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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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- Urban hydrology (urban runoff, urban flooding, echo hydrology etc.)
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- Application of mathematical modeling in water and wastewater treatment processes- Public health issues related to water and wastewater
- Water reuse (environmental and health impacts)
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- 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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# Sonochemical Oxidation of Acid Blue 113 by Fe (II)-activated Hydrogen Peroxide and Persulfate in Aqueous Environments

A. Seid-Mohammadi <sup>1</sup>, Gh. Asgari <sup>1</sup>, J. Mehralipour <sup>2</sup>, A. Shabanlo <sup>3</sup>,  
H. Almasi <sup>2</sup>, F. Zaheri <sup>4</sup>

1. Ass. Prof. of Environmental Health Engineering, Social Determinates of Health Research Center, Faculty of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran
2. Former Graduate Student of Environmental Health Engineering, Faculty of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran
3. Former Graduate Student of Environmental Health Engineering, Faculty of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran  
(Corresponding Author) (+98 811) 4420474 Shabanlo\_a@yahoo.com
4. BS of Environmental Health Engineering, Faculty of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran

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## Abstract

Residual Azo dyes pose a major environment problem due to the benzene rings present in their structure. In this experimental study, the efficiencies of the US/H<sub>2</sub>O<sub>2</sub>/Fe<sup>2+</sup> and US/S<sub>2</sub>O<sub>8</sub><sup>2-</sup>/Fe<sup>2+</sup> processes in degrading Acid Blue 113 Azo were investigated. For this purpose, the effects of the parameters involved in these processes such as initial solution pH in the range of 3 to 11, different concentrations of H<sub>2</sub>O<sub>2</sub>, and -S<sub>2</sub>O<sub>8</sub><sup>2-</sup> in the range of 1 to 10 mM, those of FeSO<sub>4</sub> in the range of 0.1 to 1 mM, and different initial dye concentrations were investigated in a batch ultrasound reactor operated at 40 kHz. Also, the effects of aeration on process efficiency and fluctuations in the dye UV-Vis spectrum were investigated under optimum conditions. Based on the results obtained, dye removal efficiency decreased considerably in both processes with increasing pH such that maximum removal efficiency was obtained at pH 3 in both processes. Similarly dye removal efficiency decreased in both processes when FeSO<sub>4</sub> concentration rose above 0.5 mM. The optimum conditions in the US/H<sub>2</sub>O<sub>2</sub>/Fe<sup>2+</sup> process to achieve a removal efficiency of 93.5% for an initial dye concentration of 50 mg/L involved H<sub>2</sub>O<sub>2</sub> and FeSO<sub>4</sub> concentrations of 2.5 and 0.05 mM, respectively. Under the same optimal conditions, the efficiency of the US/S<sub>2</sub>O<sub>8</sub><sup>2-</sup>/Fe<sup>2+</sup> process was found to be 94.3% for a S<sub>2</sub>O<sub>8</sub><sup>2-</sup> concentration of 2.5 mM. These results suggest that the US/S<sub>2</sub>O<sub>8</sub><sup>2-</sup>/Fe<sup>2+</sup> is more effective than the US/H<sub>2</sub>O<sub>2</sub>/Fe<sup>2+</sup> in reducing the 567 nm peak of the dye structure. Finally, examination of the changes in the UV-Vis spectra of Acid Blue 113 showed that the US/H<sub>2</sub>O<sub>2</sub>/Fe<sup>2+</sup> process led to greater declines in the 276 and 203 nm peaks.

