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Aims and Scope

Journal of Water and Wastewater (Ab va Fazilab) is a bimonthly journal that publishes peer-reviewed research focusing mainly on integrated municipal water management and water supply with special concern to water resources management at catchment areas. While covering a wide variety of general topics and challenges involving usual municipal water and wastewater management which in itself are reflected from physical, natural and human activities in the urban residential area, the Journal has special emphasizes over issues that are reflected from suburban, river basin and catchment areas.

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- Municipal water demand management (unaccounted for water, water reuse and Water-Saving tips)
- Urban hydrology (urban runoff, urban flooding, echo hydrology etc.)
- Processes (physical, chemical and biological), technologies and strategies in water treatment and also municipal, industrial and rural wastewater treatment
- Application of mathematical modeling in water and wastewater treatment processes- Public health issues related to water and wastewater
- Water reuse (environmental and health impacts)
- Waste sludge management (treatment, disposal and reuse)
- Water and wastewater operation and maintenance- Sanitation and protection of aquatic ecosystems and water resources (surface and ground water)
- Urban water accidents managements, data collection, standards, regulations and strategies related to water and wastewater management
- Water governance and Sustainable water resources management and pollution control.

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A Novel Algorithm (G-JPSO) and Its Development for the Optimal Control of Pumps in Water Distribution Networks

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Abstract

Recent decades have witnessed growing applications of metaheuristic techniques as efficient tools for solving complex engineering problems. One such method is the JPSO algorithm. In this study, innovative modifications were made in the nature of the jump algorithm JPSO to make it capable of coping with graph-based solutions, which led to the development of a new algorithm called 'G-JPSO'. The new algorithm was then used to solve the Fletcher-Powell optimal control problem and its application to optimal control of pumps in water distribution networks was evaluated. Optimal control of pumps consists in an optimum operation timetable (on and off) for each of the pumps at the desired time interval. Maximum number of on and off positions for each pump was introduced into the objective function as a constraint such that not only would power consumption at each node be reduced but such problem requirements as the minimum pressure required at each node and minimum/maximum storage tank heights would be met. To determine the optimal operation of pumps, a model-based optimization-simulation algorithm was developed based on G-JPSO and JPSO algorithms. The model proposed by van Zyl was used to determine the optimal operation of the distribution network. Finally, the results obtained from the proposed algorithm were compared with those obtained from ant colony, genetic, and JPSO algorithms to show the robustness of the proposed algorithm in finding near-optimum solutions at reasonable computation costs.

Keywords: Optimization, Pumping Stations, Operation, Water Distribution Network, G-JPSO.

3D Numerical Investigation of the Flow Pattern in Settling Basins by SSIIM2 Software

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Abstract

Settling basins are considered as a major and important component in conventional water treatment processes. The high cost of constructing these basins accounts for approximately 30% of the total capital investment of water treatment plants. Hence, it is essential to model and optimize their performance beforehand. In settling and sedimentation basins, different areas of flow including secondary and rotational flows occur due to the velocity gradient. Such phenomena cause short paths, increase flow stationary and dead zones, and change the mixing rates of the flow, which collectively prevent laminar conditions to be created for the sedimentation process, and thereby reduce process efficiency. The remedy is to reduce as far as possible the dead zones in the flow. The first step to optimize a settling basin is to calculate accurately the velocity field and the volume of rotation zones. The present study presents the numerical simulation of a flow in a rectangular basin. Continuity and Navier-Stokes equations are solved using finite volume method. A 3D flow simulation is performed using the standard k-ε turbulence model for settling basins with and without baffles. Finally, the numerical results obtained are compared with experimental results reported elsewhere.

Keywords: Settling Basins, Flow Separate Zones, Flow Hydraulic, SSIIM2 Model, Standard k-ε Turbulence Model.

Sulfate Adsorption on Iron Nanocomposites on Graphene Oxide and Activated Carbon Beds

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Abstract

This study is an experimental investigation of sulfate removal efficiency using iron nanocomposites on graphene oxide and activated carbon beds. The graphene oxide used was synthesized according to the Hummer method during which process graphene oxide and activated carbon were added. The effects of various parameters including adsorbent content, pH, and contact time on adsorption were investigated. Furthermore, the data were subjected to kinetic studies. Results revealed that the highest absorption rates of 84% and 62% were achieved for iron on the graphene oxide and activated carbon beds, respectively, when 0.06 g of the adsorbent was used at pH =11 over a contact time of 9 hours. It was also found that the kinetic pseudo-second-order model best fit the data. Finally, the results indicated that the two environmentally-friendly adsorbents have a good potential for removing sulfate from aqueous solutions.

Keywords: Adsorption, Sulfate, Fe Nanocomposite, Grahene Oxide, Activated Carbon.

