Mini Review

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Durable magnetic super hydrophobic melamine sponge: to solve complex sea oil spills

Abstract

Offshore oil spills have devastating consequences for the environment and people's health. To solve this problem, a simple and environmentally friendly impregnation process was used in combination with shell bionics. Using the viscosity of polydopamine nanoFe_3O_4 and WS_2 adhere to the skeleton of the melamine sponge then the magnetic sponge is modified with n-octadecanethiol (OTD) and finally the hyper hydrophobic melamine. Modified with magnetic sponge). I was ready. The modified sponge is super-hydrophobic high adsorption capacity recyclable (oil adsorption capacity is basically unchanged after 25 cycles), and efficiency. Oil-water separation performance it can quickly separate oil on the water surface and water. In addition, the modified sponge exhibits excellent stability and durability even under harsh usage conditions such as strong sunlight, strong acid, strong alkali, and high salt content, and the moving direction of the sponge can be controlled by applying a magnetic field. In summary, mMS has many potential uses as a new magnetic adsorption material for dealing with complex oil spills[1,2].

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Introduction

With the rapid development of the industry, the amount of oil extracted and used is increasing year by year. At the same time, oil spills often occur in offshore oil fields. Since crude oil contains toxic substances such as benzene, aromatic hydrocarbons, and hydrogen sulphide, the outflow of oil into seawater destroys the marine environment, causing water pollution and death of marine organisms and is beneficial to human health. It poses a danger. There are many ways to solve an oil spill, but adsorption is one of the most commonly used solutions. Commonly used adsorbent have the properties of high porosity and high specific surface area but such as inorganic mineral and natural polymer materials[3,4]. Conventional adsorbent materials have the following drawbacks. Low adsorption efficiency, low oil-high water selectivity and cost. Therefore finding the right adsorbent is very important to tackle the problem of offshore oil pollution. In recent years, commercially available polymer sponges such as melamine sponges and polyurethane sponges have excellent elasticity, high porosity, low cost, active groups on the surface of the sponge, and easy modification, so that they have excellent oil absorption. It is attracting attention as a sex material. The amphipathic nature of the sponge significantly reduces the efficiency of oil adsorption[5,6]. Ultrafine structure of hydrophilic and lipophilic sponges by coat*ing* nanostructured materials metal nanoparticles chemical etching and graft modification of low surface energy materials can be converted to. Hydrophobic and super-lipophilic sponges improve sponge oil adsorption efficiency and oil-water selectivity. Lang et al. reported a two-step method for synthesizing super hydrophobic melamine sponges. In this method, the sponge was first dipped in a dopamine hydrochloride solution to deposit a polydopamine film on the surface. Subsequently the surface of the sponge was modified with and perfluorooctanethiols to create a super hydrophobic sponge with excellent adsorption, recovery, and oil-water selectivity... However, the fluorinated this used in this method have drawbacks such as high cost and environmental pollution. Surface The modified sponge has a water contact angle of over 150 ° and is super hydrophobic. However, grapheme is expensive and is currently difficult to use on a large scale. A good oil-water separator not only provides excellent performance, but also requires consideration of manufacturing costs, processes, and environmental protection. Note that in this process, vegetable waxes are suggested as the wettability of the material by changing the coating reagents. This is a new process for making super hydrophobic sponges. Successfully synthesized hydrophobic magnetic nanoparticles using a solvothermal reaction in the presence of a surface modifier, and then adhered them to a sponge with a silicone adhesive. This process can create a hydrophobic structure on the surface of the melamine sponge without changing the surface. However, when dealing with the problem of oil spills, it is necessary to consider issues that affect the stability of oil absorbers, such as harsh marine environments such as acids and alkalis, temperature and strong sunlight. Deterioration of oil-water reparability and oil absorption efficiency of oil-absorbing materials[7,8]. To address this issue, high temperature and high pressure resistant Nano and Nano nanoparticles have been selected that adhere to the sponge skeleton, improve sponge stability and durability, and add magnetism to it.

Experimental section mMS preparation

Melamine sponge (MS) was cut to a size of 1.0 cm x 1.0 cm x 1.5 cm and ultrasonically cleaned with ethanol and distilled water for 1 hour. After drying in an oven at 60 ° C. MS was solicited in an ethanol solution of Nano-Fe_3O_4 (100 mg) and Nano-WS_2 (40 mg) for 30 minutes, and then removed. After drying were dipped in a mixture.

