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Preparation of Carbon Nitrides Hybrid Membranes for Desalination

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Summary

Currently, seawater desalination techniques such as reverse osmosis and thermal distillation separation have been developed for solution for water treatment to provide fresh water. In particular, thin film composite polyamide membranes are dominate the desalination membranes for membrane desalination due to their excellent desalting properties and high water permeations. However, the membrane desalination technique is limited by its high energy consumption and easy fouling. In this research, we research the preparation and investigation of nanosheet hybrid membranes consisted of carbon nitride and polymers or other nanosheet materials for antifouling desalination membranes.

Carbon nitrides used as a nanosheet material, which are layered (or aggregated) by intramolecular hydrogen bonding and heptazine stack, were exfoliated by protonation (acid treatment). The maximum particle size of the protonated carbon nitride is 2 μm, which is smaller than graphene oxide (~ 10 μm) as anionic nanosheet material. The mixture of anionic nanosheets including graphene oxide and protonated carbon nitride formed aggregates in the solution, and the zeta potential changed to near neutral. This result was due to form the structures alternately layered protonated carbon nitrides and anionic nanosheets by electrostatic interaction.

Hybrid membranes consisted of carbon nitride and graphene oxides were prepared with the mixed solution, and their ion permeability was investigated. As a result, the membranes formed by electrostatic interaction (the membrane thickness: ca. 150–200 nm) were stable in aqueous solutions during the ion permeability measurements, compared with graphene oxide membranes. It was also confirmed that the ion permeability was also significantly reduced, compared to graphene oxide membranes and the composite membranes without electrostatic interaction.