**Keywords:** Sonochemical Oxidation, Hydrogen Peroxide, Persulfate, Acid Blue 113, Aqueous Environments.

# The Photocatalytic Removal of Ortho Chlorophenol from Aqueous Solution Using Modified Fly Ash - Titanium Dioxide

*M. Malakootian*<sup>1</sup>, *A.R. Mesdaghinia*<sup>2</sup>, *Sh. Rezaei*<sup>3</sup>

1. Prof., Environmental Health Engineering Research Center and Department of Environmental Health, Kerman University of Medical Sciences, Kerman, Iran  
(Corresponding Author) (+98 341) 3205128 m.malakootian@yahoo.com
2. Prof., Department of Environmental Health Engineering, School of Public Health, Tehran University of Medical Sciences, Water Quality Research Center, Institute for Environmental Research, Tehran University of Medical Sciences, Tehran, Iran
3. MSc Student in Environmental Health Engineering, Department of Environmental Health, Kerman University of Medical Sciences, Kerman, Iran

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## **Abstract**

The photocatalytic process is a useful method for the effective removal of phenolic compounds. Conducted in the spring–summer 2013 at the Engineering Research Center for Environmental Health, Kerman University of Medical Sciences, this experimental study used a modified fly ash–TiO<sub>2</sub> mixture to enhance the photocatalytic removal efficiency of ortho-chlorophenol. Fly ash obtained from the Thermal Power Plant in Zarand, Kerman, was initially washed with sulfuric acid before being oxidized with potassium permanganate. The mixture of modified fly ash and TiO<sub>2</sub> was then used for the removal of ortho-chlorophenol in the presence of UV light and the factors involved in the removal process were optimized. It was found that the ortho-chlorophenol removal efficiency recorded by the mixture of modified fly ash and TiO<sub>2</sub> was higher than that by each of the modified fly ash or TiO<sub>2</sub>/UV alone. It was, further, observed that removal efficiency with a modified fly ash to TiO<sub>2</sub> ratio of 3:1 rose to 98.8% under optimum conditions (i.e., pH: 2; contact time: 2 h; room temperature (29±2°C), and a catalyst dose of 0.6 g). The ortho-chlorophenol removal efficiency in real wastewater from the Coal Wash Plant in Zarand was recorded at 88.4%. Based on the results obtained from simultaneous use of modified fly ash and TiO<sub>2</sub>, the proposed method may be recommended for industrial applications.

**Keywords:** Ortho-chlorophenol, Modified Fly Ash, TiO<sub>2</sub>.

# Efficiency of Immobilized Nano TiO<sub>2</sub> on Fe-ZSM-5 Zeolite in Organic Pollutants Removal from Petroleum Refinery Wastewater

Z. Ghasemi <sup>1</sup>, H. Younesi <sup>2</sup>, A. A. Zinatizadeh <sup>3</sup>

1. PhD Student of Environment, Faculty of Natural Resources and Marine Sciences, Tarbiat Modares University, Noor, Mazandaran
2. Assoc. Prof. of Environmental Sciences, Faculty of Natural Resources and Marine Sciences, Tarbiat Modares University, Noor, Mazandaran  
(Corresponding Author) (+98 122) 6253101
3. Ass. Prof. of Applied Chemistry, Faculty of Chemistry, Razi University, Kermanshah

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## Abstract

Effluents from oil refineries contain different concentrations of aliphatic and aromatic hydrocarbons. Given the toxicity of the aromatic fraction that is not readily degradable by conventional treatment processes, advanced processes are required for their removal. This study investigated the photocatalytic degradation and removal of organic contaminants from oil refinery effluents. For this purpose, TiO<sub>2</sub>-Fe-ZSM-5 photocatalyst was initially produced by immobilizing TiO<sub>2</sub> into the structure of synthetic Fe-ZSM-5 zeolite. X-Ray diffraction, X-Ray fluorescence, Fourier transform infrared (FTIR) spectroscopy, scanning electron microscopy, transmission electron microscopy, and nitrogen sorption/desorption techniques were then employed to determine the structural and physicochemical properties of the products. High purity TiO<sub>2</sub>-Fe-ZSM-5 photocatalyst with a TiO<sub>2</sub> percentage of 29.28 and a specific surface area of 304.6 m<sup>2</sup>g<sup>-1</sup> was synthesized. The photocatalyst thus obtained was then applied for the removal of organic pollutants from the effluent of Bandar Abbas Oil Refinery. A maximum COD reduction of more than 80% was achieved under optimum conditions (i.e., pH: 4, catalyst concentration: 3 g/l, temperature: 45 °C, and UV exposure time: 240 min).

