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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.

Bimonthly Journal of Water and Wastewater (Ab va Fazilab) has been published onward in Persian with English abstract since 1989.

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- 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.

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# Removal of Cr(VI) from Aqueous Solutions Using Amino-functionalized Nanoporous MCM-41

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## Abstract

An amino-functionalized nanoporous material was prepared by grafting 3-aminopropyl trimethoxysilane (APTMS) group onto MCM-41. The as-synthesized material was characterized by X-ray diffraction (XRD) analysis, nitrogen adsorption-desorption measurements (BET), thermogravimetric analysis (TGA), and Fourier transform infrared spectrometry (FTIR) to confirm the ordered mesoporous structure and the functionalization of the amino group. The NH<sub>2</sub>-MCM-41 thus obtained was employed as the sorbent to remove Cr(VI) ions from aqueous solutions. The batch adsorption process was carried out to evaluate the effects of solution pH, adsorbent dosage, metal ion concentration, and temperature. Results revealed that removal efficiency increased to a maximum of 124 mg.g<sup>-1</sup> and metal uptake decreased (0.1 g.l<sup>-1</sup>) with increasing sorbent dosage from 0.1 to 3.5 g.l<sup>-1</sup>. A reverse trend was, however, observed with increasing Cr(VI) concentration. It was also found that a pH equal to 3 was the optimum level for the removal of Cr(VI) ions from aqueous solutions. Thermodynamic examinations revealed the strong dependence of the adsorption process on temperature such that adsorption capacity increased with increasing temperature, indicating the endothermic and spontaneous nature of the adsorption process.

**Keywords:** Nanoporous Material, Mesoporous Material, MCM-41, Batch Adsorption, Chromium (VI).

# Efficiency of Electro/Persulfate (EPS) Process in Degrading High Concentrations of Ceftriaxone in Pharmaceutical Effluents

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## **Abstract**

Two-valent iron ions can be used to activate persulphate anions. The objective of the present study was to investigate the electrical activation of persulphate anions and to determine the efficiency of electro-persulphate in the removal of ceftriaxone antibiotic from synthetic pharmaceutical effluents. For this purpose, a reactor (with an effective volume of 1 L) equipped with iron electrodes connected to a DC power supply was used and the effects of pH, voltage, persulphate content, and ceftriaxone initial concentration on the efficiency of the process were studied. Moreover, electrode corrosion, synergistic effects of the parameters studied, reaction kinetics, and chemical oxygen demand (COD) removal were studied. Results showed that the variables had a significant effect on process efficiency such that 96% of the ceftriaxone in the effluent was removed under the following optimum conditions: pH: 3, voltage: 10 V, a persulphate concentration of 50 mM/L, a ceftriaxone initial concentration of 0.18 mM/L, and a reaction time of 45 min. However, removal efficiency declined when the above conditions changed. It was also observed that COD removal was 72% in the optimum reaction time. Moreover, the process kinetics was found to be a first-order one. Application of an electrical process to active persulphate anion is associated with such advantages as reduced iron consumption and high antibiotic removal efficiency. Based on the results obtained, the proposed method may be recommended as an alternative for treating persistent pollutants to reduce environmental pollution.

**Keywords:** Electrochemical Process, Persulphate Anion, Ceftriaxone, Synthetic Effluents.

# Investigation of Dye Removal Efficiency of the Photoelectrocatalytic System Using Graphite and Stainless Steel as Electrodes

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## **Abstract**

The removal of Acid Orange 7 by the photoelectrocatalytic process was investigated at ambient temperature under solar irradiation using graphite as the cathode and stainless steel coated with the ZnO/TiO<sub>2</sub> nanocomposite as the anode. The microstructure of the ZnO/TiO<sub>2</sub> coated electrode was characterized by the SEM test. The results revealed dye and COD removal efficiencies of 99% and 97%, respectively, over a period of 360 minutes. The best performance was achieved in 360 minutes with no aeration at a current of 1 mA/cm<sup>2</sup>, an initial dye concentration of 100 mg/L, an electrode surface area of 30 cm<sup>2</sup>, and an electrolyte concentration of 0.01 M; energy consumption under these optimum conditions was 0.15 KWh/ppm. It may be concluded that the photoelectrocatalytic process is well capable of removing organic compounds, especially textile effluents containing dyes and non-degradable contaminants, due to its ability to produce hydroxyl radicals, superoxide, etc. Thus, the technique may be recommended for use as a pre-treatment process to reduce operational costs.

**Keywords:** Textile Dye, Photoelectrocatalytic, Nanocomposite ZnO/TiO<sub>2</sub>, Electrode Area, Electrolyte Concentration, Energy Consumption.

