medium treatment reached 631 U/L. The other treatments presented no satisfactory results in comparation with medium. Posteriori the recovery of laccase, the biomass residue from this process, consisting mostly of SCB, was used as substrate for BMP analyses under mesophilic conditions. In terms of biogas efficiency, comparatively, there is no advantage of using of this residue over traditional substrate as maize silage for instance. And in the economical aspect, the laccase production has major role in the process. Although, the use of the SCB residue after laccase production to obtain biogas is still valid alternative, increasing the process profitability.

KEYWORDS

Residue, pretreatment, Anaerobic digestion, Fungi, Lignocellulolytic

Finding equation constants transfer heat fluids in open porous structure

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ABSTRACT

The article presents the results of the development of methodology for finding the characteristics of the porous structure and heat permeability of porous materials. We describe the experimental setup that was used for the practical determination of heat permeability of porous materials. It was determined that the more porous body is compressed, the smaller are the pores in the fibrous material and becomes less function geometric characteristics of fibrous-porous body. For closed porous structure of the function to zero. Found geometric characteristics of the porous structure and heat penetration fourteen porous insulating material.

KEYWORDS

stationary thermal conditions, hyperbolic surface, material compression, coefficient of thermal permeability, characteristics of the porous structures of insulating materials

Improving water treatment technology in small waterworks by using-ozone

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ABSTRACT

Positive impact of ozone on substances contained in water causes its wider use in the technology of treating water intended for consumption. The implementation of this technology considered as modern mainly concerns large water supply stations. This is confirmed by the increasing number of plants introducing this very effective way to improve the quality of the product leaving the water treatment plant. Technical progress in the field of improving the construction of equipment for the production of ozone and its introduction into water, the way the ozone residue is used and process automation, cause a relative reduction in ozonation costs and the needs in terms of qualifications of personnel operating the equipment. In many cases, taking into account the quality of the water taken in and the requirements for drinking water, the use of ozone becomes a necessity. The subject of the article will be the analysis of the possibility of using ozone in water treatment processes in small treatment stations, which mostly prepare water for the needs of rural water supply systems. The work was based on the example of the Container Water Treatment Station (CWTS) in Mszana Dolna (Małopolskie Voivodship) with a nominal production of 15 $m^3 \cdot h^{-1}$. The station, using infiltration water, works in a two-stage filtration system with indirect ozonation of water in front of active carbon filters. The paper analyzes the technological effectiveness of CWTS by analyzing the quality indicators of treated water. It was found that treated water fully meets the requirements set for drinking water. A cost analysis was also carried out to answer the question: is there an economic justification for using this type of technological systems in small treatment stations in Poland? This analysis was based on water production and its costs in 2017. The unit cost of water was 2.59 and 3.27 $PLN \cdot m^{-3}$ for the variant including nominal production and the variant with a hydraulic load of 58.7% of the nominal load.

KEYWORDS

ozone, water treatment, small treatment stations

Evaluation of trees growth in the plant-soil treatment plant irrigated with domestic wastewater using LiDAR data and GIS technique

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ABSTRACT

The main aim of paper was evaluation of trees growth planted on the surface of plant-soil treatment plant irrigated with domestic wastewater with using LiDAR data and GIS technique. The wastewater treatment plant was designed for year-round wastewater treatment. Irrigated area was divided on plots of 0.11 ha area each, on which poplars planting were applied as well as mixture grass was sown. In the beginning phase of the wastewater treatment plant operating the irrigation dose was 110 and was introduced into each plot average every 3 days. In the paper quality and quantity of wastewater using for irrigation in period 1996-2013 were analysed with special consideration of biogens as well as organic matter considered as factors stimulating plant's growth. In addition, in the period 2003-2013 the trees inventories with diameters of planted trees were realized. The research was supplemented with documentation of aerial photographs of the observed object from last 15 years in the terms of the number of trees loss in the forest stand. The research was finally completed with LiDAR data in the form of classified point cloud derived from aerial laser scanning from 2012 realized as a part of the ISOK project. Based on this data, information about the height of each tree was obtained. Conducted interdisciplinary analyses allowed to evaluated the trees growth dynamic and condition of the plantings in the area with intensive irrigation.

KEYWORDS

wastewater treatment plant, tree increments, wastewater irrigation, spatial analyses, LiDAR

Factors affecting the development of algal assemblages in the Alqueva Reservoir, southern Portugal

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ABSTRACT

To study the conditions affecting the development of algal assemblages in the Alqueva Reservoir (southern Portugal), water and sediment samples were taken bi-monthly from January to November 2017, for physicochemical and biological assessments. Samples were collected from 2 platforms located in the reservoir and from 2 tributaries. In addition, continuous meteorological parameters were recorded. Reservoir data revealed a dynamic system, organized according to atmospheric conditions and a thermal stratification that lasted from May through September, typical of warm monomictic lakes. Thus, most of the physicochemical parameters showed significant differences between surface and bottom at both platforms. The water quality showed variations detected through changes in dissolved oxygen, 5-day biochemical oxygen demand (BOD_5), ammoniacal nitrogen and total phosphorus. These results are supported by the analysis of benthic diatoms, measured at tributaries, and phytoplankton at the reservoir, which included contamination-tolerant and bloom-forming species. Sediment analysis revealed that the concentration of phosphorus and nitrogen changed markedly between streams, where sediments are mostly constituted by coarse sand with low adsorption capacity. Therefore, nutrients are easily carried into the reservoir by inflowing water. It is essential to identify possible sources of diffuse contamination and to implement management measures to minimize effects. In addition, it is important to sensitize the neighboring population on the problems of such contamination, which mainly originated from agriculture, animal load, industry and urban development.

KEYWORDS

phytoplankton, diatoms, water quality, sediments, Alqueva

GIS Terrain Analysis for hydrogeomorphic applications and rainfall runoff modeling

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ABSTRACT

The automated spatial estimation of the runoff dynamics, thanks to an advanced and GIS based representation of topography, is a valuable tool for the determination of the travel time distribution, a major factor for the hydrologic prediction in ungauged basins, i.e. basins where it is not possible to calibrate advanced rainfall runoff models due to lack of discharge data. In general, the flow time function is usually obtained by rescaling the flow paths with constant channel and hillslope velocities. Here, a spatially distributed kinematic component is implemented and its influence on the hydrologic response is tested by means of the Width Function Instantaneous Unit Hydrograph (WFIUH) framework. Such framework, implemented thanks to the most recent GIS based methodologies, paves the way for the parsimonious rainfall runoff model called EBA4SUB (Event-Based Approach for Small and Ungauged Basins), recently developed. The presented methodology integrates the three standard steps of the common event-based approach (design hyetograph, rainfall excess and rainfall runoff transformation) accurately adapted for application with a lack of observed data. The proposed procedure requires the same input information as necessary for application of the Rational Formula (soil properties, intensity–duration–frequency rainfall curves and concentration time) and provides both the peak discharge and the design hydrograph shape and, most importantly, reduces the subjectivity of the hydrologist in its application. Results provide new insights for a better understanding of the flow time function and show that the proposed framework is promising for practical hydrology.

