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Application of Treated Wastewater in Agriculture and Importance of Proper Management in Iran

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ABSTRACT

With the development of the wastewater treatment plants and the increase in volume of treated wastewaters in our country, it is necessary to use treated wastewater wisely. Landscape irrigation and agriculture applications considered as a significant scope for the treated wastewater. In this paper, the advantages and disadvantages of these applications are investigated and the importance of the perfect management in the selection of the product type, soil type and irrigation method is explored precisely. Furthermore, the obtained results from farm irrigation with treatment wastewater in comparison with conventional irrigation are presented. The results demonstrated that during the growing season (months of mild and hot) the combination of soil and plant as a live filter could be effective to remove suspended solids, BOD, nitrogen, phosphorus and potassium that remained in the effluent. In addition, in the cold months, the soil can act as a repository for nutrients saved in the treated wastewater and by starting the hot season, nutrients will be released and thus transferred to plant.

Keywords: Wastewater Treatment, Agriculture Water, Proper Management, Soil Type, Irrigation Method

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Development of a Risk-based Algorithm for Selection of the Best Wastewater Reuse Alternative

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ABSTRACT

Wastewater reuse is an essential issue in water resources management. Wastewater reuse alternatives application results in hazards that should be investigated for alternatives' risk analysis. The purpose of this study is to develop an algorithm for risk analysis of wastewater reuse alternatives. Therefore, by integrating experts' comments, risk evaluation and assessment model is developed, and alternatives are evaluated from three aspects of environment, health-society and economic risks. In this model, risk is a combination of likelihood, severity of hazard and vulnerability of the system. Based on the calculated risks and using fuzzy Vikor, wastewater reuse alternatives are prioritized and the best alternative is selected. In this study, Shahrak-Ekbatan wastewater reuse system is evaluated with three alternatives of "irrigation of green space in treatment plant", "irrigation of green space in Shahrak-Ekbatan" and "discharging excess reused wastewater to Firoozabad stream". Then first alternative is selected as the best alternative. Also, the second alternative is selected, because of its acceptable risk. But third alternative is rejected because of its high risk, and that can be replaced with potential alternatives such as "recreational purposes". Developed approach in this study provides better understanding for users. Results of this approach are very important in risk management.

Keywords: Wastewater Reuse, Risk Analysis, Fuzzy Inference, Multi Criteria Decision Making, Urban Wastewater, Fuzzy Vikor

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Study of SBAR Capability in Petroleum Wastewater Treatment

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ABSTRACT

Petroleum water pollution and its hazardous substances are significant threat to the environment and human health. Due to high levels of these compounds, various physical properties and costly physicochemical treatment technologies, economic and environmental methods such as biological treatment are required for treating these compounds. In this way SBAR system with aerobic granules was used in 6-hour cycle. During 120-day, concentration of COD and relative TPH was increased to 500 mg/L and 115 mg/L, respectively. By Formation of granules, removal efficiency increased significantly. So that removal of COD and TPH, was never less than 87.3% and 88%. Granules were brown and their size was in the range of 5-13 mm. Granulation ratio and moisture content of granules was 97.6% and 92%, respectively and their velocity was in the range of 3-3.32 cm/s, which was higher than flock's velocity. Results showed that granulation is an efficient and flexible technology for full-scale treatment of pollutants which improves characteristics of the system and decreases the duration of sedimentation in a cycle and consequently reduces treatment time.

Keywords: SBAR, Aerobic granules, Petroleum hydrocarbons, Environmental, COD.

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Analysis of Social and Cultural Implications of the Wastewaters Recycling Based on Fuzzy Logic

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ABSTRACT

Recycling and reuse of wastewaters are of the new policies that provide water resources to respond to the need of the growing population. In many societies, social acceptability of these processes has an important role in the success of the reuse from refined wastewater, because the final product of this process is in direct relation with the consumer. Therefore, social and cultural implications of wastewater treatment should be investigated and the effects of public and private policies and practices on human communities must be analyzed. This paper is based on findings of a research project by fuzzy inference methods to determine the affecting factors on social acceptability of the use of recovery waste waters from urban, industrial and agricultural water consumptions. The results show social acceptability of the project won't be very high (fuzzy number 5) in case that the water from recycling will be consumed in urban uses, but for industrial uses or agricultural purposes, it is possible to achieve high social acceptance. Ignoring social variables affecting the system and low social acceptance could make social crisis, mass protests or social resistance against new resources.

Keywords: Recycling of Wastewaters, Fuzzy Analysis, Social Acceptance, Social Acceptability, Social Implications

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The Study of Soil Characteristics Irrigated by Unconventional in Surface and Deep Layer

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ABSTRACT

Management of unconventional water management in agricultural lands reduces environmental risks and increases its productivity. The purpose of this study was evaluating and comparing the effect of wastewater, saltwater and brackish water on some soil physical and chemical properties. for this purpose, five study sites including control area, irrigation with saltwater, brackish water wastewater and consolidated irrigation of waste water and saltwater were selected. In each site 5 profiles were drilled based on area. The soil samples were taken from both layers of (0-30) and (30-60) centimeter. The results showed that using wastewater has increased soil properties such as organic matter and bulk density rather than the other treatments but there was no change in soil texture. There was no significant change in acidity between treatments. The electrical conductivity of saline water showed enormous difference between two depths in this treatment which represents the decreased trend of electrical conductivity from surface to depth. But this trend was stable in brackish water and wastewater treatment. Variance analysis of samples with 99% probability showed that irrigation with wastewater leads to an increase in dissolved Lime and chlorine in the soil, which is in contrast with irrigation with brackish and salty water samples.

