Journal of **WATER & WASTEWATER**
(Ab Va Fazilab)

Manager : A. Pirayandeh
Editor-in-chief : A. Abrishamchi (Ph.D)
Administrative Director : A. Mousavi

This journal is indexed by :
ISC: www.srlst.com, SID: www.SID.com
Magiran: www.magiran.com, Civilica: www.civilica.com

Persian Editor : N. Moradi
English Editor : E. Roustazadeh
Graphic Designer : M.R. Rahimi
Word Processor : A.R. Shafiee

Printed by : Shakiba

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.
Bimonthly Journal of Water and Wastewater (Ab va Fazilab) has been published onward in Persian with English abstract since 1989.
It is an open access, peer-reviewed bimonthly of Water and Wastewater sciences, published on behalf of the Water and Wastewater Consulting Engineers.
Water and Wastewater (Ab va Fazilab) Journal publishes refereed, original research papers and high quality review papers on all aspects of water and wastewater sciences.
All articles published by Water and Wastewater (Ab va Fazilab) Journal are made freely and permanently accessible online immediately upon publication.
The following shows some examples of the journals main fields of study:
- Rural and municipal water supply management (Conventional & Unconventional Sources)
- 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.

Journal of Water and Wastewater (Ab va Fazilab)is indexed by : srlst.com , SID.ir and magiran.com and has an Impact Factor of 0/2 among Iranian science and technical journals in ISC. ISC is a system which deals with analysis and ranking authors, publications and institutes.(Regional Information for Science and Technology)

Although the journal is sponsored by Water and Wastewater Consulting Engineers (WWCE), its editorial policies are independent of the WWCE.
ISSN: 1024-5936
eISSN:2383-0905

Table of Contents

Remediation of Groundwater Contaminated with Cadmium by Nano-Zero Valence Iron (at Batch and Pore Media Scales)

S.M. Taheri [1], M. Khayat Kholghi [2], A. Sotoodehnia [3]

1. Former Graduate Student of Irrigation and Drainage, Imam Khomeini International University, Qazvin
(Corresponding Author) (+98 51) 36237217 taheri.mohaddeseh@yahoo.com
2. Prof. of Irrigation and Reclamation, College of Agriculture and Natural Resources, University of Tehran, Karaj
3. Ass. Prof. of Water Engineering, Imam Khomeini International University, Qazvin

(Received Jan. 3, 2014 Accepted Oct. 13, 2014)

Abstract

Since a major portion of the food we use is provided by corps irrigated with water that is supplied from groundwater resources, remediation of contaminated groundwater using in-situ methods like permeable reactive barriers (PRBs) seems to be a top priority. Given the need to reduce Cd contamination in southern Tehran, the present study was designed to compare the rate of Cd absorption by nZVI with that by Zeolite and Calcite. The results of the study revealed a higher Cd adsorption by nZVI as compared to that by Calcite and Zeolite. Also, when nZVI concentration was raised from 1 to 2 g/l, enhancements were observed after two hours in Cd adsorption by up to 5.5%, 3.4%, and 11.5% in solutions containing 0.2, 0.5, and 4 ppm of Cd, respectively.Moreover, for a contact time of 24 hours and when the initial concentration of the contaminant was raised from 0.2 to 0.5 ppm, the adsorption rate declined to 5.45% and 7.75% for nZVI injections of 1 and 2 g/l, respectively. In a second part of the study, such environmental conditions as changes in pH and temperature were investigated for their effects on Cd adsorption. Compared to the initial concentration of 4 ppm, Cd adsorption reduced by 37.15% under acidic conditions (pH=3.7) and by 92.75% under alkaline conditions (pH=13.1) after a contact time of 3 hours. Similarly, a reduction equal to 38.5% was observed in Cd adsorption after 6 hours when temperature was raised from 20 °C to 75 °C. In order to explore the bioenvironmental impacts of injecting nanoparticles aimed at adsorption and precipitation of Cd, the concentration of iron nanoparticles present in the environment was measured. As a result of the reaction between the solutions containing 0.5 ppm of Cd with the absorbent solution containing 2 g/l iron, the iron nanoparticle concentration in the solution was observed to decline to 0.0041% of its initial concentration after 24 hours. In the experiments conducted in a vertical saturated porous and homogeneous medium, injection of 3 g/l of nZVI, as the absorbent, into water containing 2.92 ppm of the contaminant reduced the contaminant concentration to levels below the limits recommended for drinking water. The reaction between nZVI and Cd dissolved in the medium revealed that the nanoparticles served as an efficient absorbent as they not only adsorbed Cd over time, but also removed it from the medium through precipitation.

