# Thermodynamic and Mathematical Methods in Heat Integration of Atmospheric Unit of Tehran Oil Refinery

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## Abstract

*In a process unit, reducing the energy consumption, increasing the production capacity and economic profit of the process, have been always considered and various methods, including thermodynamic methods and mathematical methods, have been improved for this purpose. In present study, atmospheric distillation process of Tehran refinery has been optimized by two different methods and their results, have been reported. By the first method, in which optimization has been performed by Aspen Analyzer software, based on pinch technology (as the thermodynamic method), comparisons between real situation and based ideal design, show the difference about 34%. The required number of units by ideal design is reported 21, the utility consumption is $1.3\times10^5$ kW and required area is $2.2\times10^4$ $m^2$. The second method, performed optimization by GAMS software which is based on synheat model as the mathematical method. The required number of units is reported 28, the utility consumption is $5.2\times10^4$ kW and required area is $6.6\times10^3$ $m^2$. In present study with the use of HeVi software, the results of mathematical optimization is visualized in the form of grid diagram for heat exchangers and streams.*

**Keywords: Optimization, Pinch, Mathematical Optimization Methods, Atmospheric Distillation Column, Heat Exchanger Network, HeVi Software.**

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# An Investigation on Appropriate Procedure for Micro-Reactor Fabrication & Simulation

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## Abstract

*In the recent years, microscale equipment has been one of the advantages in the engineering sciences. In this regard, manufacturing micro-reactors is one of the significant progress in chemical and chemical engineering science. Using the micro-reactor instead of conventional scale reactor leads to significant decrease in research expense. On the other hand, conventional scale reactors are not able to perform some reactions. Hence, micro-reactor is applied in industrial scale, when reaction is not performed in conventional scale reactor. In this study, micro-reactor manufacturing procedures are described. Selecting micro-reactor scheme, evaluation of design, selecting construction material, and manufacturing are four main step in micro-reactor manufacturing. According to property change of heat and mass transfer, flow distribution and flow regime in microscale, simulation of micro-reactor before manufacturing is one of the most important step in micro-reactor-manufacturing.*

**Keywords: Fabrication, Micro-Reactor, Design Evaluation, Microscale, Simulation, CFD.**

# Electrochemical Advanced Oxidation Processes: A Case Study on Application of Fered-Fenton for Waste-Activated Sludge Treatment

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**Abstract**

*In last two decades, electrochemical advanced oxidation processes have attracted scientists' attention as efficient and environmentally friendly technologies to upgrade and eliminate deficiencies of traditional wastewater and sludge treatment processes. In this study, besides an overview on electrochemical advanced oxidation processes based on Fenton's reaction chemistry, highly efficient Fered-Fenton technology which is a combination of Fenton and electrochemical processes is investigated. In this regard, results of the research group studies on a setup of Fered-Fenton system for waste-activated sludge treatment are presented. The results of these studies which have been conducted comprehensively for the first time, demonstrate Fered-Fenton process efficiency in degrading organics, heavy metals, nutrients and pathogens.*

**Keywords:** **Electrochemical Advanced Oxidation Processes, Fered-Fenton Technology, Wastewater Treatment, Waste-Activated Sludge Treatment.**

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# An Investigating on Parameters Affecting the Size and Size Distribution of the Precipitated Oxalate Particle Size in a Stirred Tank Reactor

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**Abstract**

*In the thorium nuclear fuel cycle, precipitation of of thorium oxalate using oxalic acid is one of the main stages of processing. In this research, the aim of the study was to investigate the effects of sedimentation temperature, concentration and flow rate of the reactants, mixing rate, time and temperature of the digestion on the size of the thorium oxalate particles their distribution in a stirred tank reactor in a batch process. It was observed that with increasing concentrations and material fluxes, the particle size was reduced and the particle size distribution narrowed. By increasing the mixing rate, larger particles produced, but the uniformity of the particles increased first and then became smaller. With increasing the reaction and digestion temperature, the particle size was larger but the particles became even more uniform. Increasing the time of the digest resulted in the production of coarse particles but more uniform distribution. By analyzing the results, the optimum temperature was determined 10 °C, the optimal oxalic acid concentration and flow rate were 1.5 M and 10 ml / min respectively , and the optimum mixing speed was determined 150 rpm. The optimum time and temperature of the digestion were determined at 6 hr and 75 ℃, respectively.*

