HYDROXYPROPYLTRIMETHYL AMMONIUM CHITOSAN CHLORIDE FUNCTIONALIZED GRAPHENE OXIDE FOR BIOFOULING CONTROL ON REVERSE OSMOSIS MEMBRANES

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Due to increasing water scarcity and decreasing quality of freshwater sources, there is a growing need for alternative water treatment strategies. Reverse osmosis (RO) will be crucial for addressing these water resource issues as it desalinates water and removes contaminants of emerging concern. However, RO desalination still faces problems with membrane biofouling. Bacteria present in the feed water can attach to the membrane surface and reproduce, creating a biofilm that decreases the performance of the membrane. Addressing biofouling is critical for increasing the efficiency of RO systems and the production of drinkable water.

One strategy to mitigate biofouling in RO systems is to modify the membrane surface with materials that can prevent bacterial attachment or inactivate bacteria cells that are able to attach. Nanomaterials such as graphene oxide (GO) have been studied extensively for this purpose. GO sheets work as promising anti-biofouling agents due to their ability to kill bacteria and smooth out the membrane surface. GO sheets have sharp edges that can puncture bacteria and contain functional groups that generate reactive oxygen species (ROS) which chemically inactivate bacteria. Furthermore, in combination with other biocidal materials, GO can form nanocomposites with improved anti-biofouling properties. For this research, GO sheets were functionalized with a quaternary ammonium salt of chitosan and then chemically bonded to the membrane surface to increase biofouling resistance. N-[(2-hydroxy-3-trimethylammonium)propyl] chitosan chloride (HACC) was synthesized and cross-linked with GO via EDC-NHS reaction. The GO-HACC nanocomposite was then bonded to the surface of the RO membranes via EDC-NHS reaction and the effects of this surface coating on the membrane's antibacterial activity, selectivity and permeability were explored.

PRESENTER BIO: Jennifer Jackson completed her undergraduate studies in chemical engineering at the University of Florida (UF) in 2017. Currently, she is a Ph.D. student in the Department of Environmental Engineering Sciences at UF where she is focusing on developing new strategies to mitigate biofouling on thin-film composite membranes.