Adsorption of Malachite Green Dye Using Modified γ-Alumina

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(Received May 10, 2015 Accepted Nov. 14, 2015)

Abstract

Modified γ-Alumina was used for the adsorption of the cationic dye malachite green (MG) from aqueous solutions. The properties of the modified particles were initially determined by FT-IR, XRD, SEM, and EDAX. The effects of such parameters as initial dye concentration, contact time, initial pH, adsorbent dose, and temperature on dye removal were investigated and the pHzpc of the adsorbent was determined. Results showed that equilibrium was achieved in 60 min and MG removal increased with increasing adsorbent dosage and pH. The experimental results indicated that 0.1g of modified γ-Alumina was capable of removing 91.61% of the MG dye from an initial concentration of 50 mg L^{-1} at pH=10. Results of isotherm and kinetic studies revealed that adsorption of Malachite Green dye onto modified γ-Alumina best fitted the Temkin isotherm and pseudo-second-order kinetic models.

Keywords: γ-Alumina , Malachite Green Dye, Kinetic, Isotherm.

Cyanide Removal Efficiency of Photocatalytic Nanoparticles Stabilized on Glass Microbeads Under Sun Irradiation

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Abstract

This paper investigates cyanide photodestruction (at pH 9) using the S, N-TiO_2 photocatalyst synthesized by the sol-gel method and stabilized on glass microbeads. The main raw materials were thiourea, as a source of N and S, and tetra butyl ortho titanate. The effects of S and N doses, visible light (a 400W light), sunlight, irradiation time, and different initial cyanide concentrations (50, 100, 200, and 300 ppm) were studied on cyanide photodestruction. Cyanide concentration was measured by the titration method and the photocatalyst film was characterized by X-ray diffraction (XRD), UV-Vis diffuse reflection spectroscopy (DRS), Scanning Electron Microscopy (SEM), and Energy dispersive X-ray (EDX) analysis. XRD patterns and SEM images were used to determine the nanoparticle size of the photocatalyst on glass microbeads. EDX and DRS analyses confirmed the presence of S and N as well as the activity of the photocatalyst in the visible region, respectively. The S, N-TiO_2 film with 0.25 g Thiuourea proved to be the best cyanide photodestruction agent in the visible light. Based on the results obtained, S, N-TiO_2/ glass microbead was capable of destroying cyanide (50 ppm) by up to 94% in the visible light and by approximately 100% in the sunlight. The results also indicated that S, N-Tio_2/scoria stone was capable of destroying cyanide by 85% in the visible light and by 94% in the sunlight within 4 h. The reaction kinetic for all cyanide concentrations and two photocatalyst substrates were described by a first order equation. Finally, it was concluded that the S, N-TiO_2 stabilized on glass microbeads could be effectively used as a new method for treating wastewater containing free cyanide under the sunlight.

Keywords: Photocatalyst, Cyanide photodestruction, Nonmetal-doping TiO_2, Sunlight irradiation.

SBAR Capability for Methyl Tertiary Butyl Ether Removal: Characterization of the Bio-granules

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Abstract

The growing use of MTBE as a substitute for Tetraethyl lead and its adverse impacts on the environment warrant its removal from wastewater. Given the low efficiencty and the high cost associated with the chemical and physical processess commonly used for the removal of MTBE, which also release hazardous by-products into the environment, biological techniques have been explored as the more appropriate methods for its removal. This research seeks to investigate the feasibility of the SBAR system and aerobic biogranules for MTBE removal. For this purpose, a synthetic wastewater containing the materials needed for the microorganisms was used for the experiments and the pH level and DO were set to 7–8 and 2–5 mg/L, respectively. TEM was employed to characterize the granules. Results showed that over 90% of the initial COD (500 mg/L) was removed after 4h, which was attributed to the air stripping (28%) and sorption (1.5%) mechanisms. The resulting granules were brown in color, 2–6 mm in size with a mean fall speed and a density equal to 0.65 cm/s and 0.055 g/ml, respectively. The superiority of the resulting granules to the flocs led to improved sedimentation in the reactor. Finally, TEM investigations showed that the sylyath and rotifer species formed the dominant populations in the granules.

Keywords: Chemical Oxygen Demand, Aerobic Granules, Methyl Tert-Butyl Ether, Air Stripping, Adsorption.

Isolation and Identification of Cadmium and Lead Resistant Bacteria and their Bacterial Removal from Wastewater

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Abstract

Municipal and industrial effluents continually release into the environment heavy metals of a variety of physical and chemical forms and at various concentrations. Biological treatment processes have attracted a growing attention for the removal of heavy metals from these effluents. For the purposes of the present study, bacteria that are relatively resistant to heavy metals, such as cadmium and lead, were isolated from municipal waste and purified. They were then subjected to biochemical tests for identification and their minimum inhibitory concentrations were determined. Bacterial minimum inhibitory concentrations were initially measured in flasks containing 25, 50, 75, 100, 150, 300, 500, and 700 ppm of lead and cadmium before superior bacteria at populations of 108 CFU/ml were evaluated in terms of their ability to remove lead and cadmium at concentrations of 50, 100, 150, and 300 ppm from enriched municipal wastewater. Base on the results, *Bacillus laterosporous* and *Yersinia pseudotuberculosis* were identified as the resistant bacteria and the minimum lead and cadmium inhibitory concentrations for these bacteria were determined to be 300 and 500 ppm, respectively. Moreover, *Bacillus laterosporous* and *Yersinia pseudotuberculosis* recorded maximum removal efficiencies of around 50.6% and 45.7%, respectively, with wastewater containing 100 mg/l of lead and 36.18% and 21.41% in the case of cadmium from wastewater enriched with 100 mg/l of lead and 150 mg/l of cadmium.