KEYWORDS

GIS Terrain Analysis, hydrogeomorphic applications, rainfall runoff

Procedure for excluding land from agricultural and forestry production as a mechanism of agricultural and forest areas protection

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ABSTRACT

The Act on protection of agricultural and forest land from February 3, 1995, among other mechanisms of agricultural and forest areas protection, indicates the limitation of their purpose for non-agricultural or non-forest purposes. Protection of agricultural and forest land is carried out with the procedure of excluding land from production in which it is necessary to obtain the consent of the relevant authority. In certain cases, annual fees and a one-off payment are calculated for the exclusion of land from agricultural or forestry production.

The article analyses the scale of the exclusion of land from agricultural and forestry production within the whole country. The area of agricultural and forest land excluded from production by voivodships was examined and the purposes for which these lands had been excluded were indicated. Trends concerning the exclusion of land from agricultural and forestry production on the basis of statistical data from 2000-2016 are presented. The procedure of excluding land from production on a local scale was also analysed, based on the example of Kazimierza Wielka commune, located in the Świętokrzyskie province. The results of this analysis were presented both in graphical and analytical form.

KEYWORDS

exclusion of land from production, agricultural land, forest land, protection of agricultural and forest areas, real estate cadastre

Energy status of polish companies from the mining industry based on the experience of the energy auditor

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ABSTRACT

After the introduction in Europe of the "Energy Efficiency Act" of May 20, 2016, which entered into force on October 1, 2016, every large enterprise in Poland had to carry out an energy audit by 30 September 2017 at the latest. A large entrepreneur (in accordance with the Act on the freedom of economic activity) is a company that over the last 2 financial years, counting separately each year, exceeded any of the following indicators: 250 or more employed, balance sheet total of 43 million € or more, annual turnover of 50 million € or more. The energy audit of an enterprise must be repeated every 4 years and within its scope it must cover a minimum of 90% of energy consumption in buildings or complexes of buildings, in industrial installations and in transport. This article presents the energy auditor's experience regarding the energy status of large Polish companies from the aggregate mining industry and beyond, as well as their further possible development.

KEYWORDS

mining, energy, renewable energy sources, energetic audit

Microbiological hazards in closed facilities at sewage treatment plants

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ABSTRACT

In the study the degree of microbiological air pollution in several commune sewage treatment plants (capacity up to 15,000 PE) with a covered construction was investigated. The indoor air samples were taken by the collision method in selected rooms of the treatment plant as well as outdoor (both on the windward and leeward side) during different seasons. The presence of indicator organisms was determined in the samples according to the Polish Standards. Identification of individual indicators was done on solid selective-differentiating substrates. In the case of colonies observed on the MacConkey substrate, the material was then sifted onto SS and Endo substrates (to verify the presence of bacteria from Salmonella, Shigella, coliforms and enterococci species). It can be concluded that in all facilities, with the exception of one site, the average CFU (colony-forming unit) values for the total number of bacteria and fungi do not exceed the limit set by the Polish Standards for uncontaminated atmospheric air. There were no significant differences in concentrations of bacteria and fungi observed at windward and leeward sites. The concentration of microorganisms in the immediate vicinity of covered reactors (aeration chambers) in the three examined facilities was rather low. The CFU number of individual indicators, measured in rooms intended for the staff, was comparable CFU in technological rooms and some indicators, e.g. the number of actinomycetes, were even significantly higher in such rooms. Similarly, the CFU values of hemolytic bacteria were also higher. The only place where increased concentrations of bioaerosol were found is the centrifuge room, where digested sludge was being dewatered; it means that the personnel working in this area is exposed to microbiological agents.

KEYWORDS

microbiological hazards, bioaerosols, sewage treatment plant

State-of-the-art of operation of anaerobic wastewater treatment with membrane bioreactors

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ABSTRACT

The paper provides an overview of the anaerobic membrane bioreactor technology with a special emphasis on its performance and drawbacks when applied for domestic and municipal wastewater treatment. Currently, anaerobic membrane bioreactor (AnMBR) technology is considered as a very appealing alternative for wastewater treatment due to its significant advantages over conventional anaerobic treatment and aerobic membrane bioreactor (MBR) technology. According to the reported data, the renewable energy produced at the plants (i.e. from methane) covered the energy demand for membrane filtration while the excess energy can be further utilized. Anaerobic membrane bioreactors are an attractive and very promising technology that needs further research efforts and applications at an industrial scale.

KEYWORDS

anaerobic digestion, bio solids, membrane, MBR, AnMBR, anaerobic wastewater treatment, biogas

Interaction of arrangements of the local spatial management plan in the field of environmental protection with the investment and construction process

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ABSTRACT

The local spatial management plan, adopted in Poland at the level of the municipality, is a source of universally binding law, determines the purpose of the area, the distribution of public purpose investments and defines the ways of development and the conditions for land development. The local plan is the basis for issuing the building permit decision on the areas for which its arrangements apply. It directly interferes with the rights vested in entities in real property and property rights. The provisions of the plan, as an act of universally binding law, bind everyone, including all administrative bodies and courts, as well as property owners. When adopting a local spatial management plan, the commune council should be guided by a number of values, including maintaining spatial order, architectural and landscape values, as well as environmental protection requirements. A local plan is an act of local law, therefore it must contain standards defining the specific purpose of each area covered by the regulation in an unambiguous manner, it cannot contain provisions that make land development conditional on subsequent opinions of public administration authorities or allow any entities to individually agree on deviations from the adopted plan. In practice, however, the ambiguity of provisions regarding environmental protection is noticed, in particular in the interpretation of the concept of biologically active land. The work presents how significantly this problem affects the construction investment.

KEYWORDS

spatial planning, environmental protection, construction investment

The impact of linear investments on the spatial structure of agricultural regions

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ABSTRACT

Linear investments cause irreversible changes in the existing shape and way of using the land located alongside it. In the case of the construction of the highway, these lands are mostly located in rural areas and prior to construction, they were used mostly in agriculture. Losses resulting from such investments affect the natural environment and landscape. Along the impact zone wind conditions change, also exhaust emissions and noise increase. Investors try to avoid the design of wide protection zones of greenery, due to the cost of buying a larger area of land and they usually use it only when it is necessary. Severe ecological losses result from land degradation, disturbances in the drainage system and changes in water relations. Such investments also have a negative impact on the profitability of agricultural holdings, in particular organic farms. The market value of land adjacent to the motorway is also decreasing. Often, on both sides of the motorway there remain land with a small area, access to the ground is difficult or even impossible. In order to reduce the negative impact of linear investments on the spatial structure of agricultural areas, infrastructure integration is carried out. The implementation of consolidations related to the construction of motorways in Poland is not a common and frequent phenomenon, which lacks concrete plans and schemes of actions. The paper presents the objectives of consolidation in the area of the village of Szczepanow in the Lesser Poland Voivodeship.

