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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.)
- 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)
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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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# Water Resources Assessment Using an Integrated Approach Based on Water Accounting, A Case Study of Mashhad Plain

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## **Abstract**

Assessment is both a fundamental step in integrated water resources management and one of the most important stages in planning and implementing such management systems. Water accounting is regarded as a tool for organizing and combining the data collected from various sources to develop an information system that will provide a tool for the integrated assessment of water resources by combining relevant physical and economic data. Based on these observations, the present study was designed to analyze the present status of water resources in Mashhad Plain as the study area. For this purpose, the framework proposed by the UN was adopted and water accounts of the study region were compiled for the years 2001 and 2006 to extract the relevant assessment indicators. In a second stage, the policy options emerging from the available documents and regional development plans were examined and a final evaluation of the water use policies in the study area was conducted using an analytical system dynamics model in SIMULINK. Results indicate that not only can the present local aquifer declines be reduced but significant improvements can also be made in the gross productivity rate across the region by correcting and updating the present water allocation policies (especially by correcting agricultural water uses and reallocating water to other sectors) provided that assessments are based on a regional rather than a farm scale. For instance, if allocation to high water consuming crops such as tomato and sugar beets or livestock is stopped to reallocate part of the water saved to the service industry, the regional water productivity will be enhanced by 5690 and 2115 IRR per cubic meter for the years 2006 and 2001, respectively.

**Keywords:** Water Accounting, Integrated Water Resources Management, SEEA-Water, Mashhad Plain

# Pathotyping of *Escherichia coli* Isolated from Inlets to Tehran Water Treatment Plants

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## Abstract

Water borne infections are of great importance for public health due to the role of water in the transmission of pathogens which cause gastrointestinal diseases. Traditional methods based on culture media commonly used for the identification of *E. coli* are not only time-consuming but fail to detect certain pathotypes of *E. coli* as well. To overcome these shortcomings, molecular methods were employed in the present study for the rapid and specific determination of *E. coli* pathotypes. For this purpose, 978 water samples were collected during the period from September 2012 to September 2013 and 106 *E. coli* strains were selected using multistep biochemical and molecular screening (tetraplex PCR) method. Virulogenes were determined by designing specific primers and developing efficient protocols. While it was shown that water has a great capability for transmitting pathogenic microorganisms, the results revealed that 10 strains contained the *est*, *elt*, and *eaeA* genes; five contained the *bfpA* gene; four contained the *pCVD* and *ipaH* genes; three contained the *VT1* and *VT2* genes; and finally one strain contained the *cnf1* and *cnf2* genes. It was also found that molecular methods based on our newly designed primers are sensitive, specific, and rapid protocols for pathotyping of *Escherichia coli*.

**Keywords:** *Escherichia coli*, Coliform Bacteria, Pathotypes, Tehran, Water Treatment Entrance.

# Study of Mercury Pollution in Water, Sediments, and Fish from Hamoon International Wetland

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## **Abstract**

Contaminant levels in fish are of particular importance because of the potential health risks they pose to human consumers. The present study was designed and implemented to determine mercury concentrations in water, sediments, and fish from Hamoon wetland against international standards. For this purpose, the LECO, AMA 254, ASTM Standard D-6722 was used to determine mean Hg concentrations in the muscles of *Ctenopharyngodon idella*, *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Hypophthalmichthys nobilis*, *Schizocypris altidorsalis*, and *Schizothorax zardunyi* as 0.14, 0.28, 0.15, 0.15, 0.34, and 0.36 mg/kg, respectively, and 0.21, 0.32, 0.22, 0.23, 0.36 and 0.41 mg/kg in their kidneys. Water mercury concentrations at three stations were determined to be 0.06, 0.07, and 0.08 mg/kg while they were 0.39, 0.44, and 0.48 mg/kg in the sediments. Laboratory analysis results showed significant differences in mercury concentrations between fish kidney and muscle ( $p < 0.001$ ). However, these concentrations were found to be below the limits recommended by the United Nations Food and Agriculture Organization (FAO), World Health Organization (WHO), US Food and Drug Administration (FDA), European Union (EU), and the United Kingdom (UK).