**Keywords:** Photocatalyst, Fe-ZSM-5 Zeolite, TiO<sub>2</sub>, Photocatalytic Treatment, Petroleum Refinery Wastewater.

# Potential Removal of Styrene by the Aerobic Microorganism *Rhodococcus erythropolis* PTCC 1767

M. Arabjafari <sup>1</sup>, N. Fallah <sup>2</sup>, M. Dadvar <sup>3</sup>, B. Nasernejad <sup>4</sup>

1. MSc of Chemical Engineering Environment, Department of Chemical Engineering, Amirkabir University of Technology, Tehran
2. Ass. Prof. and Faculty Member of Food Technology and Biotechnology Group, Department of Chemical Engineering, Amirkabir University, Tehran  
(Corresponding Author) (+98 21) 64543199 nfallah2001@aut.ac.ir.
3. Assoc. Prof. and Faculty Member of Petrochemical Group, Department of Chemical Engineering, Amirkabir University of Technology, Tehran
4. Prof. and Faculty Member of Feed Technology and Biotechnology Group, Department of Chemical Engineering, Amirkabir University, Tehran

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## Abstract

Biodegradation of styrene by an aerobic microorganism (namely, *Rhodococcus erythropolis* PTCC 1767) as well as the effects of bacterial cultures non-adapted and adapted to 90 mg/l styrene were investigated. In both cases, an initial biomass concentration of 0.31 mg/l and styrene concentrations of 10, 20, 30, 50, 70, 90, and 150 mg/l were used and the tests were carried out at 32 °C and at pH 7. The results showed that the unadapted bacterial cultures were capable of biodegrading 10 mg/l in 15 h; however, removal efficiency was observed to decrease with increasing initial styrene concentration such that at a concentration of 150 mg/l, only 17% of the biomass was degraded over 48 h. On the other hand, the adapted microorganisms were capable of completely degrading Styrene at various initial concentrations of 10 to 150 mg/l over 2.7–45 h. The kinetics of styrene biodegradation by *R. erythropolis* PTCC 1767 was also studied. The styrene bioremoval data fitted to the Monod model and to five inhibition kinetic models (namely, Haldane, Webb, Yano, Aiba, and Teissier-type). Among these models, the Haldane one was found to fit satisfactorily the kinetic data ( $R^2 > 0.99$ ,  $SSE = 0.008$ ) with the following Haldane model parameters:  $q_m = 4.235$  mg/g dry cell h;  $K_s = 7.594$  mg/l; and  $K_i = 34.58$  mg/l.

**Keywords:** Styrene, *Rhodococcus erythropolis*, Adaptation, Kinetic Modeling.

# Comparison of the Cost-effectiveness of Activated Sludge Systems with Natural Wastewater Treatment Systems in Kermanshah Province

A. Almasi <sup>1</sup>, A. Dargahi <sup>2</sup>, S. Delangizan <sup>3</sup>, A. H. Hashemian <sup>4</sup>, M. Naderi <sup>5</sup>

1. Prof. of Environmental Health Engineering, Faculty of Public Health, and Founder Research Center on Social Development and Public Health Promotion, Kermanshah University of Medical Sciences, Kermanshah
2. PhD Student of Environmental Health Engineering, Faculty of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran
3. Ass. Prof. of Economics, Razi University of Kermanshah
4. Assoc. Prof. of Biostatistics, Faculty of Public Health, Kermanshah University of Medical Sciences, Kermanshah
5. MSc Student of Environmental Health Engineering, Faculty of Public Health, Kermanshah University of Medical Sciences, Kermanshah  
(Corresponding Author) (+98 31) 36517423 naderi.marzie 987@yahoo.com

