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Development of Carbon membranes and carbon/CNT membranes for wastewater treatment

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Carbon membranes are well-known for their excellent performance in gas separation, as well as liquid separation, particularly for water-oil emulsions and the purification of industrial corrosive solutions. Carbon membranes are mostly prepared by carbonizing at a temperature varying from 600°C to 900°C under an inert atmosphere a shaped green body made of an organic precursor. As a result, a porous carbon membrane with vitreous carbon is formed.

A process for preparing carbon membranes was developed previously, and it consisted of a new and simple approach to preparing carbon MF and UF membranes. These membranes were prepared by extruding a green body or a paste made of a mixture of mineral coal or graphite powder, porogen compounds, and a solution of phenolic resin/ethanol. To obtain the final porous structure, carbonization at 700°C in an inert atmosphere is required. These membranes performed very well when applied to the treatment of different industrial wastewaters such as the Textile industry wastewater and the soft drinks industry wastewater.

Adding a carbon nanotubes growth catalyzing agent to the steps of preparation of these carbon membranes allowed us to grow CNT's and iron nanoparticles inside the porosity of the material. The CNTs grew on the material's external surface as well, resulting in MF and UF layers with vertically grown CNTs on top. Such a structure is thought to be very effective at fouling reduction during filtration.

When both materials, the Porous carbon, and the porous carbon/CNTs, were used as adsorbents in synthetic aqueous humic acid solutions, we saw clearly that CNTs played an important role in enhancing the material's adsorption capacity.

Using a diluted solution of Phenolic resin/Ethanol, we were able to deposit, by slip casting, a thin nanofiltration layer and tailor its average pore size within 1 to 2 nm by varying the thermal treatment conditions. The layer had a thickness of less than 1 nanometer and the carbon structure of the layer was graphene-like according to the TEM analysis.

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References

[1] I. Jedidi, M. Cretin, S. Cerneaux, M. Saif AL Saidi, S. Al-Isaee and al., Detailed manufacturing process of a tubular carbon microfiltration membrane for industrial wastewater treatment, *Journal of Porous Materials*, 29, 2022, pp.291–306.

[2] Zeghal, S., Jedidi, I., Cretin, M., Cerneaux, S., Abdelmouleh, M., One-step synthesis of highly porous carbon graphite/carbon nanotubes composite by in-situ growth of carbon nanotubes for the removal of humic acid and copper (II) from wastewater, *Diamond & Related Materials*, 101, 2020, pp. 107557.

Time Block Preference

Time Block C (18:00-21:00 CET)

Participation

In person

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