Oil/water separation by using the photopolymerized porous hydrophobic and oleophilic materials

By

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Introduction

- The oil pollution in water has become a major environmental issue¹
- History has revealed several devastating oil spill incidents that proved catastrophic for the marine associated life
- Separation of oil from water not only help in environmental remediation but also assist in reusing of valuable energy source.
- Conventional methods are facing some challenges such as complexity in separation, high cost, secondary pollution addition and low separation efficiency.²
- Currently hydrophobic and oleophilic surfaces are getting attraction for the separation of the oil from water
- Hydrophobic and oleophilic porous surfaces can selectively absorb or filter oil related contaminants from the water³
- Natural sunlight is abundant energy source and recently, it is extensively being explored to run several reactions.
- The efforts are required to develop hydrophobic surfaces for separation of oil and water by using light-initiated reactions.

Method⁴

Photopolymerized Synthesis of hydrophobic network by using porous substrate

- A porous substrate was selected such as polyurethane
- Styrene monomer enclosed in a glass reactor
- The reactor exposed to the sunlight
- After styrene polymerization, hydrophobic porous network obtained
- Following scheme has explained the steps involved in its synthesis

Results & Discussion⁴

Morphological characterization⁴

- Styrene polymerized by light-initiated reaction on the CNF grafted PU in a glass reactor
- Polystyrene produced on polyurethane along with grafted CNF has produced more surface roughness
- Introduction of CNF also increases the mechanical stability to the PU network after styrene polymerization

BET Surface area⁴

- Introduction of CNF has substantially improved the surface area

Separation of hexane and water⁴

- Hexane and water mixture tried to pass
- Hexane passed quickly and water stopped by PS-CNF-PU

Conclusion

- Light initiated polymerization is a cost-effective way to achieve a hydrophobic porous network.
- Photoinitiated polymerization achieved in a simple glass reactor and no complex or harsh conditions are required
- The introduction of carbon nanofiber enhanced the surface roughness and provide the stability to the hydrophobic network
- Introduction of carbon nanofiber has substantially improved the surface area
- PS-CNF-PU has displayed excellent capability for the separation of oil-water model
- Further coating of polystyrene with low surface energy material provide a chance to make surface superhydrophobic

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Acknowledgement: Authors gratefully acknowledge the support provided by the “King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia”.