KEYWORDS

spatial planning, line investments, infrastructure integration

Impact of small municipal solid waste landfill on groundwater quality

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ABSTRACT

The aim of the paper is to analysis changes physicochemical elements in groundwater in the area of a small municipal solid waste landfill located in the territory of the European Union on the basis of 7-year hydrochemical research. Samples of underground and leachate water near the surveyed landfill were collected four times a year in two periods, between 2008-2012 during the use of the landfill and between 2013-2014 at the stage of its closure. The research results were analyzed on the basis of general physicochemical properties: pH, TOC, EC; inorganic elements: Cr, Zn, Cd, Cu, Pb, Hg; and one organic element - PAH. The analysis was carried out in accordance with the EU and national legislation requirements regarding the landfill monitoring system. The assessment of the groundwater and analysis indicators of the leachate pollution allowed interpretation impact of the municipal solid waste landfill on the state of the water environment in the immediate vicinity. The obtained research results have shown that the increased values of Cd, EC and TOC turned out to be the determinants of the negative impact of leachate on the groundwater quality below the landfill. Deterioration of the chemical status in the quality of groundwater within the landfill area was a consequence of the lack of efficiency of the existing drainage system, which may result from the 19-year period of its use. The applied correlation relationship between physicochemical elements between leachate waters and groundwater with a time shift due to the extended time of migration of pollutants or mass transport in waterlogged ground can be an important information tool to identify the threat of groundwater pollution in the area of landfills.

KEYWORDS

landfill, leachate water, groundwater quality, physicochemical elements

Use of fly ashes from municipal sewage sludge combustion in production of fine-grained concrete

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ABSTRACT

In recent years, the quantity of thermally conversed municipal sewage sludge in Poland has increased (according to the data of the Central Statistical Office, in 2000 - 34100 tons of dry mass, 2005 – 37400 tons, 2010 - 66400 tons, 2015 -165400 tons). Application of fly ashes from combustion of municipal sewage sludge in the concrete technology realizes assumptions concerning the waste management proposed in the European Union. This study presents results of investigations on the influence that a partial replacement of the Portland cement by these ashes would exercise on strength parameters of concrete if compared to a reference concrete and concretes containing conventional admixtures (siliceous and calcareous fly ashes) in their composition. Potential influence of application of fly ashes from combustion of municipal sewage sludge on the environment was investigated through the determination of heavy metals leachability. The investigations showed that the concretes containing fly ashes from combustion of municipal sewage sludge improve on strength parameters as well as satisfy the environmental requirements on heavy metals leaching.

KEYWORDS

concrete additives, fly ashes, strength of concretes, heavy metals leaching

Ecological risk assessment of chemical contaminants in stormwater sediments

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ABSTRACT

Contaminants bound to suspended solids transported by stormwater pose quantity and quality problems to the water ecosystem. Therefore, it is necessary to carry out an ecological risk assessment. Currently, Polish legal regulations do not require that stormwater sediments should be tested for hazardous substances prior to their removal. Ecological evaluation was performed for polycyclic aromatic hydrocarbons (PAHs) and heavy metals in the sediments from three selected stormwater sedimentation tanks located in urban catchment areas of Kielce city. The purpose this study was to analyze sediments for chemical contaminants and to demonstrate the relationship between contaminant levels and physical attributes of the catchment, including land use, drainage area, age of catchment and impervious surface in the watershed. Levels of PAHs and heavy metals (Cd, Cr, Ni, Pb and Zn) in stormwater sediments were then compared with Polish regulations and ecological screening values to determine their potential risk to environment were established. The results of the current study suggest that stormwater sediments are moderately contaminated with PAHs and heavy metals according to domestic regulations. They are, however, highly contaminated according to ecological benchmarks, which are exceeded several times.

KEYWORDS

stormwater sediments, PAHs, heavy metals, contamination

Influence of grain sphericity on the rapid filtration and backwashing beds

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ABSTRACT

CHead losses during water flow through the filtration layer are described by the Kozeny-Carmana or Erguna formulas. These losses depend on the layer height and grain size, filtration speed, water temperature and bed porosity. The porosity of the bed has some connection with the sphericity of grains. This relationship is described in a very imprecise manner by the Wen and Yu equations. Because the sphericity of grains is very difficult to measure, it is very often assumed that sphericity equals one. That is the shape of grains are close to spherical and equals are used in a simplified form. A small mistake is made in the case of sand, especially riverbed, whereas for crushed deposits the calculation error can be large.

In the present investigations the device for three-dimensional shape measurement of Kamika Instruments for measuring of sphericity and size of anthracite, chalcedonite, sand and pyrolusite grains were used. These tests were performed for grain size obtained from sieve analysis. These beds filled up with a transparent column allowed to measure the head losses during filtration as a function of the filtration speed, the minimum fluidization velocity and the expansion of the bed during backwashing. The results of the measurements allowed to verify correction coefficients used in the above mentioned formulas and in the formulas with the Akgiray and Saatci, Niven modifications, as well as using the Richrdson and Zaki models. The results showed that for beds, especially crushed grains, omission the sphericity of grains generates an error that is difficult to accept.

KEYWORDS

sphericity, bakwashing rapid filters, filtration beds, minimum fluidization velocity, bed expansion

The scale of air pollution depending on the level of development of selected areas

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ABSTRACT

Air pollution is the result of natural processes and intense urban development linked to, i.a., technological advancement. The volatile substances undesired emission causes environmental threats such as acid rain, aggravated greenhouse effect or the ozone depletion. Moreover, the pollution released into the air, especially the suspended particulates, are harmful to the human respiratory system, skin and eyes. This paper presents the body of analyses conducted in Poland, western Europe (France) and north-east Europe (Bulgaria) on the changes In air pollution concentrations. Collected data relates to the period from 2010 to 2015. This study also shows the pollutant emission In Katowice and Gdansk cities between 2015 and 2017. The data concerning the pollutant emissions have been provided by European Environment Agency and meteorological stations located on Kossutha St. in Katowice and Leczkowa St. in Gdansk. Collected data indicate that pollution concentration levels are different for each region and they mostly depends on the stage of the country or city development. Furthermore, conducted analyzes point to the seasonal changes in the pollutant emissions in Poland. Higher pollutant concentrations have been noticed during the autumn and winter time.

KEYWORDS

air pollution, environment, Europe, Poland

Possibilities of effective use of natural shale gas resources in the Carpathian Foredeep

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ABSTRACT

Gas, as the only one from fossil fuels, is an ecological source of energy and in many cases may be a good supplement to systems based on renewable sources as a peak source. Gas is used in Polish geothermal heat plants, eg in Podhale or Mszczonów. The demand for natural gas exceeds its extraction in Poland, which is why it is necessary to import natural gas. In order to increase the possibilities of natural gas extraction shale gas exploration in various regions of Poland has been conducted for several years.Paper presents the results of research works aimed at recognizing of possibilities of effective development into and exploitation of natural gas from argillaceous series of the Autochthonous Miocene in the Polish part of Carpathian Foredeep. The Carpathian Foredeep is an exceptional petroleum basin in which biogenic gas is reservoired in a very thick but shallow sediment pile of lithologies varying from mudstones to sandstones. Up to now, gas production has originated from sweet-spot intervals of conventional sandstone reservoirs whereas undetermined gas volume has remained undiscovered in successions of clayey sandstones with mudstones and claystones. However, some features make the Carpathian Foredeep petroleum basin a specific target from the point of view of well stimulation during hydrocarbon production from unconventional reservoirs.