Keywords: Groundwater, Zeolite, Cadmium, Calcite, nZVI.

Investigation and Control of Algal Grwoths in Water Resources Using Zn Oxide Nanoparticles

M. Eskandary [1], S. Dehestani Athar[2], B. Abdollahi Nejand [3], B. Khayat-Rostami [4]

1. PhD of Nanomaterials Engineering, Department of Nanotechnology, Research Institute of Mineral Processing, Academic Center Education, Culture and Research (ACECR), Tehran, Iran
(Corresponding Author) (+98 21) 86017232 msnano1361@yahoo.com
2. Ass. Prof., Faculty of Public Health, Kurdistan University of Medical Sciences, Sanandaj, Iran
3. PhD of Nanomaterials Engineering, Department of Nanotechnology, Research Institute of Mineral Processing, Academic Center for Education, Culture and Research (ACECR), Tehran, Iran
4. Research Committee Secretary, Ardabil Regional Water Board, Ardabil

(Received May 7, 2014 Accepted Aug. 21, 2014)

Abstract

Increasing nutrients such as nitrates and phosphates in water resources lead to the growth of various algal species, causing undesirable odors and taste in the water. This study investigated the identification and removal of harmful algal growths by Zinc oxide nanoparticles (using Ardabil Yamichi Dam reservoir as a case study). Samples were initially collected from the Yamichi Dam reservoir and the algae in the water samples were cultivated. Enough time was allowed for the algae to grow before they were identified under the microscope. The results showed that most of the algal species grown in the culture medium belonged to the species Cladophora and Euglena. Zinc oxide nanoparticles were then synthesized to be used in the removal and/or inhibition of algal growths. ZnO nanoparticles were subsequently characterized by transmission electron microscopy (TEM) and X-ray diffraction (XRD) methods which revealed that the size of the ZnO nanoparticles was in the range of 10–30 nanometers and further that the nanoparticles were pure and of a hexagonal phase. In continuation, the capability of ZnO nanoparticles with concentrations in the range of 0-3 ppm to inhibit algal growth was investigated. Results showed that no reduction was observed in algal growth for Zinc oxide nanoparticle concentrations below 1 mg/lit. At concentrations between 1 to 2 mg/lit, however, a significant reduction was observed in algal growth. Finally, it was found that algal growths completely stopped at ZnO concentrations beyond 2 mg/lit.

Keywords: Alga Growth, Zinc Oxide Nanoparticles, Water Resources, Biomas.

Functionalized Nanoporous Silica by Mono and Dendrimeramine in Methylene Blue Removal from Wastewater

Z. Salahshoor [1], A. Shahbazi [2], A.R. Badiei 3

1. MSc Student, Environmental Sciences Research Center, Shahid Beheshti University, Tehran
2. Ass. Prof., Environmental Sciences Research Institute, Shahid Beheshti University, Tehran
(Corresponding Author) (+98 21) 22431971-114 a_shahbazi@sbu.ac.ir
3.Assoc. Prof., Dept of Chemistry, Sciences Campus, Tehran University, Tehran

(Received Aug. 23, 2014 Accepted Feb. 2, 2015)

Abstract

Many organic dyes such as Methylene Blue are toxic, carcinogenic, and non-biodegradable due to their aromatic complex structure and high solubility in water. It is, therefore, essential to remove them from effluents discharged into the environment. In this study, SBA-15 mesoporous silica was synthesized by the hydrothermal method and later functionalized with mono- amine (NH2-SBA-15) and dendrimer amine (MDA-SBA-15). Then, the effect of surface modification on adsorption efficiency of Methylene Blue was examined in a batch system. The prepared materials were characterized by XRD, FT-IR, SEM, and BET analyses. The results showed that, under identical conditions, removal efficiency with MDA-SBA-15 was 2.6 and 3.3 times higher than those achieved with NH2-SBA-15 and SBA-15, respectively. Equilibrium isotherms were analyzed by Langmuir, Freundlich, Tempkin, and Dubnin–Radushkevich isotherms. Equilibrium data was best described by the Langmuir isotherm models, indicating a monolayer adsorption process. Tempkin isotherm parameters indicated that the adsorption process by MDA-SBA-15 was exothermic. The removal efficiency of Methylene Blue from aqueous solutions by MDA-SBA-15 was more than 90%, which was higher than the efficiency achieved by other nano-sorbents. This showed that MDA-SBA-15 could be used as an effective adsorbent in wastewater treatment.

