

SURFACE INTERACTIONS BETWEEN NANOSCALE IRON AND ORGANIC MATERIAL:
POTENTIAL USES IN WATER TREATMENT PROCESS UNITS

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ABSTRACT

Membrane fouling is an inhibitor to optimal efficiency in membrane systems. Ceramic membranes derived from iron oxide nanoparticles called ferroxanes were coated with a zwitterionic polymer called poly (sulfobetaine methacrylate) (polySBMA). Membrane samples with and without polySBMA coating were subjected to fouling with a bovine serum albumin solution and fouling was observed by measuring permeate flux at 10 mL intervals. The coated membrane samples decreased initial fouling rate by 27% and secondary fouling rate by 24%. Similarly, they displayed a 30% decrease in irreversible fouling during the initial fouling stage, and a 27% decrease in irreversible fouling in the secondary fouling stage.

The addition of chemical disinfectants into drinking water treatment processes results in the formation of compounds called disinfection by-products (DBPs). The harmful effects of DBP exposure require that they be monitored and controlled for public safety. This work investigated the ability of nanostructured hematite derived from ferroxane nanoparticles to remove organic precursors to DBPs in the form of humic acid via adsorption processes. The results show that pH and ionic strength have an effect on adsorption capacity and mechanism. Lower pH systems facilitate better adsorption capacities than higher pH systems, and lower ionic strength systems facilitate better adsorption than higher ionic strength systems.