Chemical Engineering Journal 213 (2012) 1–7

Contents lists available at SciVerse ScienceDirect

Chemical Engineering Journal

journal homepage: www.elsevier.com/locate/cej

# Superhydrophobic kapok fiber oil-absorbent: Preparation and high oil absorbency

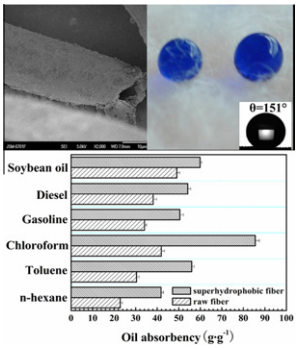
Jintao Wang [a,b], Yian Zheng [a,b], Aiqin Wang [a,*]

[a] Center of Eco-Material and Green Chemistry, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, Lanzhou 730000, PR China
[b] Graduate University of the Chinese Academy of Sciences, Beijing 100049, PR China

## HIGHLIGHTS

- Superhydrophobic kapok fiber was prepared via sol–gel method and used for oil sorption.
- The modified kapok fiber is covered by silica nanoparticles and surface become rough.
- The modified kapok fiber have high oil sorption capacity and oil–water separation selectivity.
- The modified kapok fiber have the capability of removing oil in oil/water mixture.

## GRAPHICAL ABSTRACT




## ARTICLE INFO

*Article history:*
Received 9 August 2012
Received in revised form 20 September 2012
Accepted 21 September 2012
Available online 11 October 2012

*Keywords:*
Superhydrophobic
Silica nanoparticles
Kapok fiber
Oil sorption capacity
Reusability

## ABSTRACT

Superhydrophobic and oleophilic oil sorbent was successfully prepared by the incorporation of silica nanoparticles onto kapok fiber via sol–gel method and subsequent hydrophobic modification using hydrolyzed dodecyltrimethoxysilane (DTMS). The formation of silica nanoparticles was confirmed by Fourier transform infrared (FTIR) spectroscopy, scanning electron microscopy (SEM), and investigation of the wetting behavior of water and oil on fiber surface. The coated fiber exhibited excellent oil/water selectivity in the cleanup of oil over water. The as-prepared fiber can quickly absorb diesel and soybean oil up to above 46.9 and 58.8 g/g, with the improvement in oil sorption capacity to be 46.6% and 20.2% compared with raw fiber, respectively. Owing to high oil sorption capacity, excellent hydrophobic property and reusability, and good environmental friendliness, the as-prepared oil sorbent can be considered as promising alternative for organic synthetic fiber to clean up the spilled oil.

© 2012 Elsevier B.V. All rights reserved.

## 1. Introduction

In recent years, water pollution caused by the oil spillage has become increasingly serious with the acceleration of urbanization and industrialization process [1]. Commonly used methods of solving these oil-leakage problems include mechanical extraction, combustion and chemical degradation. Owing to the economy and efficiency for oil spill cleanup, mechanical extraction by sorption materials is regarded as one of the most desirable choices for the recovery of oil. Although many sorption materials such as inorganic mineral materials [2], synthetic materials, [3] and natural materials [4] have been widely studied for the removal of spilled oil, these materials still have some limitations such as low oil sorption capacity, inadequate buoyancy, high cost, and poor reusability. Especially, most of materials studied have poor hydrophobicity, resulting in low oil–water separation selectivity and efficiency [5,6]. Hence, the exploitation of new oil sorption materials with high sorption capacity, low cost, low water pickup, excellent environmental benefit and reusability is rather important for oil pollution treatment.

Superhydrophobic surface with water contact angles higher than 150° has attracted extensive interest [7,8]. Previous studies have revealed that superhydrophobicity depends on not only the

* Corresponding author. Tel.: +86 931 4968118; fax: +86 931 8277088.
*E-mail address:* aqwang@licp.cas.cn (A. Wang).

1385-8947/$ - see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.cej.2012.09.116