Keywords: Adsorption, Mesoporous Silica, SBA-15, NH2-SBA-15, MDA-SBA-15, Methylene Blue

Determine the Optimum Conditions for Acid Red 14 Removal by Iron Nanoparticles Modified with Nickel in a Slurry System

M. Niksefat [1], B. Ayati [2]

1. MSc Student, Faculty of Civil and Environmental Engineering, Tarbiat Modares University, Tehran
2. Assoc. Prof., Faculty of Civil and Environmental Engineering, Tehran
(Corresponding Author) (+98 21) 82883328 ayati_bi@modares.ac.ir

(Received Aug. 27, 2014 Accepted Feb. 9, 2015)

Abstract

In this study, bimetallic iron–nickel nanoparticles were obtained by chemical co-deposition of iron chloride with sodium boron hydride used as a strong reducing agent. The bimetallic nanoparticles thus obtained were then used to remove acid red 14 in a slurry system. Experiments were conducted to investigate such parameters as initial dye concentration, nano-particle dosage, pH, the time required for the nano-particles to be used after they are formed, the stirring speed, and the temperature required to reach optimum reaction conditions. Control experiments were subsequently performed under the optimum conditions thus determined to identify any other remaining factors involved. The optimum conditions included a temperature of 25±2 ºC, a newly synthesized nano-particle concentration of 0.05 g/L, an initial dye concentration of 200 mg/L, a pH level of 7.5, and a mixing duration of two minutes. The results indicated the high activity of the nanoparticles such that removal efficiencies equal to 79.39, 90.52, and 94.42 percent were achieved after 2, 30, and 240 minutes, respectively. Moreover, a COD removal of 72.61 percent was achieved after 4 hours of reaction.

Keywords: Wastewater Treatment, Oxidation and Reduction, Bimetallic Nanoparticles of Fe-Ni, Remove the Dye, Acid Red 14 (AR14).

Efficiency of Ciprofloxacin (CIP) Removal from Pharmaceutical Effluents Using the Ozone/Persulfate (O_3/PS) Process

A.R. Rahmani [1], A. Shabanlo [2], S. Majidi [2], M. Tarlani Azar [2], J. Mehralipour [3]

1. Prof. of Environmental Health Engineering, Facutly of Public Health, Hamadan University of Medical Sciences, Hamadan
2. MSc Student of Environmental Health Engineering, Faculty of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran
3. MSc Student of Environmental Health Engineering, Faculty of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran

(Corresponding Author) (+98 81) 34523451 Jamalmehralipour@yahoo.com

(Received May 17, 2014 Accepted Nov. 29, 2014)

Abstract

A newly emerging environmental problem is the discharge of pharmaceutical effluents containing antibiotic compounds. Compared to common methods, the ozone/persulfate process is a novel measure for treating persistent pollutants. This process is highly efficient in removing pollutants by using the free radicals of sulfates as powerful oxidants. In this study, a semi-continuous reactor with a useful volume of 1 L was used to evaluate the performance of the ozone/persulfate process in treating the ciprofloxacin antibiotic at concentrations from 10 to 100 mg/L in the presence of 0 to 15 mM of persulfate in 30 min. The results showed that under the optimized operating conditions of pH = 3, persulfate dose = 10 mM, ozone dose = 1 g/h, and an initial antibiotic concentration of 10 mg/L, this method was capable of removing 96% of the contaminant. Moreover, the efficiency of the process was found to be a function of experimental conditions. Based on the results of this study, it may be concluded that the ozone/persulfate process can be considered as an appropriate process for treating persistent and non-biodegradable pollutants.

Keywords: Ozone/Persulfate Process, Antibiotic Ciprofloxacin, Persistent Pollutants, Pharmaceutical Effluents.

Isolation and Identification of Phenol Degrader Bacteria from Sirjan Golgohar Mine Effluent

M. Hassanshahian[1], M. Lashkari [2], B. Khirkhah[3]

1. Assoc. Prof. of Microbiology, Department of Biology, Faculty of Sciences, Shahid Bahonar University of Kerman, Kerman, Iran
(Corresponding Author) 09132906971 hasanshahi@gmail.com
2. MSc Student of Micorobiology, Islamic Azad University, Sirjan Sciences and Research Branch, Sirjan, Iran
3. Ass. Prof. of Microbiology, Islamic Azad University, Sirjan Sciences and Research Branch, Sirjan, Iran

(Received Dec. 14, 2013 Accepted Dec. 3, 2014)

