Enhanced Binding of Reduced Graphene Oxide to Polyurethane Sponge for Oil Absorption

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Abstract

In this work [1], we have shown increased binding of reduced graphene oxide onto the surface of polyurethane (PU) sponge using two different coupling agents: (3-aminopropyl)triethoxysilane (APTES) and titanium(IV)(triethanolaminato)isopropoxide (TTEAI), resulting in a composite material that can be utilized as a re-usable and efficient oil-water separation tool. The coupling agents were introduced before and after reduction of graphene oxide to compare the impact of the sequence on the absorbance capacities. The sponges were evaluated based on hydrophobicity and pump oil absorbance capacities (Figure 1). The structure and properties of the sponges were evaluated using scanning electron microscopy and Fourier transform infrared spectroscopy. Results revealed that reacting the graphene oxide PU sponge with the coupling agent titanium(IV)(triethanolaminato)iso-propoxide prior to reduction significantly improved oil absorbance. This was due to the improved binding of reduced graphene oxide to the polyurethane framework. The resulting improved rGO-coated PU sponge is a highly efficient and reusable sorbent material and is a promising alternative to current absorbent materials for oil−water separation applications (Fig 2).

References

[1] Tjandra, R; Lui, G; Veilleux, A; Broughton, J; Chiu, G; Yu, A, Ind. Eng. Chem. Res, **54** (2015), 3657-3663

Figures

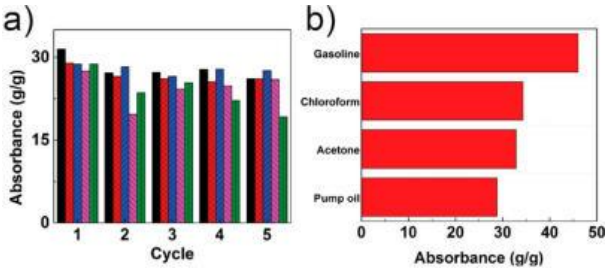

Figure 1 (a) Normalized absorbance capacities for pump oil over five cycles for (left to right) rGO, a-APTES-rGO, a-TTEAI-rGO, b-APTES-rGO, and b-TTEAI-rGO. (b) Absorbance of a-TTEAI-rGO in various organic media.

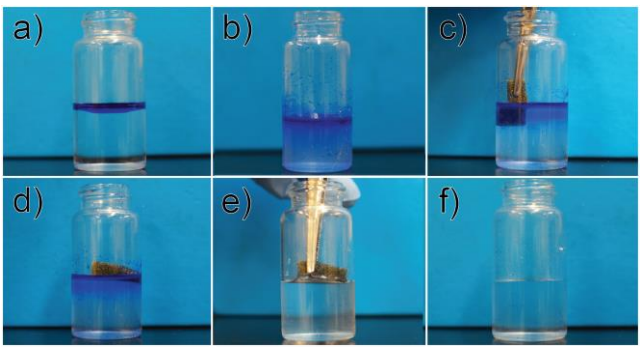

Figure 2 (a) – (f) Removal of emulsified, dyed pump oil from water using the as-prepared modified rGO/PU composite sponge