KEYWORDS

shale gas, Carpathian Foredeep, Autochthonous Miocene, Poland

The sustainable and beneficial use of the water hyacinths biomass to turn it into a valuable resource

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ABSTRACT

Invasive species are a major environmental problem in every country as well as in Portugal, especially in the Guadiana river basin. The Integrated Project International Aquatic Ecosystem Analysis 2017/2018 reviews the problematic behaviour of water hyacinth (Eichornia crassipes) as an invasive species and potential mediator in unwanted occurrences in the Guadiana river basin. This issue is very actual since it represents a constant threat for a number of aspects, namely environmental, social and economic impacts. The objective of the project was analysis of all the factors with importance in order to come up with a way of dealing with water hyacinth invasion phenomenon, although, in this case we study a way of biomass reuse. The aim of this study is to show the sustainable and beneficial ways of water hyacinth biomass utilization, in order to present the water hyacinth not only as a potential threat but as a valuable resource that would satisfy some of the stakeholder's interest and could be used in the Guadiana river basin. The methods used to analyze the characteristics of the Guadiana river basin was 5S model and the ecological key factors. These include the analysis of field data from previous research and information given by the stakeholders. The results include analysis of biochar, composting and animal feed production. It is concluded that the current population of water hyacinth will be insufficient for any kind of industrial operation, but can be used to fertilize small gardens as a donation.

KEYWORDS

water hyacinth; composting, Guadiana river basin

A proposed model of development of less favoured areas (LFA) in the Milejów commune, łęczyński district

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ABSTRACT

Rural land in Poland accounts for more than 90% of the country's area and plays a very significant role. It is inhabited by 38.1% of the population. Unfortunately, these people are largely unemployed. The present status of the agricultural production space is a result of many centuries of human activity closely connected with social and economic, legal and political conditions. The spatial arrangement of land in the rural areas of central, southern, southeastern and eastern Poland, developed by historical processes, is characterized by the frequent occurrence of individual plot patchworks. An incorrect configuration of land owned by farms considerably affects the profitability and effectiveness of agricultural production.

The accession of Poland to the European Union offered many options for development to our country and in particular to the Polish countryside. Reconstruction of the defective spatial structure in Poland is one of the priorities of the EU's agricultural policy. Numerous development programmes (SOP, RDP) are used for financing land consolidation and exchange works being one of the basic tools for transforming ownership and structural relations in rural areas.

With regard to the fact that agricultural land in Poland is greatly differentiated, particular attention should be paid to less favoured areas (LFA). It seems obvious that farmers in LFA are not able to generate earnings from crops identical to those generated by farmers in favoured areas.

For the purposes of this publication, specific surveys were carried out in the gmina of Milejów, poviat of Łęczna, Lublin Voivodeship. Five villages in that gmina were classified as less favoured areas. The analyses showed that Milejów is one of two gminas in the poviat of Łęczna with the smallest average area of plot owned by individual farmers. Based on the analysis of the structure of ownership and use, fragmentation and distribution of plots, as well as identification of less favoured areas, an alternative land development model was proposed along with the reconstruction of the existing arrangement of land through comprehensive consolidation and exchange of land.

KEYWORDS

land consolidation, spatial structure of land, rural areas, less-favoured areas (LFA)

Biological monitoring of freshwater ecosystems – advantagous of various approaches

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ABSTRACT

Traditional instrumental measures of physical and chemical parameters of water quality are useful to determine sources of water pollution but they are not able to evaluate impact of pollution on living organisms. The most efficient way to understand the threats to biological elements in an ecosystem is to monitor them directly. Two major approaches of biological monitoring have been developed: passive and active biomonitoring. Te passive approach uses organisms growing naturally (in-situ) within the area of interest. On the other hand Active biomonitoring base on organisms introduced and exposed to the pollutants to monitor their reactions. Both approaches of biomonitoring are under the current study in the Department of Ecology and Environmental Protection of the Poznan University of Life Sciences.

For the purpose of monitoring of rivers we have developed macrophyte method based on calculating Macrophyte Index for Rivers (MIR), which was introduced into the national monitoring of running waters in Poland. The method base on quantitative and qualitative evaluation of freshwater plant species. The method is able to assess the ecological status according to requirements of the Water Framework Directive (WFD). Assessments based on aquatic plants can identify eutrophication which is a major problem of surface waters in Poland and it is a good example of efficient implementation of passive biomonitoring approach.

The active approach of biomonitoring under our studies is dedicated to systems based on bivalves as an early warning systems of the tap water pollution. Currently a series of experiments completed proved the strict relationship between behavioural changes (such as valves opening level and velocity of valves movement) and the level of various inorganic substances and pesticides. Laboratory experiments based on the native mussels *Unio tumidus* proved that molluscs as filter feeders with limited mobility are highly susceptible to water pollution.

KEYWORDS
biological monitoring, water protection, water degradation, pollution, quality control

The use of natural soil for the treatment of secondary effluent in the northern climate

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ABSTRACT

In northern climate, cold temperature can significantly impact the efficiency of the biological wastewater treatment process. Systems with lagoons and spray irrigation are particularly vulnerable. Unfortunately such systems are often located on the northern rural areas because they are well suited for small communities where land is usually available and where it is important to keep costs as low as possible. In addition, in cold climate, during winter months, discharge of an effluent to local lakes or tributaries is usually prohibited. The idea of converting lagoon effluent to man-made snow during winter months can help to solve the problem. In the spring, melting water soaks into the soil as it does during summer irrigation. The system uses soil properties as a porous medium for physical and biochemical filtration. In the paper, the results of the studies of the groundwater quality from two different sites of full scale snow storage and treatment are presented. Process factors, such as the concentration of nitrogen, conductivity and phosphorus have been adopted as parameters of concern and are used to assess the effectiveness of the atomizing freeze crystallization process and its effect on the quality of groundwater at the snow deposit site. Significant reduction of phosphorus was achieved by its sorption to the fine soil particles and precipitation. The rest of dissolved phosphorus, as well as other nutrients, are up taken by plants. Usually, It happens before they reach the ground water table. Nitrate is broken down through a process of denitrification in anaerobic conditions present in the soil. Vegetation at the snow deposit site and buffer zone removes most of the nitrogen as nitrates compounds and other nutrients. Monitoring ground water quality confirms that atomizing freeze crystallization process and the treatment of secondary effluent in the soil profile have effectively removed most of contaminants.

KEYWORDS

freeze crystallization, land application, wastewater treatment, spray irrigation

Preliminary assessment of the wind conditions as a potential for using wind microinstallation in order to improve air quality in Poland

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ABSTRACT

Poland has been struggling with the problem of exceedance permissible levels of air pollutions such as particulate matter (PM10, PM2.5) and benzo(a)pyrene for several years. The recent data presented by World Health Organization confirmed poor air quality in Poland. Of the European's 50 most polluted cities, 36 are in Poland. The rest city are located in Bulgaria (Vidin and Dimitrovgad – two the most polluted city in Europe), Czech Republic and Italy. However, the industry and conventional energy sector significantly reduced the amount of pollutants emitted to the air in recent years. Currently, the main causes of the poor air quality are outdated and inefficient heating installation based on solid fuels, commonly used in households. Therefore, use of renewable energy sources is one of the solutions aiming to improve air quality in Poland.