Abstract

Phenol and phenolic compounds are highly toxic substances that are found as monoaromatic compounds in various industrial effluents from oil refineries, petrochemical plants, (coal) mines, and phenol resin plants. Their discharge into the environment, especially in water resources, causes serious toxicity. Traditionally, physicochemical methods have been used for the removal of phenol and phenolic compounds. Nowadays, bioremediation is known to be the best method for phenol removal from wastewater. The objective of the present study was twofold: isolation and identification of phenol degrading bacteria in the effluent from Golgohar Mine in Sirjan. For this purpose, samples were collected from different sections at Golgohar Mine and its effluent. Phenol degrading bacteria were isolated via enrichment of the samples in the Bushnell Hass medium with phenol used as the only source of carbon and energy. The predominant phenol degrader bacteria were selected by measuring turbidity at 600 nm. The bacteria were subsequently identified by amplification of 16S rRNA withspecific primers and PCR sequencing. In this study, 17 strains of phenol degrader bacteria were isolated in soil and wastewater samples collected from different zones of the mine. Screening methods confirmed that 4 strains exhibit a better capability for phenol degradation as evidenced by their capability to degrade 0.4 g/l of phenol. Molecular identification showed that these bacteria belong to the species Pesudomonas sp, Nitrratireductor sp., and Salegentibacter sp. The results also show that the effluent from Golgohar Mine in Sirjan contains many phenol degrading bacteria. The use of these bacteria in the treatment process may lead to a significant reduction in phenol pollution in the mineral effluent.

Keywords: Bacteria, Bioremediation, Phenol Contamination, Phenol, Wastewater.

Evaluation of Absorption of Cd, Zn, Pb, Ni, Fe, and Cu Present in Hospital Wastewater by Phytoremediation Using Vetiver Grass

A. Dindarlou [1], M. Hedayat [2], A. Hosseini [3]

1. Instructor of Horticulture Sciences, College of Agriculture and Natural Resources, Persian Gulf University, Bushehr, Iran
(Corresponding Author) 09179284473 adindarlou@gmail.com
2. Ass. Prof. of Horticulture Sciences, College of Agriculture and Natural Resources, Persian Gulf University, Bushehr, Iran
3. MSc Graduate, Persian Gulf Research Institute, Persian Gulf University, Bushehr, Iran

(Received Nov. 24, 2014 Accepted Dec. 2, 2014)

Abstract

Hospital effluent is one type of urban wastewater that, due to its special source, may contain different pathogens and microorganisms, various intestinal disease agents, bacteria, viruses, sycophants, and toxic substances present in hospital wastewater latex including heavy metals. In this study, efforts have been made to evaluate the absorption of Cd, Zn, Cu, Ni, Fe, and Pb present in hospital wastewater by phytoremidiation. For the purposes of this study, the vetiver grass was cultivated in 8 treatments with 4 replications based on a completely randomized design and irrigated for 75 days with various combinations of normal water and hospital wastewater. Results showed that more of the Pb, Cu, Zn, Fe, and Ni (9.243, 2.313, 2.3188, 2625.3, and 27.638 µg of dry matter, respectively) was absorbed and collected in the root while Cd (3.45 µg of dry matter) accumulated in the soil, and only trace amounts of heavy metals accumulated in the branches and leaves. The reason for the greater accumulation of Pb, Cu, Ni, and Zn in the root rather than in the aerial parts is the high tolerance of the vetiver grass to high heavy metal concentrations in soil. Based on the results of this study, the use of vetiver may be recommended for the removal of contaminants in hospital effluents.

.

Keywords: Wastewater, Hospital Wastewater, Phytoremediation, Heavy Metals, Vetiver.

Waste Load Allocation Based on Total Maximum Daily Load Approach Using the Charged System Search (CSS) Algorithm

E. Faraji [1], A. Afshar [2], F. Feizi [3]

1. Former Graduate Student of Environmental Engineering, Faculty of Civil Engineering, Iran University of Science and Technology, Tehran
(Corresponding Author) faraji101511@yahoo.com
2. Prof., Faculty of Civil Engineering, Iran University of Science and Technology, Tehran
3. Former Graduate Student of Environmental Engineering, Faculty of Civil Engineering, Iran University of Science and Technology, Tehran

(Received May 29, 2014 Accepted Jan. 14, 2015)

Abstract

In this research, the capability of a charged system search algorithm (CSS) in handling water management optimization problems is investigated. First, two complex mathematical problems are solved by CSS and the results are compared with those obtained from other metaheuristic algorithms. In the last step, the optimization model developed by the CSS algorithm is applied to the waste load allocation in rivers based on the total maximum daily load (TMDL) concept. The results are presented in Tables and Figures for easy comparison. The study indicates the superiority of the CSS algorithm in terms of its speed and performance over the other metaheuristic algorithms while its precision in water management optimization problems is verified.