**Keywords:** **Precioitation, Thorium Oxalate, Particle Size, Particle Size Distribution, Stirred Tank Reactor.**

# Microbial Fuel Cell Technology in the Treatment of Industrial, and Municipal Wastewater

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**Abstract**

*Wastewaters are the main source of many water pollutants in Iran and the world. Widespread environmental pollution is a danger that threatens future generations.*

*Microfiber fuel cell (MFC) as a multi-purpose renewable energy technology can be used in the treatment of various wastewater and generation of electricity or bio-hydrogen, simultaneously. In this review paper, the performance of MFCs with the criteria of power generation, removal of toxic pollutants such as heavy metals and wastewater treatment efficiency with parameters such as chemical oxygen demand (COD) and coulombic efficiency (CE) are presented. According to the high diversity of wastewater that has been investigated over the past few years, the presented subjects in this paper has been divided into several groups of synthetic, food and food-processing, industrial, municipal wastewaters.*

**Keywords: Microbial Fuel Cell, Wastewater Treatment, Electricity Generation, Bioenergy, Food Processing Industry Wastewater, Industrial Wastewater, Municipal Wastewater.**

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# An Investigation on Synthesis of Titania Photocatalyst Based on Silica Mesoporous and Effective Parameters on its Performance

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**Abstract**

*In recent decades, many strategies have been used to increase photocatalytic activity and adsorption of Titania as one of the most applicable photocatalysts. One of the most useful method is distribution and adding of these nanoparticles on nano porous adsorbents. One of the most important advantages of this method is the concentration growth of pollutant around Titanium, adsorbing the produced intermediates and ability of easily recycling of nanophotocatalyst. Nowadays among all of mesoporous materials, mesoporous silica has attracted many attentions because of their unique properties like uniform porosity, high surface area, good thermal stability, suitable applicability, appropriate compatibility and etc. In this study three common methods of increasing surface area of titania with mesoporous silica was investigated. These methods include sol-gel, impregnation and hydrothermal. Besides, reaction temperature, calcination temperature, percentage and source of titania were explored as affective parameters of enhancement of titania surface area.*

**Keywords: Nano Photocatalyst, Titania Surface Enhancement, Silica Mesoporous.**

# Petroleum Coke Desulfurization Methods for Use in Aluminum Industry

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## Abstract

*The coke used in aluminum production should possess certain sulfur content (below 3 wt. %). The application of sulfur rich coke will have detrimental effects on the environment. In the aluminum production industry, high sulfur anodes have a lower life span and higher energy consumption, as well as high environmental effects during electrolysis, which are unfavorable to aluminum industry. Therefore, desulfurization of coke is very essential. There are several petroleum coke desulfurization methods. The main objective of this research is the investigation of different petroleum coke desulfurization methods in order to obtain low sulfur coke. The reduction of petroleum coke sulfur not only provides the feed for aluminum production units, but it also protects the environment. This doubles the importance of petroleum coke desulfurization. Different desulfurization methods such as solvent extraction, calcination, separation with molten compounds and hydrogen purification are used in order to remove C-S bonds in petroleum coke. Studies have shown that coke desulfurization by solvent extraction of 35%, calcination of 90%, separation with molten materials 93%, and hydrogenation of 90% have been achieved, which according to the operational conditions of the processes and changes in the coke eventually The desulfurization method is used industrially by calcination.*

**Keywords: Petroleum Coke, Desulphurization, Extraction, Calcination, Molten salt.**