Keywords: *Bacillus Laterosporous*, *Yersinia Pseudotuberculosis*, Heavy Metal, Minimum Inhibitory Concentration, Municipal Wastewater.

Physical and Chemical Characterization of Fat and Oil Deposits in Mashhad City Sewer Lines and the Solutions Developed

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Abstract

Formation of oil, fat, and grease deposits in sewer pipelines is a major concern as they result in sewage overflow and pose health problems. Analysis of two sample deposits collected from the sewer lines of Imam Reza Street in the city of Mashhad suggested that the chemical reactions promoted by edible oils in the sewer lines lead to the formation of insoluble soap and deposits. Being sticky, the deposits accumulate over time to eventually block the lines. The analysis also showed that the moisture content of the samples ranged between 50–62%, indicating that water does not play a main role in their formation. The samples were also found to contain 61.78% and 84.35% saturated fatty acids, with palmitic acid being the dominant one. Calcium was the main metal in the samples, which is due to both water hardness and corrosion of the sewer lines. Based on the results obtained, the origin of these deposits, and the relevant protocols for the management of oil and fat wastes, solutions were proposed to prevent deposit formation and sewer line clogging that suit the special cultural and environmental conditions of the city. These proposals are under consideration for implementation in the region.

Keywords: Physical and Chemical Characterization, Fat, Oil and Grease Deposits, Sewer Lines Blockage Prevention, FOG Managements.

Efficiency of Worm Reactors in Reducing Sludge Volume in Activated Sludge Systems

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Abstract

The activated sludge process is the most widely used on a global scale for the biological treatment of both domestic and industrial effluents. One problem associated with the process, however, is the high volume of sludge produced. Excess sludge treatment and disposal account for up to 60% of the total operating costs of urban wastewater treatment plants due to the stringent environmental regulations on excess sludge disposal. These strict requirements have encouraged a growing interest over the last few years in reducing sludge volumes produced at biological treatment plants and a number of physical, chemical, and mechanical methods have been accordingly developed for this purpose. The proposed methods are disadvantaged due to their rather high investment and operation costs. An alternative technology that avoids many of these limitations is the worm reactor. In this study, the characteristics of this technology are investigated while the related literature is reviewed to derive the optimal conditions for the operation of this process in different situations.

Keywords: Activated Sludge, Sludge Minimization, Worm Reactors, Predation.

GIS-based Assessment of Arsenic Contamination of Water Supplies in Rural Areas of Rivash Town: Comparisons with National and WHO Standards

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Abstract

Arsenic is one of the most hazardous elements in drinking water. Water contaminated with arsenic causes a variety of diseases in humans including cancer. The present study was conducted to survey Arsenic concentration in rural water resources in Rivash Twon, Kashmar, Iran. For the purposes of this cross-sectional study, 60 samples were collected from 10 underground drinking water supplies during the period from April to June, 2013. Samplings and sample preservation were performed according to standard methods. Measurements were performed via the VGA method using atomic absorption. Such water quality parameters as pH, TDS, EC, residual chlorine, and temperaturte were also measured to determine any relationships likely to exist between As concentration and the parameters measured. As levels were then compared with national and international standards. It was found that the average values of As concentration at the stations A, B, C, D, E, F, G, H, I, and J were 1.53±1.03, 1.30±1.07, 10.55±3.83, 11.21±5.01, 10.57±3.68, 2.34±0.73, 3.22±0.58, 9.89±3.57, 10.48±5.07, and 2.23±0.53 $\mu g/L^{-1}$, respectively. As concentrations at five stations were found to be higher than the values recommended in WHO guidelines; the remaining stations revealed values below the national standard. While the differences between As level and the national standard were statistically significant ($p<0.001$), those between As level and WHO standard were significant ($p<0.001$) in 50% of the stations studied. Except in the case of pH, no significant relationships were detected between As level and any of the TDS, EC, temperature, salinity, or residual chlorine values. From the results of this study, it may be suggested that it is essential to plan for replacing safe drinking water supplies for the current polluted ones with high AS levels in the district. Controlling the present water supplies on a regular basis is also highly recommended.

Keywords: Water Contamination, Arsenic, Drinking Water Sources, Villages of Rivash City.