Keywords: Water Crisis, Saline Water, Brackish Water, Wastewater, Physical and Chemical Properties of Soil, Qom Plain

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Bioenergy Production from Sweet Sorghum Irrigated with Wastewater in Laboratory and Pilot Scales

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ABSTRACT

Sweet sorghum that is adapted to the country hot and dry climatic condition, was selected as a raw material for biofuel and biogas production. Bioethanol is produced from sweet sorghum stalks and grains and biogas is produced from its byproducts. The purpose of this study was to plant sweet sorghum irrigated with different qualities of water in order to produce biofuels. This experiment was conducted at the East wastewater treatment plant of Isfahan water and waste water company in 1992. The results showed maximum biomass (87 t/ha) was produced in treatments irrigated with raw and waste water and minimum biomass (66 t/ha) was produced with agricultural water. Although total coliform in raw and waster was 1.2×10^{8} and 1.9×10^{4}, respectively but it was less than 1×10^{2} in sweet sorghum leaves, stems and grains. 6372 L of bioethanol was produced from 1 ha of sweet sorghum. From its byproducts, 15435 cubic meter of CNG was produced which can be used in gas vehicles. In addition 43218 kWh electricity, 36994 mega calorie heat, and 16t of organic fertilizer were produced. Electricity could be sold to national grid electricity and heat could be used in bioethanol plants and the organic fertilizer could be used in agriculture.

Keywords: Wastewater, Bioenergy, Sweet sorghum, Bioethanol, Biofuel

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Statistical Modeling and Process Optimization of Industrial Wastewater Treatment of Mobarekeh Steel Complex Using Response Surface Methodology

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ABSTRACT

In this study, modeling and optimization of coagulation and flocculation processes in COD removal of galvanized wastewater treatment plant of Mobarakeh Steel Complex (MSC) were studied. Experiments of this study were designed using response surface method which is one of the most efficient methods in experimental design. The variables assessed in this study, are four factors including pH, input turbidity, coagulant and coagulant aid concentrations that each of them has been studied in five levels. In the modeling stage, by developing a second order regression model, predicting COD percentage removal at different values of assessed variables becomes possible without experiment. In the optimization phase, the optimal values of variables, with the goal of maximizing COD removal and minimizing material consumption, indicates the use of 350 mg/L ferric chloride as coagulant, 0.14 mg/L polyelectrolyte as coagulant aid in pH of 11 and input turbidity of 79 NTU.

Keywords: Coagulation-flocculation, COD, Optimization, Galvanized Wastewater, Response Surface

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Investigation of Operating Parameters on Wastewater Treatment Using Sequencing Batch Reactor

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ABSTRACT

Due to the population growth and human activities in the agricultural and industrial fields, healthy and sanitary water has become scarce. Due to its high contamination load, environmental harms and water discharge standards, starch producing industry is regarded as one of the industries polluting water sources which its treatment and recovery remains important. In the present study, after fabrication of sequencing batch reactor (SBR), the effects of temperature, respiration depth, difference between sludge acclimation to organic matter (starch) and organic loading rate on reactor efficiency have been investigated. The experiments were designed using Design Expert Software and carried out in reactors named SBR_1 and SBR_2 which were acclimatized with 500 mg/l and 1500 mg/l organic substrates, respectively. Chemical oxygen demand (COD) removal percentage was measured as process response. According to the results, the experimental responses were in agreement with predicted models. In 25℃, the removal performance was high and it was 85.6% in average. In comparison with SBR_1, the average COD removal efficiency was 12% higher in SBR_2. The reactors performances in deep respiration were higher than middle and surface respiration. In optimal conditions, the COD removal efficiency was as high as 96.36%. Consequently, it is safe to note that sequencing batch reactor is an appropriate option for treating "starch-containing wastewater".

Keywords: Sequencing batch reactor, Wastewater treatment, Analysis of variance, Response surface methodology, Starch

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Application of Statistical Techniques In Order To Improve Neural Modeling of Industrial Waste Water Treatment Plants

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ABSTRACT

With regard to environmental issues, proper operation of wastewater treatment plants is of particular importance that in the case of inappropriate utilization, they will cause serious problems. In order to achieve a better and efficient control over the operation of an industrial wastewater treatment plant (WWTP), powerful mathematical tool can be used that is based on recorded data from some basic parameters of wastewater during a period of treatment plant operation. For the first time in Iran, the multilayer perceptron feed forward neural network with a hidden layer and stop training method was used to predict quality parameters of the industrial effluent. Principal Component Analysis (PCA) technique was applied to improve performance of generated models of neural networks. Also, factor analysis method was used to determine the effective parameters that improve the models accuracy and efficiency. Mean Square Error (MSE), Rout Mean Square Error (RMSE) and correlation coefficient (R) were used for performance evaluation of the models. Correlation coefficients (R) was between 0.8 to 0.94 that showed good accuracy of the models in estimating qualitative profile of wastewater

Keywords: Industrial Wastewater Treatment Plant, Artificial Neural Network, PCA, Factor Analysis, Fajr petrochemical

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