# Synthesis of $C_{14}/Fe_3O_4@SiO_2$ and Its Performance in Removing Uranium (VI) from Aqueous Solutions and Real Wastewater Using Benzamide

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## Abstract

Uranium separation and removal are important from environmental, public health, and strategic viewpoints. Scientists have put great efforts to develop technologies for uranium removal and regeneration because of its important applications and beneficial uses. In this study, efforts have been made to synthesize a modified form of  $Fe_3O_4@SiO_2$  and benzamide uranium complexes that can be exploited to remove and adsorb uranium onto an adsorbent that can be recycled. In the first step,  $Fe_3O_4@SiO_2$  was synthesized and later modified with trimethoxysilane. The adsorbent was subsequently characterized by SEM and FTIR. In a second step, experiments were performed to determine optimum stirring speed, contact time, ion strength, and adsorbent reusability. Finally, the performance of the adsorbent was tested in samples of real wastewater. SEM and FTIR analyses confirmed the satisfactory synthesis and modification of  $Fe_3O_4@SiO_2$  Nps. Statistical analyses revealed that although contact time, ion strength, and stirring speed were effective in adsorbent performance, they only led to a removal enhancement of 5% and a decrease of only 17% with increasing RPM to 250 and the enhancement of ion strength to 1.5M. The highest U(VI) removal efficiency in the synthetic solution was found to be 97%, which reduced to 49% in real wastewater samples. It was concluded that the nano-composite  $C_{14}/SiO_2-Fe_3O_4$  adsorbent with its magnetic core and resistant surface not only offers the possibility for easy separation of uranium from solutions but is also reusable and is only slightly affected by changes in stirring speed or ion strength. It, therefore, has a good capability for use as a U(VI) adsorbent in wastewater treatment.

**Keywords:** Uranium, Nano-composite  $C_{14}/SiO_2-Fe_3O_4$ , Wastewater, Benzamide.

# Adsorption of Pb(II) from Aqueous Solutions on Wheat Straw: Effects of Humification and Sterilization

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## Abstract

Biosorption is one of the methods used for the separation of heavy metals from aquatic environments. The objective of this study was to investigate wheat straw humification and the capability of its microorganisms for the biosorption of Pb from aqueous solutions. Wheat straw (<2 mm) was incubated under lab conditions with a moisture content of 70% for 60 days. Samples from the incubated straw were taken on days 1, 20, and 60 to determine their physical, chemical, and biological properties. Two sterilized and non-sterilized subsamples were also prepared and Pb adsorption isotherms on the subsamples were studied in NaNO<sub>3</sub> solution (0.001 N) with different Pb concentrations at pH 6. Among the Langmuir, Freundlich, and Temkine models, only the latter failed to fit Pb adsorption data. The highest sorption capacities (q<sub>max</sub>) were obtained by the Langmuir model for the humified and unsterile sample (108.41 mg g<sup>-1</sup>) and the lowest was obtained for the fresh and sterile sample (63.36 mg g<sup>-1</sup>). Lead adsorption increased significantly with incubation time and its highest values were recorded with unsterile straw samples taken on days 1, 20, and 60 which were equal to 32.21, 43, and 60.96%, respectively, for the highest Pb concentration. The Langmuir constant (K<sub>l</sub>) and Freundlich constants (K<sub>f</sub> and n) were significantly higher for the more humified wheat straw samples compared to those for raw straw. All the adsorption parameters recorded higher values with the unsterile wheat straw compared to the sterile one, indicating the ability of the microorganisms to adsorb Pb from aqueous solutions.

**Keywords:** Wheat Straw, Humification, Sterilization, Lead Biosorption, Isotherm.



# Isolation and Identification of Sulfur Degrading Bacteria in the Sludge from Tehran Refinery Wastewater Treatment

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## Abstract

Identification of sulfur-degrading microorganisms is a major step in microbial desulfurization of organic compounds, especially oil. Microbial desulphurization is ecologically safe and economically justifiable; hence, the importance of knowledge on the identification, isolation, and adaptation of microorganisms from operational, economic, and environmental viewpoints. The objective of this descriptive–applied research was to identify and isolate sulfur-degrading bacteria in the sludge from Tehran refinery wastewater treatment plant. For this purpose, 120 samples (10 samples per month over a 12–month period) were collected from different locations and elevations of the sedimentation basin. The samples were then stirred and homogenized before they were transferred to the laboratory where they were cultured on specific and differential media to allow the microorganisms to grow. Finally, tests were performed and the following bacteria were identified in the samples: *Brevundiomonas vesicularis*, *Acinetobacter* spp, *Clostridium* spp, *Alcaligenes* spp, *E.coli*, *Bacillus* spp, *Klebsiella* spp, *Acromobacter* spp, and *Desulfovibrio* spp. Results indicate that all the bacteria identified in the samples used sulfur as their only source of energy. Another important contribution of this study is that *Brevundiomonas vesicularis* is for the first time identified in this study as a sulfur-degrading one.