**Keywords:** Mercury, Fish, Sediments, Hamoon International Wetland.

# Investigation of Phenol Removal from Aqueous Solutions by Electro/Fenton and Electro/persulfate Processes

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## Abstract

Phenol, or hydroxyl benzene, is a toxic aromatic hydrocarbon discharged into the environment through certain industrial effluents which, thereby, pollute water resources. This study examines phenol removal from aqueous solutions through electro-Fenton and electro/persulfate processes using iron electrodes. For this purpose, a laboratory-scale electrochemical batch reactor was used that was equipped with four electrodes and a direct DC power supply. In the tests carried out, the effects of operational parameters such as initial pH; current density; and initial concentrations of phenol, hydrogen peroxide, and persulfate on the removal of phenol were investigated. The results showed that EPS and EF processes achieved phenol removal efficiencies of 95.18% and 93.99%, respectively, at operating conditions of pH = 3, initial phenol concentration of 100 mg/l, hydrogen peroxide and persulfate concentration of 0.4 mM, and a current density 0.07A/dm<sup>2</sup> over 45 min. Increasing persulfate and hydrogen peroxide concentration from 0.4 to 0.8 mM reduced phenol removal efficiencies from 95.18% and 93.99% to 43% and 85%, respectively. Generally speaking, EPS and EF processes exhibited almost identical phenol removal efficiencies. Finally, the integrated electrochemical and persulphate process was found to be more productive in producing electrical iron and persulphate activation than using each single process in isolation.

**Keywords:** Electrofenton, Electropersulfate, Phenol, Iron Anode.

# Electrochemical Treatment of Wastewater Containing Mixed Reactive Dyes Using Carbon Nanotube Modified Cathode Electrodes

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## **Abstract**

Nowadays, advanced electrochemical oxidation processes are promising methods for the treatment of wastewaters containing organic dyes. One of these methods is the Electro-Fenton (EF) technique in which an electrical current is applied to the cathode and anode electrodes to promote electrochemical reactions that generate hydroxyl radicals which mineralize organic pollutants and remove them from wastewater. To carry out the Electro-Fenton process in this work, the carbon paper (CP) electrode was initially modified with carbon nanotubes (CNT) to produce the CP-CNT electrode which was used as the cathode to remove a mixture of organic dyestuff (containing Reactive Blue 69, Reactive Red 195, and Reactive Yellow 84) from wastewaters. Comparison of the two types of cathode electrodes (i.e., CNT and the modified CP-CNT) showed that the CP-CNT outperformed the CP electrode. The EF process was employed to treat 500 ml of a mixture of dyes (50 mg/L of each dye) containing sodium sulfate and  $\text{Fe}^{+3}$  ions. The results revealed that the highest color removal efficiency was achieved when a current of 300 mA was applied for 210 min. COD measurements were used to calculate the effective current and power consumption. It was found that the 300 mA current applied over a period of 210 min yielded the highest effective current and the lowest power consumption. The amount of dyes mineralized by the EF process in the dye solution indicated that 78% of the initial COD had been removed under the above conditions. It may be concluded that the Electro-Fenton process can be successfully used for the treatment of wastewaters containing mixtures of dye pollutants. Cathode electrode type, electrical current, and electrolysis duration were identified as the parameters affecting the process.