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## Abstract

To determine the economic feasibility of wastewater treatment plants requires methods to determine their cost/effectiveness ratio. The objective of the present descriptive analytical study was to determine and compare the cost/effectiveness ratios of two types of wastewater treatment systems operating in Kermanshah Province. For this purpose, data and information on the wastewater treatment plants under study were collected from both local water and sewage companies and treatment plant operators. The data were then subjected to statistical analysis using the SPSS software program. All the costs associated with the erection and operation of the treatment processes were analyzed and plant efficiencies were determined to work out the cost/effectiveness index for each plant as a basis for comparisons. Average values of overall efficiency determined from the mean values of total suspended solids, biochemical oxygen demand, and chemical oxygen demand removals in both activated sludge and natural systems were found to be  $76.37 \pm 18.19\%$  and  $61.69 \pm 19.0\%$ , respectively. Also, the two systems were found to be significantly different with respect to their overall efficiency. Moreover, the cost/effectiveness ratios obtained for the two activated sludge and natural systems were 0.23 and 0.58, respectively. Based on the results obtained, it may be claimed that, despite their lower efficiency, natural treatment systems outperform activated sludge ones due to their higher cost/effectiveness ratio, which makes them superior to the activated sludge process. Natural treatment systems owe their superiority to their lower investment, operation, and maintenance costs.

**Keywords:** Activated Sludge Systems, Natural Systems, Cost-Effectiveness, Kermanshah Province.

# Comparison Between Age, Length and Weight with Mercury Concentration in the Muscle of Two Fish Species; *Barbus grypus* and *Barbus luteus* of Fishes Maroon River in Behbahan

*M. Momtazan*<sup>1</sup>, *M. Asefi*<sup>2</sup>, *R. Zamani Ahmadmahmoudi*<sup>3</sup>

1. Former Graduate Student of Civil and Environmental Engineering, Faculty of Water Sciences Engineering, Shahid Chamran University, Ahvaz  
(Corresponding Author) 09166728197 mah\_momtazan@yahoo.com
2. Former Graduate Student of Civil and Environmental Engineering, Faculty of Water Sciences Engineering, Shahid Chamran University, Ahvaz
3. Faculty Member of Fishery and Environment, Faculty of Natural Resources and Geosciences, Shahrekord Universtiy, Shahrekord

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## **Abstract**

Increasing attention is nowadays being paid to contaminants in fish due to their significant effects on the fish and other organisms that live on them. This study was designed to investigate mercury concentrations in the muscle tissues of the two species of *Barbus grypus* and *Barbus luteus* indigenous to the Maroon River in Behbahan, southeast of Khuzestan Province. For this purpose, 20 fish from each species were randomly collected from the river over the period from June to December 2009. The fish were then subjected to biometric tests and their gender and age were determined while the Mercury Analyzer AMA254 was used to measure mercury concentrations in their muscle tissues. Examination of the data on age and weight correlations with mercury concentration in the muscle tissues of both species showed that the data did not exhibit a normal distribution but, rather, revealed statistically significant differences. Comparison of the mean values of mercury concentration in the tissues (0.809 mg/kg in *Barbus grypus* and 0.388 mg/kg in *Barbus luteus*) with MRL standard limits showed that both species had mercury concentrations below the maximum standard limit set by the EPA. Comparison with WHO standard limits, however, revealed that *Barbus grypus* had a muscle mercury concentration higher than the WHO allowable limit.

**Keywords:** Mercury, Fish, Muscle, *Barbus grypus*, *Barbus luteus*, Maroon River in Behbahan.

# Optimized Management of Groundwater Resources in Kish Island: A Sensitivity Analysis of Optimal Strategies in Response to Environmental Changes

*D. Mahmoodzadeh<sup>1</sup>, H. Ketabchi<sup>2</sup>, B. Ataie-Ashtiani<sup>3</sup>*

1. Former Graduate Student of Environmental Health Engineering, Faculty of Civil Engineering, Sharif University of Technology, Tehran, Iran (Corresponding Author)  
09123034600 dmahmoodzadeh@alum.sharif.edu
  2. Ass. Prof., Department of Water Resources Engineering, Tarbiat Modares University, Tehran, Iran
  3. Prof., Faculty of Civil Engineering, Sharif University of Technology, Tehran, Iran
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## **Abstract**