**Keywords:** Sulfur, Tehran Refinery, Sulfur Bacteria.

# Modeling of Phenol Extraction from Wastewater Using Intelligent Techniques

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## **Abstract**

In this study, the extraction of phenol from wastewater was simulated using intelligent methods which include multi-layer perceptron, radial basis functions network, and support vector regression. To design the network structure and to train and test it, 184 experimental data sets were used. Inputs to the network consisted of organic–aqueous volume ratio, rotor speed, temperature, pH, and time while extraction efficiency was the output. Root mean square error and correlation coefficient were used in all the three models as network performance and network stop criteria. Comparison of the results obtained from the three models revealed that the support vector regression was the best model with a correlation coefficient of 0.684 and a root mean square error of 0.99. Moreover, model results showed good agreement with experimental data. Optimal process operational parameters included an organic to aqueous volume ratio of 0.22, a rotor speed of 350 rpm, a temperature of 22.86 °C, a pH equal to 7.5, and an agitation time of 15.86 minutes; the corresponding extraction efficiency was obtained to be 96.35.

**Keywords:** Modeling Phenol Removal, Multilayer Perceptron Network, Radial Basis Function Network, Support Vector Regression.

# Using the IRWQIGT Index to Determine Toxicity Levels in Groundwater Resources: A Case Study of Semnan Province

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## **Abstract**

The objective of the present descriptive-analytic study was to estimate the toxicity level of the groundwater resources in the Province of Semnan using the IRWQIGT index and its zoning via GIS. The experiments were conducted over the period from October 2013 to October 2014 during which time monthly samples were taken from the 41 wells that supply drinking water to the cities and towns in the Province. All the samples were subjected to lab analyses at Semnan Water and Wastewater Laboratory where such chemical parameters as Arsenic, Phenol, Mercury, Detergents, Cadmium, Lead, Chromium, Cyanide, Iron, Magnesium, and TPH were determined according to the procedures of Standard Methods (2008). The measurements were subsequently used to calculate the groundwater toxicity level index (IRWQIGT). Finally, a zoning map of the IRWQIGT index for Semnan Province was prepared using GIS. Results showed that the IRWQIGT index in Semnan Province ranged between 96.54 and 98.2, indicating an excellent water quality. The lowest (96.585) and highest (98.076) values of IRWQIGT were recorded in the cities of Sorkkeh and Mahdishahr, respectively, and that the values for all the parameters were in the standard range. These results indicate that water of excellent quality is available in all the cities in the province so that no toxicity treatment is required.

**Keywords:** IRWQIGT, Groundwater, Toxicity, Semnan, Zoning, GIS.

# Removal of Reactive-dyes from Textile Plant Effluents Using Polyvinyl Alcohol-coated Active Carbon obtained from Sesame Seeds

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## **Abstract**

In this study, the adsorption of active carbon derived from waste sesame seeds coated with polyvinyl alcohol (AC/PVA) was investigated for removing red 198 and blue 19 reactive dyes from textile effluents. The batch process was carried out to identify such parameters as pH, adsorbent dose, contact time, and initial dye concentration involved in the dye removal adsorption capacity of AC/PVA. Also, batch kinetic and isotherm experiments were conducted. Results indicated that the maximum dye removal was obtained in an acidic pH over 90 min of contact time and that adsorption rates followed the pseudo-second-order kinetics. Blue and red dye concentrations were determined using the spectrophotometric method at 590 and 517 nm, respectively. It may be concluded that AC/PVA is capable of removing blue and red reactive dyes and can be used as an efficient, cheap, and accessible adsorbent for treating textile effluents.

**Keywords:** Reactive Dye, Carbon Active, PolyVinyl Alcohol, Wastewater, Adsorption.

# Evaluation of Seasonal, ANN, and Hybrid Models in Modeling Urban Water Consumption, A Case Study of Rasht City

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## **Abstract**

Forecasting future water consumption in cities to plan for the required capacities in urban water supply systems (including water transmission networks and water treatment facilities) depends on the application of behavioral models of urban water consumption. Being located in the North-South corridor, Rasht City is assuming a new role to play in the national economy as a foreign trade center. It will, thus, be necessary to review its present urban infrastructure in order to draft the required infrastructural development plans for meeting the city's future water demands. The three Seasonal Autoregressive Integrated Moving Average (SARIMA), Artificial Neural Network (ANN), and SARIMABP approaches were employed in present study to model and forecast Rasht urban water consumption using monthly time series for the period 2001–2008 of urban water consumption in Rasht. The seasonal unit root test was applied to develop the relevant SARIMA model. Results showed that all the seasonal and non-seasonal unit roots are present in all the frequencies in the monthly time series for Rasht urban water consumption. Using a proper filter, the SARIMA patterns were estimated. In a second stage the SARIMA output was used to determine the ANN output and the hybrid SARIMABP structure was accordingly constructed. The values for Rasht urban water consumption predicted by the three models indicated the superiority of the SARIMABP hybrid model as evidenced by the forecast error index of 0.41% obtained for this model. The other two models of SARIMA and ANN were, however, found to yield acceptable results for urban water managers since the forecasting error recorded for them was below 1%.

**Keywords:** Seasonal Model, ANN, Hybrid Model, Forecasting, Urban Water Demand.