**Keywords:** Electro-fenton, Reactive Dyes, Carbon Nano Tubes, COD Reduction.



# Application of UV/TiO<sub>2</sub>/H<sub>2</sub>O<sub>2</sub> Advanced Oxidation to Remove Naphthalene from Water

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## **Abstract**

Naphthalene is released into the environment by burning such organic materials as fossil fuels and wood and in industrial and vehicle exhaust emissions. Naphthalene is used in the manufacture of plastics, resins, fuels, and dyes. The aim of this study was to evaluate the performance of UV/TiO<sub>2</sub>/H<sub>2</sub>O<sub>2</sub> process to decompose naphthalene in aqueous solutions. For this purpose, the photocatalytic degradation of naphthalene was investigated under UV light irradiation in the presence of TiO<sub>2</sub> and H<sub>2</sub>O<sub>2</sub> under a variety of conditions. Photodegradation efficiencies of H<sub>2</sub>O<sub>2</sub>/UV, TiO<sub>2</sub>/UV, and H<sub>2</sub>O<sub>2</sub>/TiO<sub>2</sub>/UV processes were compared in a batch reactor using the low pressure mercury lamp irradiation. The effects of operating parameters such as reaction time (min); solution pH; and initial naphthalene, TiO<sub>2</sub>, and H<sub>2</sub>O<sub>2</sub> concentrations on photodegradation were examined. In the UV/TiO<sub>2</sub>/H<sub>2</sub>O<sub>2</sub> system with a naphthalene concentration of 15 mg/L, naphthalene removal efficiencies of 63, 75, 80, 88, 92, 95, 96.5, and 98% were achieved, respectively, for reaction times of 5, 10, 20, 30, 40, 50, 60, 100 and 120 min. This is while removal efficiencies of 50, 59.5, 69, 80, 85, 88, 91, and 95% were obtained in the UV/TiO<sub>2</sub> system under the same conditions. For initial pH values of 3, 4, 5, 6, 7, 9, 10, and 12, naphthalene removal efficiencies of approximately 96.8, 85.5, 86, 75.5, 68.8, 57.8, and 52.5% were achieved, respectively, with the UV/TiO<sub>2</sub>/H<sub>2</sub>O<sub>2</sub> system. Thus, it may be claimed that, compared to either H<sub>2</sub>O<sub>2</sub>/UV or TiO<sub>2</sub>/UV process, the H<sub>2</sub>O<sub>2</sub>/TiO<sub>2</sub>/UV process yielded a far more efficient photodegradation.

**Keywords:** Advanced Oxidation Processes, Aqueous Solution, H<sub>2</sub>O<sub>2</sub>/TiO<sub>2</sub>/UV, Naphthalene.

# Application of Response Surface Methodology (RSM) for Modeling and Optimizing Coagulation Process for the Removal of Bromide Ions

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## **Abstract**

In this paper, the response surface methodology and the central composite design are used to model and optimize bromide removal efficiency in the coagulation process. Bromide ions are naturally found in surface waters. Despite its non-toxicity, when exposed to disinfectants commonly used in water treatment, bromide ions produce disinfection byproducts which are more carcinogenic than their chlorinated counterparts. A key process in water treatment is coagulation. Most studies have recently focused on enhanced coagulation achieved by new coagulants known as inorganic polymer coagulants which exhibit a remarkable ability in both removing colloidal particles and reducing turbidity and the zeta potential from water. In the present experiments, poly-aluminum chloride (PAC) is used as a coagulant. Moreover, an experimental design is constructed using the Design-Expert software to develop an efficient model with a regression coefficient of 0.9925 which fitted the observed data on bromide removal efficiency. It is found that coagulant dosage and initial bromide concentration have direct impacts on bromide removal efficiency while a different behavior is observed in the case of pH.

**Keywords:** Response Surface Methodology, Central Composite Design, Enhanced Coagulation, Bromide Ion, Poly-Aluminum Chloride.