Keywords: Meta Heuristic Algorithms, Charged System Search Algorithm (CSS), Waste Load Allocation, Total Maximum Daily load (TMDL).

Modeling Relationships Between Surface Water Quality and Landscape Metrics Using the Adaptive Neuro-Fuzzy Inference System, A Case Study in Mazandaran Province

M. Mirzaei [1], A.R. Riyahi Bakhtiari [2], A.R. Salman mahini [3], M. Gholamalifard [4]

1. MSc Graduate Student of Environment, Faculty of Natural Resources, Tarbiat Modares University, Noor, Mazandaran
2. Assoc. Prof. of Environment, Faculty of Natural Resources, Tarbiat Modares University, Noor, Mazandaran (Corresponding Author) (+98 11) 44553101 riahi@modares.ac.ir
3. Assoc. Prof. of Environment, Faculty of Fisheries and Environment, Gorgan University of Natural Resources and Agriculture, Gorgan
4. Ass. Prof. of Environment, Faculty of Natural Resources, Tarbiat Modares University, Noor, Mazandaran

(Received Sep. 30, 2013 Accepted July 11, 2014)

Abstract

Landscape indices can be used as an approach for predicting water quality changes to monitor non-point source pollution. In the present study, the data collected over the period from 2012 to 2013 from 81 water quality stations along the rivers flowing in Mazandaran Province were analyzed. Upstream boundries were drawn and landscape metrics were extracted for each of the sub-watersheds at class and landscape levels. Principal component analysis was used to single out the relevant water quality parameters and forward linear regression was employed to determine the optimal metrics for the description of each parameter. The first five components were able to describe 96.61% of the variation in water quality in Mazandaran Province. Adaptive Neuro-fuzzy Inference System (ANFIS) and multiple linear regression were used to model the relationship between landscape metrics and water quality parameters. The results indicate that multiple regression was able to predict SAR, TDS, pH, NO_3^-, and $PO4_3^-$ in the test step, with R^2 values equal to 0.81, 0.56, 0.73, 0.44. and 0.63, respectively. The corresponding R^2 value of ANFIS in the test step were 0.82, 0.79, 0.82, 0.31, and 0.36, respectively. Clearly, ANFIS exhibited a better performance in each case than did the linear regression model. This indicates a nonlinear relationship between the water quality parameters and landscape metrics. Since different land cover/uses have considerable impacts on both the outflow water quality and the available and dissolved pollutants in rivers, the method can be reasonably used for regional planning and environmental impact assessment in development projects in the region.

Keywords: Landscape Metrics, Land Use, Land Cover, ANFIS, Mazandaran Province.

Optimization of Conditions the Precipitate Elimination from the Water Supply Pipelines (Case Study: Esfezar Village in Southern Khorasan Province)

H. Kardan Moghadam[1], A. Akbarpour[2], M.S. Hosseini Bajd[3], Z. Rahimzadeh Kivi[4]

1. PhD Student of Water Resources, Abureyhan Campus, University of Tehran, Tehran
(Corresponding Author) 09155611912 hkardan@ut.ac.ir
2. Assoc. Prof. of Water Engineering, Univerisity of Birjand, Birjand
3. Assoc. Prof. of Chemistry, University of Birjand, Birjand
4. Former Graduated Student of Water Resources, University of Birjand, Birjand

(Received Oct. 28, 2014 Accepted May 10, 2015)

Abstract

This Study explores the influence of $CaCO_3$ sedimentation in the Qanat system of Esfezar area in Southern Khorasan Province. Experiments were conducted to evaluate the decrease in transient water hardness in the drinking water supply network in the areas neighboring the Esferaz Qanat. The significance of the study lies in the fact that the Qanat under study is the only source of drinking water in the region. For the purposes of this study, experiments were carried out using a reservoir in which water pH was increased by adding lime to form sediments. Chemical coagulants were also added to accelerate the sedimentation process. From among the coagulants of $FeSO_4$, $Fe_2(SO_4)_3$, and $CuSO_4$ used, optimizations revlead that $Fe_2(SO_4)_3$ yielded the best results at pH=9/5 in drinking water given the quality parameters of EC:440dS and pH = 7.7. Dimension analysis using the Reynolds Number was also conducted to simulate the qanat discharge, which was further calibrated against experimental results. The results obtained from the model showed that using a spiral pipe and $Fe_2(SO_4)_3$ as the coagulant led to reduced transient hardness of water. The results also revealed that $CaCO_3$ sedimentation reduced in the local water supply network.

Keywords: $CaCO_3$, Qanat , Provisional Hardness , $Fe_2(SO_4)_3$, Coagulant.

.