Groundwater in coastal areas is an essential source of freshwater that warrants protection from seawater intrusion as a priority based on an optimal management plan. Proper optimal management strategies can be developed using a variety of decision-making models. The present study aims to investigate the impacts of environmental changes on groundwater resources. For this purpose, a combined simulation-optimization model is employed that incorporates the SUTRA numerical model and the evolutionary method of ant colony optimization. The fresh groundwater lens in Kish Island is used as a case study and different scenarios are considered for the likely environmental changes. Results indicate that while variations in recharge rate form an important factor in the fresh groundwater lens, land-surface inundation due to rises in seawater level, especially in low-lying lands, is the major factor affecting the lens. Furthermore, impacts of environmental changes when effected into the Kish Island aquifer optimization management plan have led to a reduction of more than 20% in the allowable water extraction, indicating the high sensitivity of groundwater resources management plans in small islands to such variations.

**Keywords:** Environmental Change, Kish Island, Fresh Groundwater Lens, Combined Simulation- Optimization Model, Optimal Management.

# Comparison of Multi Objective GMDH-type Neural Network and Bayesian Belief Network in the Prediction of Treated Water Turbidity Case Study: Great Water Treatment Plant in Guilan Province

*A. Daghbandan*<sup>1</sup>, *F. Alitaleshi*<sup>2</sup>, *M. Yaghoobi*<sup>3</sup>

1. Ass. Prof. of Chemical Engineering, Faculty of Engineering, University of Guilan, Rasht  
(Corresponding Author) (+98 13) 33824392 daghbandan@guilan.ac.ir
2. MSc Student of Chemical Engineering, University of Guilan, Rasht
3. Operating Engineering, Great Guilan Water Treatment Plant, Rasht

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## **Abstract**

In this paper, the factors affecting water turbidity removal are identified using the Response Surface Methodology (RSM). The GMDH-type Neural Networks and Bayesian Belief Network (BBN) are subsequently employed for modeling and predicting treated water turbidity using an input-output data set. To validate the proposed model, a case study is carried out based on 700 sets of data obtained from Guilan WTP. For modeling, the experimental data obtained from the operation unit are divided into train and test sections (70% for training and 30% for testing). The predicted values are then compared with experimental ones. The determination coefficients of the predicted values for the two BBN algorithms, consisting of EM and GD, and the GMDH model are found to be 0.9388, 0.9196, and 0.97095, respectively. Evidently, the GMDH model outperforms the BBN model in predicting treated water turbidity.

**Keywords:** Water Treatment, Turbidity, Modeling, GMDH-NN, BBN.

# Effect of Structural Modification of Polyurethane Foam by Activated Carbon on the Adsorption of Oil Contaminants from Water

A. A. Nikkhah<sup>1</sup>, H. Zilouei<sup>2</sup>, A. R. Keshavarz<sup>1</sup>

1. MSc Student, Department of Chemical Engineering, Isfahan University of Technology, Isfahan
2. Assoc. Prof. of Environmental Biotechnology, Isfahan University of Technology, Isfahan (Corresponding Author) (+98 31) 33915632  
hzilouei@cc.iut.ac.ir

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## Abstract

This study investigates both the capacity of pure polyurethane foam in adsorbing oil contaminants and the effect of its structural modification by activated carbon (composite) on the performance of the foam in terms of adsorption capacity and efficiency. To this end, pure polyurethane foam and its activated carbon composites were synthesized and crude oil removal tests were conducted with initial crude oil concentrations of 20 to 280 g/L. Experimental results showed that the optimum weight percentage of activated carbon introduced into the foam structure was 5% wt, which enhanced adsorption capacity by up to 21%. The presence of activated carbon in the foam structure increased the hydrophobicity of the composites while, at the optimal concentration of activated carbon, its adsorption efficiency increased by up to 73% for an initial oil concentration of 20 g/L. Equilibrium studies showed that the Langmuir and Redlich-Peterson isotherms were the fitting ones for oil removal adsorption description. Chemical recovery of the sorbents used was performed using oil solvents (toluene and petroleum ether), which confirmed enhancement in both adsorption efficiency and capacity of the pure sorbent foam and the composite adsorbent.

**Keywords:** Oil Contamination, Adsorption, Polyurethane Foam, Activated Carbon, Composite