Wind energy resources are varied on the area of the country. The highest wind energy potential occurs in the northern part of Poland, and the lowest in the south-western part. The use of wind energy resources by high-power installations is not always possible. Consequently, the wind microinstallations, as a part of distributed energy system, have an opportunity to enhance the local energy security. In Poland, the most widely used data for estimate the wind conditions are obtained from Institute Meteorology and Water Management-National Research Institute. However, it should be noted that this data should be used only for the nearest area of measurement station due to high variability of wind conditions. Therefore, preliminary assessment of the wind conditions was based on the results obtained from own measurement station located in Rabka-Zdrój. Rabka-Zdrój is a health resort municipality located in Lesser Poland. The measurement of data recording had been initiated in November 2017. The currently available data was used to assess the wind conditions as a potential for using wind microinstallation.

The scientific work was financed from budgetary sources for years 2017-2021, as a research project under the “Diamentowy Grant” programme (grant agreement No. DI2016 003946). Part of the work was prepared under the AGH-UST statutory research grant No. 11.11.140.031.

KEYWORDS

air quality, Rabka Zdrój, wind energy, microinstallation, wind conditions

Influence of selected factors on removal of organic matter in a model of moving bed biofilm reactor

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ABSTRACT

The aim of the research was to determine the impact of selected factors on removal of organic matter, expressed in biological oxygen demand at 5 days (BOD_5) and chemical oxygen demand (COD_{Cr}) in a laboratory scale moving bed biofilm reactor (MBBR). Factors that were included in the experiment are: carrier filling ratio (CFR), hydraulic load and aeration intensity. The tested model of the bioreactor consisted of five independent chambers with diameter D = 0.14 m and height H = 2.0 m, which were filled with biomass carriers: 0%, 20%, 40%, 60%, 70% (v/v CFRs). During the research, hydraulic loads at the level of Qh1 = 0.073 $m^3 \cdot m^{-2} \cdot h^{-1}$ and Qh2 = 0.036 $m^3 \cdot m^{-2} \cdot h^{-1}$ were applied, which provided hydraulic retention times (HRT) of 24 and 48h respectively. The reactors were subjected to constant aeration at P1 = 3.0 $dm^3 \cdot min^{-1}$ and P2 = 5.0 $dm^3 \cdot min^{-1}$. The tests were carried out in laboratory conditions for 183 days. In the analyzed period, 37 measurement series were carried out, subjecting physical and chemical analysis to 222 sewage samples. The analyzed model received domestic sewage, after preliminary treatment in the septic tank, which were characterized by high variability of BOD_5 (110.0 - 1350.0 $mgO_2 \cdot dm^{-3}$) and CODCr (224.0 - 1450.0 $mgO_2 \cdot dm^{-3}$). The average values of these indicators were at the level of 521.24 $mgO_2 \cdot dm^{-3}$ for BOD_5 and 711.33 $mgO_2 \cdot dm^{-3}$ for COD_{Cr}. The research results allowed to determine the efficiency of wastewater treatment in each chamber, and thus determine the optimal filling ratio with carriers (60%), which provided the highest elimination of BOD5, CODCr in the effluent. By analyzing the ANOVA variations and the Kruskal-Wallis test, the significance of the impact of the discussed factors on the values of the tested indicators in treated wastewater was verified. In the case of BOD_5, no significant effect was found only in the case of hydraulic load. At the same time, a three-factor interaction was found, which meant that

the studied factors significantly modified the mutual interactions in the BOD_5 reduction process. Analysis of the three-factor interaction showed that in conditions of lower aeration (P1 = 3.0 $dm^3 \bullet min^{-1}$) reactors with a higher CFR (from 40% to 70% v/v) had better BZT_5 reduction effects only at lower hydraulic load (Qh2 = 0.036 $m^3 \bullet m^{-2} \bullet h^{-1}$). In turn, with increased aeration (P2 = 5.0 $dm^3 \bullet min^{-1}$) in the reactors filled with carriers from 0% to 60%, the lowest BZT_5 values were obtained with a higher hydraulic load (Qh1 = 0.073 $m^3 \bullet m^{-2} \bullet h^{-1}$). In the case of COD_{Cr}, a significant impact of the examined factors was closely related to the other work parameters of the reactor. For example, carrier filling ratio had a significant impact on the COD_{Cr} values only at a lower hydraulic load.

KEYWORDS

wastewater treatment, moving bed biofilm reactor, bod cod reduction, hydraulic load, intensity of aeration

Effects of biochar addition on vermicomposting of food industry sewage sludge

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ABSTRACT

Sewage sludge (SS) is a byproduct of wastewater treatment which is commonly used as fertilizer in the world. However, due to possible contamination with heavy metals, xenobiotics and fecal pathogens the use on fields is not so common in Poland. Safer alternative for agriculture use is the SS produced by food industry in small „inhouse" wastewater treatment plants, as substances that are used in production are usually less harmful. As pretreatment of industrial wastewater is required before dumping the wastewater into common stream, the SS is an abundant byproduct that needs to be managed in environmental friendly and cost effective manner. As usually the water content in SS is high the dosage and logistics are problematic and thus we propose converting the sewage sludge into solid granular fertilizer in vermicomposting process. Not only weight and volume of product are decreased, but also the nutrients such as N, P, K get concentrated and made more accessible for plants. The SS is also further stabilized and less prone to produce odors and becoming putrid. The aim of this study was the in-depth analysis of process of SS wermicomposting with biochar. SS was acquired from local soft drink factory wastewater treatment plant. Batches of SS were inoculated with 20% mature vermicompost and E. fetida worms. Instead of typical bulking agents (like woodchips or straw) powdered biochar was used in concentrations of 5,10 and 15% as it exhibits beneficial influence on process and increase value of final product.

KEYWORDS

biochar, vermicomposting, sewage sludge

A photovoltaic system as a support power source for a hotel facility

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ABSTRACT

Silesia is one of the most industrialised regions of Poland. There is a dominance of mining, metallurgy and other branches of the heavy industry. Unfortunately, due to the economy based on coal, it is also a region whose natural environment suffered from considerable degradation and a high level of air pollution. In order to change this negative image of Silesia, various activities are undertaken. One of such activities has to do with an attempt at the gradual replacement of coal-based power industry with a power industry based on renewable energy sources (RES). This paper presents an analysis of the implementation of photovoltaic (PV) as an auxiliary source of electrical energy to power a hotel located in Katowice. The hotel under analysis is a 4 stars hotel with 168 rooms and a large conference centre. All amenities in this structure (including the kitchen) feature an electrical supply because apart from an electrical link and a district heating substation the hotel does not have other sources of power. On the basis of the actual daily profiles of the consumption of electrical energy and on the basis of the area available on the hotel building, one conducted many simulations of the operation of a photovoltaic system which could be installed in this building. In this case, the selection of the power of the system is a critical parameter because it must ensure the most efficient consumption of the energy which is produced. Moreover, in the course of a number of months, an anonymous survey devoted to RES was conducted among the hotel guests. It follows from the survey that the application of RSE in hotel buildings may attract a certain new group of guests with pro-ecological beliefs to those buildings. These people are even willing to be charged slightly more for a hotel service, knowing that the hotel uses RES.

