## Nanocomposite membranes for water treatment: Prospects and challenges

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Membrane separation processes have become one of the fastest emerging technologies for desalination and water treatment due to their distinct advantages over traditional processes. In particular, membrane separation processes have lower operating costs, compact design and high product quality. However, the low thermomechanical strength of polymeric membranes and their vulnerability to fouling has limited the development of sustainable and energy-efficient membrane processes for many water treatment applications. Given that, much research works are currently underway on the development of high-performance membranes to tackle these challenges. The development of nanocomposite membranes combines the low fabrication cost of polymeric membranes with the high thermomechanical properties of ceramic membranes.

The general idea for the synthesis of nanocomposite membranes is to induce the thermal, electrical, hydrophilic, anti-bacterial and molecular sieve properties of nanomaterials to the base membrane. We used TiO2 nanoparticles (NPs) to effectively generate highly oxidizing hydroxyl radicals which readily attack and decompose organic contaminants in water. Electrically conductive membranes were fabricated membranes by using ITO and ATO NPs whose surface could be tuned by applying an external electrical field to prevent adsorption of foulants based on electrostatic repulsion. Graphene oxide (GO) nanosheets offered us an exciting opportunity to integrate the antibacterial, electrical properties and mechanical strength of these NPs. We also developed strategies to overcome the major challeng for the fabrication of nanocomposite membranes, i.e., the severe aggregation of the NPs and their weak compatibility with polymers. These two phenomena lead to formation of non-selective voids at the interface of the polymer and NPs, which significantly reduces the rejection percentage.

## Biography

Sadrzadeh researches the fundamental and applied aspects of membrane materials and process development, focusing on their applications in industrial/residential wastewater treatment. He has an h-index of 27 (according to Scopus) with his refereed publications cited more than 1900 times. He is currently directing Advanced Water Research Lab (AWRL) at the University of Alberta that is equipped with the membrane and nanoparticle synthesis and characterization equipment as well as membrane filtration systems. There are 15 graduate students and 4 postdoctoral fellows are working under his supervision on cutting-edge membrane technologies.

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