CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

S0814

Project Title

Nanoparticulate Fouling of Polyproylene Microfiltration Membranes by Clarified Secondary Treated Wastewater and River Wa

Abstract

Objectives/Goals

This project was conducted in order to analyze the flux rates of nanoparticulate fouling of microfiltration membranes in two different types of feedwater: clarified secondary treated wastewater and Santa Ana River water. The initial idea was to conduct an experiment working with different types of nanoparticles, such as silver and gold nanoparticles. Some further research led to the formation of analyzing flux rates of different types of feedwater by using fluorescent nanobeads instead of actual nanoparticles.

Methods/Materials

Flux rate was determined by mimicking a microfiltration set-up. First, water samples were collected from clarified secondary treated wastewater from Orange County Sanitation District and Santa Ana River. Then, a mimic microfiltration was set up, consisting of a vacuum pump, a 4 place electronic balance, and a computer that grammatically collected flow data with an acquisition program. A microfiltration test cell was prepared using several 20-cm long tubes of 0.2 micrometer nomial size polypropylene membrane tubes. Next, base flow of deionized water was measured for 3 minutes. (A base flow rate with deionized water was done before each flux rate measurement with the feedwater.) Next, the deionized water was spiked with Fluospheres carboxylate-modified microspheres 0.1 micrometer, orange fluorescent (540/560) nanobeads using a pipet. Each flow rate was measured two times each. After, each feedwater was spiked with the same nanobeads, and the flow rate, which lasted for 22 minutes, was measured two times each. Finally, at the end of each flow rate experiment, the fiber was frozen and cross sectioned for microscopic observation and photos.

Results

Clairified secondary treated wastewater fouled more quickly (its flow rate decreased more rapidly) than Santa Ana RIver water. By comparing the two different types of feedwater' flux rates, the flux rate at 15.08 minutes of the clarified secondary treated wastewater already had 10.02% average flux rate while the Santa Ana River water had 28.68% average flux rate.

Conclusions/Discussion

The contributions of this project were beneficial. It is seen that clarified secondary treated wastewater fouled more quickly than Santa Ana River water, a realization that further study of nanoparticles and their effect in different feedwater should be conducted.

Summary Statement

Nanoparticles and other small bacteria exist in public drinking water, and scientists must conduct further research to produce a more safer and cheaper way to get rid of these nanoparticles.

Help Received

Mother and father gave transportation and monetary funds; Mr. Starodub directed project and gave advice; Used lab equipment at University of California Irvine and Orange County Water District; Professor C. and Mrs. S assisted project