KEYWORDS

renewable energy sources, photovoltaics, tourism , hotel

Demand of a hotel for electrical energy and the conception of the reduction of this demand by application of renewable energy sources (RES)

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ABSTRACT

Tourism is in Poland one of the most developing branch of industry. Every year the number of tourists visiting Poland increases. Hotel sector consists mostly of small and medium enterprises and in this category of business the price of energy is an important item of the final budget (taking into account the relatively high unit price of energy). Hotels characterise by a specific twenty-four hour profile of energy demand - they use the increased amount of energy in the morning and in the afternoon and early evening, while at midday the significant decrease in energy request can be observed. In the article, the analysis of energy profile for the medium size hotel consisting of about 160 rooms is presented. The energy profile was created on the basis of the whole year measurements of electric energy consumption. It was taken the attempt of balancing the hotel energy needs by applying the renewable energy sources (RES) accesible for using in the hotel building. The installation should provide the commercial success and it was the important criterium of the system optimisation due to the changing rules of the support of the development of alternative energy sources by the Polish government. Additionally, in the article the results of the survey carried out among the guests of two hotels were presented. The survey concerned the various aspects of using renewable energy sources in hotels and included the question about the influence of RES application on the decision of the choice of the hotel for staying by various groups of potential guests.

KEYWORDS

profile of energy demand , renewable energy sources, solar energy, wind energy, tourism, hotel

New approach to river maintenance depending on climate change

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ABSTRACT

Climate change has spread to various fields of water management. Climate change forces us to change and further develop the optimized technologies for the production of drinking water or the purification of wastewater. But climate change also has an impact on the river. The supply (flow) in the rivers changes. The task of water maintenance and water management is to facilitate the clean drain and to improve fresh water ecology. In recent decades, in addition to the classical hydraulic engineering (seawall,

Meandering) applied the engineering-biological construction. In recent years, the Instream River Training has been propagated as another option for waterbody maintenance. The following presentation will present the principles and benefits of the Instream River Training for small river.

KEYWORDS

Climate change, water management, river, engineering-biological construction

Assessing water quality for irrigation and soil salinization risk under drought: the case of the Alqueva reservoir (Guadiana river basin)

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ABSTRACT

Water is a scarce resource in Mediterranean regions where adverse climatic conditions that promote water shortages tend to increase with global change. In 2017 Portugal, a country in the Mediterranean climate zone, experienced a drought season that has extended throughout almost the entire territory of mainland Portugal reaching the level of severe drought. In fact, drought years are becoming more frequent in Portugal, where climate change is leading to larger water abstractions for agriculture. Under water scarcity conditions and high atmosphere evaporative demand, the risk of land salinization is one of the major threats to the sustainability of irrigated agriculture. This scenario makes very important the assessment of the quality of irrigation water and the risks of salinity for crop production, in order to ensure the maintenance of long-term salt balance at a crop, farm or regional scale. This study is focused on the salinity risks for the production of the most representative crops grown in the Alqueva irrigation area, a scheme with a total area of 120 000 ha centered in the Alqueva reservoir, within the Guadiana river basin. For the purpose of the study, a chemical assessment of some major inorganic ions, pH and electric conductivity (ECW), was conducted during 2017, in water samples collected on four platforms sited in the reservoir. Water quality for irrigation was evaluated considering both the Portuguese regulations and the FAO guidelines. Sodium adsorption ratio (SAR) and soil salinity (ECe) were estimated in order to assess potential sodium-related soil permeability and crusting problems, as well as, potential yield reductions in the most significant crops of the Alqueva perimeter. For ECe estimates two scenarios related with salt concentration factors were considered. The chemical assessment showed higher ion concentrations

patterns and water salinity with increasing drought conditions. Sodium hazard evaluation showed slight to moderate risk of reduced infiltration rates, a result that should be taken into account when surface or sprinkler irrigation systems are used. Potential yield reductions were mainly found in open-field horticultural crops classified as moderately sensitive to sensitive in the salt tolerance scale.

KEYWORDS

soil salinity; irrigation water quality; water scarcity; salt tolerance

Hydraulic investigation for emergent rigid and flexible vegetation

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ABSTRACT

Apart from hydrodynamic parameters, the influence of vegetation on flow conditions greatly depends on the plants species, plants development phase and geometric and mechanical properties. Amongst other mechanical properties, the key role is played by the flexibility (elasticity) of plants. This parameter makes the plants bend, to various degrees, under the force of flowing water. Its determination, in particular for flexible vegetation of the inter embankment zone, is crucial for forecasting the behaviour of vegetation and determining the hydrodynamic drag forces resulting from vegetation. This is also directly linked to the water table in the channel. Laboratory model investigation has been carried out on biomechanical and hydraulic properties of rigid and flexible vegetation covering river valleys. Measurements of flow conditions (amongst others: flow velocity distribution, water swelling and flow resistance of vegetation zone) were conducted in a hydraulic flume for branches of willow (Salix purpurea L.), flexible plastic rods and rigid steel rods. Results of measurements of hydraulic parameters for the investigated clusters of artificial rigid vegetation, artificial flexible vegetation and natural purple willow branches were analysed. The MEJ parameter (incl. the modulus of elasticity E) was used as a mechanical properties criterion of those vegetation clusters. The MEJ parameter can be used as a criterion to classify vegetation, for example in natural river regulation. It can also be used to determine the influence that a given type of vegetation and biological arrangement have on river dynamics. Lastly, results of research on mechanical properties of plants and theirs impact on hydraulic flow conditions could prove useful in design of hydro-engineering proecological structures.

KEYWORDS

rivers, flow conditions, vegetation stiffness, river regulation, flood prevention, ecological engineering

Origin and fate of contaminants in surface waters in Gdańsk Region

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ABSTRACT

Due to the specific nature of the urban environment, undesirable human-related substances are present in surface waterbodies. Consequently, many rivers and streams in Gdańsk Region have been constantly failing water quality targets. Composition of stormwaters is typically shaped by atmospheric pollution and surface run-off from the basin. Pollution to the atmosphere is related to emissions from power plants, domestic furnaces and industry. Major sources of surface contamination are industrial stacks, construction works and road transport. Most hazardous pollutants have usually anthropogenic source and are called priority substances, which are listed in Water Framework Directive. Cadmium, mercury and benzo(a)pyrene are those, which concentrations in Gdańsk rivers were analysed in between 2011 and 2015. Chemical status of main Gdańsk streams was determined on the basis of the pollutant annual mean concentration. All surface waters in Gdańsk were given “below good" chemical state according to the most recent environmental requirements. Thus, compounds present in the water may have a negative impact on the environment and their exposure can pose a threat to human health, fauna and flora. One may also observe a recurring trend of an increase in cadmium concentration in subsequent years and a decrease in mercury concentration over the years. The differences in benzo(a)pyrene concentrations are not large and usually remain stable without showing any particular trends. Numerous exceedances of the norms of all parameters were noted.As a result of environmental changes rainwater is being contaminated in contact with the air, absorbing solid, liquid and gaseous particles. With surface run-off and direct deposition, cadmium, mercury or benzo(a)pyrene enter the waters. To reduce the amount of pollutants entering the waters, integrated actions should be undertaken.

