FIELD OF STUDY

Chemical Engineering

DISSERTATION TOPIC

"HYBRID ADVANCED OXIDATION PROCESSES (AOP) AND MEMBRANE FILTRATION FOR WATER AND WASTEWATER TREATMENT"

EXAMINING COMMITTEE

Dr. Pedro Arce, Professor and Chair, Chemical Engineering Department

Associate Professor, Dr. Holly Stretz, Chemical Engineering Department

Professor, Dr. Joseph Biernacki, Chemical Engineering Department

Assistant Professor, Dr. Robby Sanders, Chemical Engineering Department

Professor, Dr. Jann Cupp, Collage of Education

ABSTRACT

Water pollution is a major global problem. Organic pollutants are one of the major groups of toxic and carcinogenic contaminants. The pulsed corona electrical discharge (PCD) as an advanced oxidation technology, with a point-to-point configuration of the electrodes immersed in the aqueous solution, was used for decomposing Acid Black 1 (AB1) as an azo dye in water. The effects of electrical field frequencies (60 and 120 Hz) and electrode gap spaces on decomposition of AB1 were investigated. The largest decomposition achieved was 99.93% with optimal conditions of electrical field frequencies of 120 Hz and an 8 mm electrode gap space. Finally, the pulsed corona discharge as an oxidation process was compared with the photolysis and photocatalytic processes of UV, UV/H_2O_2 and UV/TiO_2 in terms of removing AB1 from an aqueous solution, and promising results were reported.

Advanced oxidation process can be integrated with other water and wastewater treatment methods to overcome the drawbacks related to the individual technologies. In this work, UV/H_2O_2 (AOP) is used as a pretreatment for improving the efficiency of membrane filtration for water treatment focusing water reuse. Membrane fouling is an important concern for membrane filtration technology for water treatment. Performance of a hybrid UV/H_2O_2–nanocomposite membrane (UF) system for natural organic matters (humic acid) and synthetic organic matters (AB1) removal in a water treatment process was studied. Different mixed matrix membranes embedded with titanium dioxide (TiO_2) nanoparticles, multi-walled carbon nanotubes (MWCNTs) were fabricated by the phase inversion method. UV/H_2O_2 pretreatment changed the physicochemical properties of humic acid (HA) aggregates. The oxidation pretreatment alone improved flux decline at 120 min from 21% to 80% and increased the flux recovery ratio (FRR%) from 58% to 80% for the pure Polysulfone(PSF). The oxidative pretreatment also improved purification for the PSF/TiO_2 nanocomposite membranes. The flux decline improved from 81% to 95% with only a slight improvement on the 94% FRR increasing to about 99% FRR. UV/H_2O_2 pretreatment of the AB1 solution resulted in enhanced Total Organic Carbon (TOC) rejection, decolorization, and enhanced antifouling membrane behavior.

BIOGRAPHICAL SKETCH

Negin Koutahzadeh was born in Esfahan, Iran. She received her MSc in Natural Resources and Environmental Engineering from Isfahan University of Technology in 2011. Her graduate research focuses on development of different biological, chemical and physical water/wastewater treatment processes. She has developed an extensive background in water treatment research area. Her graduate research has resulted in 7 peer-reviewed journal articles with more than 116 citations (h-index 5) according to Google Scholar. Results of Negin's doctoral dissertation have found applications for technology of interest to industries focused on cleaning fluids.

EDUCATION

PhD., Engineering - Chemical Engineering, Tennessee Technological University, Tennessee, Cookeville, USA (2017).

M.Sc, Natural Resources and Environmental Pollution Engineering, Isfahan University of Technology, Esfahan, Iran (2011).

B.Sc, Natural Resources and Environmental Engineering, University of Maybod, Yazd, Iran (2007).

College of Engineering

TENNESSEE TECH

The Department of

Chemical Engineering

Announces the Dissertation Defense

Of

Negin Koutahzadeh

In Partial Fulfillment of the Requirements

For the degree of

Doctor of Philosophy

Monday, April 10th, 2017 at 8 am.

Held at

Prescott Hall Room 225

1020 Stadium Drive,

Tennessee Technological University

Cookeville, TN 38505