

O 14. ELECTRO-SPUN NYLON 6,6-ORGANOCLAY MATS FOR OIL-WATER SEPARATION

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ABSTRACT: Separation of oil from water is a worldwide challenge due to the increasing industrial oily wastewaters and polluted oceanic waters. Oil spills, shipping accidents, offshore or marine vessel leakage, and illegal discharges of oily wastes cause significant environmental damage. To deal with this problem various strategies have been employed for developing cost-effective and environment-friendly ways to oil spill cleanup. A wide variety of natural materials can be used as sorbents for this aim. However, synthetic oil absorbers are the generally most effective in removing oil. Different types of synthetic oil absorber materials are designed to remove oil content from water sources due to their oleophilic properties. In recent years, nanotechnology-based approaches have been applied and various nanomaterials can be fabricated which have exhibited good performance. Among these nanomaterials, non-woven fibrous mats are widely used for oil cleanups due to their scalable production. Fibrous mats are successfully fabricated by the electro-spinning technique which utilizes high electrostatic forces for fiber production. This technique allows developing novel nanofibrous materials having small fiber diameter, high surface-to-volume ratio, and controllable porous structures to be applied for a variety of applications.

In the present work, oil absorbent nanofiber mats having high oleophilicity were prepared by electro-spinning technique. For this purpose, nylon 6,6 was selected because it is a crystalline polymer containing oleophilic hydrocarbon chains connected by hydrophilic functional amide groups. Additionally, there has been a little investigation of the use of electro-spun nylon 6,6 as a sorbent for removal of oil from water. For that reason, two different organically modified montmorillonites (o-MMT, with commercial names; Tixogel VP and Cloisite 20A) are incorporated into nylon 6,6 polymer separately, in order to fabricate new mats having more oleophilic properties. Dispersion and exfoliation of o-MMTs in nylon 6,6/formic acid solution were achieved by ultrasonic treatment during 20 min followed by mixing overnight with magnetic stirrer. After reaching the more homogenous solution, it was placed in a 10-ml syringe with 19-gauge needle tip and electrospun onto an aluminum foil to produce nylon 6,6-organoclay nanofiber mats. The surface morphologies of generated mats were observed by SEM analysis. Motor oil and other domestic oils absorption behaviors of mats were investigated and absorption capacities were calculated in terms of weight gain. These novel nanofiber mats exhibited excellent absorption capacities up to 60-80 times their own weights for motor oil. As a result, it can be reported that these novel oil absorbent materials are promising candidates for oily wastewater treatments.

Keywords: Nylon 6,6, organoclay, oil separation, nanofiber, electro-spun