KEYWORDS

engineering and technical sciences, environmental engineering, environmental chemistry, surface waters, priority substances

The tourist use in the Conservation Units of the State of Santa Catarina (Brazil) and the performance of tour guides and environmental drivers

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ABSTRACT

Santa Catarina is a State located in the subtropical climate of Brazil and possess in his territory of 95,734 km^2, a large expanse of the Atlantic Rain Forest Biome. In this region there are 28 protected areas such as National Parks and Biological Reserves, for example. This protection covers in sum 3.8% of the total territory of Santa Catarina and is ensured by law through the Brazilian System of Conservation Units. The focus of this research was to analyze the tourist use in the Conservation Units (CUs) of the State of Santa Catarina. Over the last decades the potential of tourism linked to protected areas has been studied to encourage political and investment actions in Brazil. The performance, legal responsibility and training of tour guide professionals within federal and state UCs and their surroundings. The regulation of the profession is through the Institute Chico Mendes of Biodiversity (ICMBio), manager of the federal UCs. The state UCs, under the management of the Environmental Foundation (FATMA), do not have specific regulations, which establish norms and procedures for the provision of services linked to visitation and tourism in CUs, by conductors of visitors, being an issue defined in the management plans of protected areas. In addition to the lack of regulation, the training courses curriculum presents heterogeneity in the content and integration of the generic themes that defines the goals of the tourism proposals. This research intends to contribute with an overall view for the State of Santa Catarina, about the respective questions of tour guidance areas, being able to offer subsidies for the construction of strategies and methodologies of tourism planning. In a second stage, include a mapping of traditional communities that live in areas of influence of the Units and can be integrated into the tourist activities.

KEYWORDS

Tourism; Protective Areas; Landscape Conservation

LC-MS/MS method validation for determination of selected neonicotinoids in groundwater for the purpose of a column experiment

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ABSTRACT

Neonicotinoids are currently one of the most widely used class of insecticides in agriculture. These pesticides were detected in surface and groundwaters in many places around the world, which contributed to placing them on the European Union first Watch List in 2015. This Regulation recommends inter alia indicative analytical method for neonicotinoids determination in groundwater samples which is liquid chromatography (tandem) triple quadrupole mass spectrometry LC-MS/MS with solid-phase extraction, and establishes maximum acceptable method detection limit of 0.009 µg/L. In this paper basic parameters of LC-MS/MS method validation are presented. The tests were performed for five different pesticides from neonicotinoids group: clothianidin, imidacloprid, thiacloprid, thiamethoxam and acetamiprid in concentration range from 0.1 µg/L to 100 µg/L. Infinity 1290 (Agilent, USA) chromatograph coupled with QTrap 5500 mass spectrometer (Sciex, Canada) was used. The calibration curves were obtained on the basis of results of analyses of 6 standard solutions. Linearity was not lower than 0.9987. Limit of detection calculated from Fleming formula on the basis of multiple analysis of blank sample was about 0.1 µg/L whereas limit of quantification not exceeded 0.12 µg/L. Precision expressed as relative standard deviation was lower than 3%. The accuracy and uncertainty of validated method were also determined. Validation of LC-MS/MS method was performed for the purpose of a further column experiment, hence to simplify the method and reduce the time of the experiment, solid-phase extraction was omitted. As a result, established in the Regulation detection limit was not reached.

KEYWORDS

walidation, LC-MS/MS, neonicotinoids, groundwater

Analysis of water consumption in the campus of Warsaw University of Life Sciences – SGGW in years 2012-2016

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ABSTRACT

The specificity of the university's activities means that the distribution of water consumption in such centers may be different in relation to other users of water supply networks. The literature lacks information on the structure of water consumption in academic campuses. The article presents the results of research on the water distribution structure in the campus of the Warsaw University of Life Sciences – SGGW in years 2012-2016. The water consumption in the campus is registered automatically using the water consumption monitoring system. The collected data will be subjected to statistical analysis. For the analyzed years, the amount of water consumption in monthly periods will be determined. The variability of daily and hourly water consumption for each month will be presented. Average water demands per day in the WULS campus for each day of week will be calculated. Unit water consumption per student and daily and hourly peaking factors will also be calculated. The obtained results will be compared with the structure of water consumption in single and multi-family buildings presented in the literature.

KEYWORDS

water supply, daily peaking factor, hourly peaking factor

Studies on threshold density of plant concentration *Phragmites australis* focused on their hydraulic interaction in the riverbed

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ABSTRACT

The paper features the results of numerical analyses and field survey concerning the density threshold for concentration of Phragmites australis plants in the aspect of its impact on hydraulical flow conditions in the river. Simulations were performed for a typical vegetation concentration mapped from representative natural riverbed of Sleza River (Lower Silesia/Poland). The numerical model was constructed, which was calibrated on the basis of field survey conducted with use of hydrometric current meter and an acoustic Doppler current profiler (ADCP). For given fixed spatial configuration (of the area) of analyzed riparian plant community, in numerical model, the community density was altered by i.e. increase of stems distribution density. Such boundary measure of plant concentration (density) was sought, that after it is exceeded, the flow through the plant community is negligibly small in comparison to dominant stream circumfluenting the plant „obstacle".

The analysis was also conducted on variable and dependent on vegetation density hydraulic interactions between the vegetation zone and water stream in river. Knowledge of boundary density for particular vegetation species in riparian zones can be used in ecological engineering, especially in proecological river regulation. The conservation practices can be performed in the riverbed that allow to keep vegetation communities, interfering only its density and by that there is an opportunity to control the riverbed processes.

KEYWORDS

rivers, vegetation, flow conditions, ecological engineering, density of vegetation zone

Analysis of struvite migration into soil profiles

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ABSTRACT

At the end of the twentieth century, among people involved in agricultural production, a discussion began on cultivation technologies for crops. It was found that the current methods of fertilization do not fulfill their role, because the barrier of effectiveness of the doses of nutrients was achieved. The rapid physical and chemical degradation of the soil affected the physiological condition of the plants, resulting in a decrease in yields and their quality. First of all, you need to take care of the right condition of the soil as the basic and only source of nutrients, water, and growth substances for the plant. Soil additives, consisting of specific mixtures of mineral compounds, should influence the activation of cellular metabolism processes, soil microflora, best adapted to the environment. Applied proper fertilization stimulates the processes occurring in the humus in a gentle way. This triggers a series of reactions favoring the development of soil and plants, allowing to compensate for the degrading impact of intensive agricultural production. Works on fertilizers enriched with microelements, growth regulators or amino acids with an extended release period of biogenic elements have begun. An important element in the application of fertilizers is their dose, which is closely related to the previously determined soil parameters. This work focuses on the analysis of struvite migration in the soil profile and its impact on the chemical and physical parameters of the soil.

KEYWORDS

struvite, soli

Influence of the length of a study period on dimensioning of usable capacity of mains water tanks

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ABSTRACT

The article shows the influence of the length of the water demand observation period on the usable capacity of the mains water tank. The analysis conducted was aimed at defining the minimum observation period allowing for calculating the optimal usable capacity of a water tank operating in a rural water supply system. The analysis uses cluster analysis and the k-means method, which is an innovative application for determining the hourly means of water demand distributions. Based on the analysis of research conducted in two water supply systems with a different number of recipients, it was found that the water demand observation period of one year is optimal for calculating the usable capacity of mains water tanks.

KEYWORDS

water demand, usable capacity, water tank, dimensioning, operational volume, water storage

Directions of development of rural areas in Poland (sustainable agriculture, ecological agriculture)

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ABSTRACT

The development of rural areas is determined primarily by the natural environment. Abiotic factors such as soil, water and ambient temperature are very significant for agriculture. At the same time, the development of rural areas is conditioned by demographic aspects, structure of settlement, and professional activity of the local people.