# Kinetic Modeling of Synthetic Wastewater Treatment by the Moving-bed Sequential Continuous-inflow Reactor (MSCR)

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## **Abstract**

It was the objective of the present study to conduct a kinetic modeling of a Moving-bed Sequential Continuous-inflow Reactor (MSCR) and to develop its best prediction model. For this purpose, a MSCR consisting of an aerobic-anoxic pilot 50 l in volume and an anaerobic pilot of 20 l were prepared. The MSCR was fed a variety of organic loads and operated at different hydraulic retention times (HRT) using synthetic wastewater at input COD concentrations of 300 to 1000 mg/L with HRTs of 2 to 5 h. Based on the results and the best system operation conditions, the highest COD removal (98.6%) was obtained at COD=500 mg/L. The three well-known first order, second order, and Stover-Kincannon models were utilized for the kinetic modeling of the reactor. Based on the kinetic analysis of organic removal, the Stover-Kincannon model was chosen for the kinetic modeling of the moving bed biofilm. Given its advantageous properties in the satisfactory prediction of organic removal at different organic loads, this model is recommended for the design and operation of MSCR systems.

**Keywords:** Synthetic Wastewater, Reaction Kinetic, MSCR, Biofilm.

# Evaluation of Synthesized Fe<sub>3</sub>O<sub>4</sub>/MWCNTs Nanocomposite Used in the Heterogeneous Fenton Process for the Removal of Ciprofloxacin Antibiotic

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## **Abstract**

Ciprofloxacin is an antibiotic vastly administered for the treatment of infections. A major portion of the drug remains non-metabolized and is excreted to find its way ultimately into water environments through discharge into wastewater. Although carbon nanotubes have been widely employed for the removal of contaminants, ciprofloxacin still poses problems against its proper removal. It is the objective of the present study to synthesize magnetite Fe<sub>3</sub>O<sub>4</sub>/MWCNTs and to evaluate its performance in ciprofloxacin removal via the heterogeneous Fenton process. For this purpose, the performance of the synthesized nanocomposite was evaluated while the effects of the following parameters were also investigated on the heterogeneous Fenton process under lab conditions: pH, 4–10; adsorbent quantity, 1–3 g/l; initial antibiotic concentration, 30–200 mg/l; contact time, 15–300 min; and H<sub>2</sub>O<sub>2</sub> concentration, 5–25 μmol/l. Moreover, the synthesized Fe<sub>3</sub>O<sub>4</sub>/MWCNTs was morphologically and microstructurally characterized using Transmission Electron Microscopy (TEM) and X-ray diffraction (XRD) while the formation of carboxylic functional groups was verified by Fourier transform infrared spectra (FT-IR). It was found that the efficiency of the heterogeneous Fenton process for the removal of ciprofloxacin at a concentration of 30 mg/l was 95% in approximately 180 minutes and a molar ratio of 1 ml H<sub>2</sub>O<sub>2</sub>/2g Fe. Based on the results obtained, the Fe<sub>3</sub>O<sub>4</sub>/MWCNTs magnetite nanocomposite is well capable of removing ciprofloxacin from aqueous solutions in the heterogeneous Fenton process.

**Keywords:** Magnetite Nano-Composite, Ciprofloxacin Antibiotic, Heterogeneous Fenton.

# Effect of Nanocoagulants on Reducing Microbial Contamination in Drinking Water (A Case Study)

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## **Abstract**

A growing interest has been recently shown to the application of modern technologies, especially nanotechnologies, as a management approach to alleviating the adverse effects of environmental pollutants. One area that may most benefit from these new technologies is the water resources management. The present study was designed to evaluate the effectiveness of nanocoagulants in reducing the microbial load of drinking water. For the purposes of this study, the drinking water supply of the City of Ilam was chosen for a case study and its parameters of biological oxygen demand (BOD), total hardness (TH), and fecal coliforms were determined. It was found that application of nanocoagulants at temperatures as high as 40 °C, over a detention time of more than one hour, and at pH = 6 yielded the highest efficiency in removing the microbial load and BOD<sub>5</sub>, but it had no effect on TH removal. Based on the results obtained, it may be claimed that nanocoagulants may serve as a good alternative to common coagulants and disinfectants in treating drinking water while they can also improve and optimize water treatment processes.

**Keywords:** Drinking Water, Microbial Contamination, Nanocoagulants.