The main objective of rural land management is improving the spatial structure and the working and living conditions of the rural population in close relation to environmental protection and development of such grounds. In Poland, agricultural development directions include sustainable and ecological agriculture. These forms of agriculture are developing intensively with regard to a large need for maintaining high crop yield and at the same time reducing the environmental burden. The production of high quality food is significant, while the highest possible biological equilibrium in the natural environment should be maintained at the same time.

This article aims to prove that the above-mentioned directions of development of rural areas are very important in Poland and they generate many advantages for the natural environment. In addition, a useful procedure in improving the spatial structure is land consolidation process carried out in rural areas. Its main objective is improving the configuration of land giving it an optimum shape. This process has a positive impact on agriculture and the community living in such areas.

KEYWORDS

land consolidation, sustainable agriculture, ecological agriculture, land-use, land development

Ecological and landscape aspects in land consolidation process

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ABSTRACT

Land consolidation process plays a significant role in rural land arrangement because it stimulates the functions of these areas, e.g. in the economic, social or environmental sphere. Consolidation of land generates a number of advantages for the community living in the specific area since it improves the spatial structure of land. Ecological and landscape aspects play an important role in such a process. Determination of ecological risks is an element taken into account while preparing a relevant project of the spatial restructuring of land. Elements of natural environment which to a large extent determine the need for such a change include: soil quality, water, terrain relief, landscape, and air.

Works on the landscape conditions of the spatial structure of rural areas take into account: the existing status, the expected shape of the landscape and the method of work used to achieve the intended effect. Ecological and landscape aspects play a significant role in consolidation works. Therefore, this paper aims to emphasize the importance of such aspects in the consolidation process.

KEYWORDS

land consolidation, environmental protection, spatial planning, environmental impacts, land-use, land development, ecological land-use

Nitrogen transformations and removal pathways in intensified constructed wetlands for treatment of ammonia stripped effluent

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ABSTRACT

This study investigated the treatment performance and nitrogen removal mechanism of highly alkaline ammonia-stripped digestate effluent in horizontal subsurface flow constructed wetlands (CWs). A promising nitrogen removal performance (up to 91%) was observed in CWs coupled with intensified configurations, i.e., aeration and effluent recirculation. The results clearly supported that the higher aeration ration and presence of effluent recirculation are important to improve the alkalinity and pollutant removal in CWs. The influent pH (>10) was significantly decreased to 8.2–8.8 under the volumetric hydraulic loading rates of 0.105 and 0.21 d-1 in the CWs. Simultaneously, up to 91% of NH_{4+}-N removal was achieved under the operation of a higher aeration ratio and effluent recirculation. Biological nitrogen transformations accounted for 94% of the consumption of alkalinity in the CWs. The significant enrichment of δ15N-NH_{4+} in the effluent (47–58‰) strongly supports the occurrence of microbial transformations for NH_{4+}-N removal. However, relatively lower enrichment factors of δ15N-NH_{4+} (−1.8 ‰ – −11.6‰) compared to the values reported in previous studies reflected the inhibition effect of the high pH alkaline environment on nitrifiers in these CWs.

KEYWORDS

Alkaline wastewater; effluent recirculation; microbial community; isotopic composition intermittent aeration

Trace-element content in ashes from different types of biomass

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ABSTRACT

Renewable energy sources play a key role in the current global strategies of reducing greenhouse gas emissions, and partly in efforts to replace fossil fuels. Biomass is one of the most important sources of renewable energy. The construction of intelligent energy systems which are based on biomass as a source of primary energy enables strengthening economic, environmental and social benefits. Biomass ashes are characterized by significant differences of their properties, dependent on the type of burned biomass and its origin. Moreover, the ashes may also contain harmful substances such as heavy metals. According to this, the assessment of the content of particular mineral components in the ashes generated from biomass and the development of a strategy for the management of these ashes is very important issues.The paper presents the results of research on the trace-element contents in the ashes generated from the combustion of various types of biomass. It also concerns the potential risks and benefits of the use of these ashes in agriculture as a mineral fertilizer. The examined biomass was divided into groups depending on its origin: woody biomass and energetic woody plants (WBB), herbaceous and energy crops (EC), agricultural residue (AR), forest residue (FR), agro-food industry waste (AFIW). The analysis of the content of the studied elements was carried out in the distinguished groups.The assessment of the environmental impact of the use of biomass for energy purposes contributes to a conscious turning towards sustainable management of renewable energy sources, which is consequently an environmentally friendly activity.

KEYWORDS

Biomass ash, trace elements

The course of the methane fermentation process of dry ice modified excess sludge

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ABSTRACT

The essence of the methane fermentation course is the phase nature of changes taking place during the process. The biodegradation degree of sewage sludge is determined by the effectiveness of the hydrolysis phase. Excess sludge, in the form of a flocculent suspension of microorganisms, subjected to the methane fermentation process show limited susceptibility to the biodegradation. Excess sludge is characterized by a significant content of volatile suspended solids equal about 65 ÷ 75%. Promising technological solution in terms of increasing the efficiency of fermentation process is the application of thermal modification of sludge with the use of dry ice. As a result of excess sludge disintegration by dry ice, denaturation of microbial cells with a mechanical support occurs. The crystallization process takes place and microorganisms of excess sludge undergo the so-called "thermal shock. The paper presents the investigations concerning the course of the methane fermentation process of dry ice modified excess sludge. The methane fermentation process lasting 8 and 25 days, respectively, was carried out in mesophilic conditions at 37°C. In the first series untreated sludge was used, and for the second and third series the following treatment parameters were applied: dose of dry ice in a volume ratio to excess sludge equal 0.35: 1 and 0.75: 1, respectively, pretreatment time 24 hours. The increase of the excess sludge disintegration degree, as well as the increase of the digestion degree and biogas yield, was a confirmation of the supporting operation of the applied modification.

KEYWORDS

excess sludge, methane fermentation, dry ice disintegration, disintegration degree, total organic carbon (TOC), soluble chemical oxygen demand (SCOD), volatile fatty acids (VFAs), biogas, digestion degree

Spatial and temporal feedback of soil erosion to climate change in an agricultural catchment in Poland

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ABSTRACT

According to Intergovernmental Panel on Climate Change (IPCC) reports and numerous researches on predicting soil erosion losses, Eastern Europe is among the regions which in the future are likely face impacts of climate change, resulting in change of spatial and temporal patterns of soil erosion scale and intensity. In Poland little research is focused on detecting the impact of climate change on local future soil erosion processes. There is also a lack of data showing the actual scale and amount of damage following the increase of soil erosion risk. This study aims at recognition and simulation of spatial and temporal characteristics of soil erosion in the experimental agricultural catchment located in Lower Silesia, Poland. The soil erosion model combined with statistically downscaled global climate models (GCMs) was used in order to perform spatially-dependent prediction. The rate of soil erosion under the influence of climate change impacts is likely to increase significantly due to the predicted increase in erosive precipitation. The intensity of soil erosion process was also examined seasonally, showing changes in spatial patterns of phenomenon. The results of this research are useful while making land management decisions including conservation practices that should be first focused on areas with the greatest risk of soil erosion induced damage.

KEYWORDS

soil erosion, climate change, spatial, Poland

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