Reagents and equipment

Laboratory Reagent Consumables; N-Octadecyl Herceptin, Run you Chemical Co., Ltd. (Shenzhen, China). Nano-Fe_3O_4 (20nm 99.0%), Aladdin Reagent Co. Ltd. (Shanghai, China).Nano-WS_2 (10nm 99.0%), absolute ethanol, Tianjin Kiting Chemical Reagent Co., Ltd. (Tianjin, China) Methyl orange, oil Red, Cyclohexane, Tianjin Chemo Chemical Reagent Co., Ltd. (Tianjin, China); Methylene Blue, Tianjin Sheen Chemical Reagent Co., Ltd. (Tianjin, China) Carbon tetrachloride, Aran Fine Chemical Research Institute, (China, Tianjin); Kerosene and Diesel Oil, China Petrochemical Group (Beijing, China); Corn Oil, Xizang Food; Paraffin Oil, Jinan Lu Chemical Industry (Jinan, China); Crude Oil, Complex Oil and Water Separation Station in Daqing Oil Field (Daqing, China). NaCl, $MgCl_2$, Tianjin Kaitsu Chemical Reagent Co., Ltd. Contact angle test of water was dropped on the surface of mMS. Images were taken after the water droplets had stabilized and the water contact angle of the sponge was calculated using the tangential method[9,10]. To ensure measurement accuracy, the contact angle of the sponge was measured 5 times at different positions on the top and bottom. Adsorption performance analysis and recycling performance analysis the saturated adsorption capacity of modified sponges of crude oil, kerosene, diesel oil, corn oil, paraffin oil, n-hexane and carbon tetrachloride is 40-100 g ° g-1. Since the density of carbon tetrachloride is much higher than that of other petroleum products, the adsorption rate of carbon tetrachloride by mMS is significantly higher. A suction press is used to retrieve the sponge. As shown in Figure 6b, the elasticity of the modified sponge is still good after 25 cycles and the adsorption rates of kerosene, light oil and corn oil are slightly reduced, but still can maintain above 40g°g-1. I can do it. MS is a kind of porous material. When the sponge comes into contact with oil, its pores absorb the oil through capillary action. This adsorption press behaviour destroys the pore structure of the sponge and reduces the adsorption rate. The results show that mMS absorbs various oils and organic solvents well and are recyclable. In practice, after the sponge is recovered by the recovery device, the oil adsorbed on the sponge is recovered by the mechanical press, thereby effectively reducing the cost while achieving the recycling target and reducing the cost by treating the adsorbed oil. Avoid next pollution. Or organic matter is caused by the combustion or evaporation of matter[11,12].

Stability and Durability Test

We investigated the effects of light pH temperature and sodium chloride concentration on the stability and durability of mMS. The wetting angle of the modified sponge was measured every 2 hours while exposed to direct sunlight for 10 hours. The modified sponges were immersed in acidic and alkaline solutions at pH 11 and using HCl and Noah respectively. After drying the contact angle was calculated using a contact angle tester. To mimic the stability of modified sponges in seawater [13,14].

Oil-Water Separation Performance Analysis

MS is a novel foam material with a high opening rate and a three-dimensional network structure. It is amphiphilic, which means it can adsorb both oil and water. This property significantly reduces the sponge's oil adsorption rate. Making the sponge super hydrophobic and lipophilic can improve the material's oil adsorption rate in the oil–water mixed solution. As a result, the oil–water separation efficiency is an important indicator for testing the adsorption material's performance. The modified sponge can effectively separate the oil–water mixture, as shown in and the oil–water separation efficiency of corn germ oil, kerosene, diesel, paraffin, n-hexane, and crude oil is greater than. Shows the use of a simple device to separate the mixed solution of water and CCl_4. Due to the wettability of the mMS water cannot pass through the sponge. Under the action of gravity, carbon tetrachloride is separated from the oil–water mixture, and the separation efficiency can reach 98.3%. The modified sponge can also be used as a filter layer by a device to separate oil and water [15,16].

Conclusion

In summary, the super hydrophobic sponge magnetic material was successfully prepared in a few simple steps. SEM images confirmed a high porosity of mMS and an increase in sponge roughness before and after the change. ED's images confirmed that the sponge surface was successfully modified with Nano Fe3O4, Nano WS2, and n-octadecanethiol. The Michael addition reaction between n-octadecanethiol and polydopamine was confirmed by FIFR, resulting in a coating on the surface of the sponge. Analysis of the wettability of mMS showed that the sponge had a water contact angle of over 150 °, showing super hydrophobicity and. Adsorption and circulation experiments have shown that mMS has high adsorption performance for a variety of organic solvents and oils. The structure of mMS is stable after 25 cycles similar to the ability to maintain adsorption rates of various oils and organic solvents above. Oil-water separation experiments have shown that mMS can maintain excellent oil-water selectivity both on the surface and in water, with oil-water separation efficiencies of over 98% for various oils in dynamic oil-water mixtures. MMS has performed well in harsh environment stability and durability tests. It can maintain super hydrophobicity even in the presence of strong sunlight, hot water bath, acid, alkali, high salt solution, etc. In addition, the magnetic properties of mMS allow it to be used to propel the sponge magnetically. It is expected to be widely used in oil field leaks in the future..

References

1. Shi, L. Hazards of offshore oil spills and their emergency response *Inf Rec Mater.* 19,2(2018).
2. Wei QF, Mather RR, Fotheringham AF, *et al.* Evaluation of nonwoven polypropylene oil sorbents in marine oil-spill recovery. *Mar Pollut Bull.* 46,780-783 (2003).
3. Singh H, Bhardwaj N, Arya SK, et al. Environmental impacts of oil spills and their remediation by magnetic nanomaterial. *Environ Nanotechnol Monit Manag.* 14,00305 (2020).
4. Nriagu J, Udofia EA, Ekong I, et al. Health Risks Associated with Oil Pollution in the Niger Delta, Nigeria. *Int J Environ Res Public Health.* 13,346 (2016).
5. Angelova D, Uzunov I, Uzunova S, et al. Kinetics of oil and oil products adsorption by carbonized rice husks. *Chem Eng J.* 172,306-311 (2011).
6. Maleki, H. Recent advances in aerogels for environmental remediation applications: A review. *Chem Eng J.* 300,98-118 (2016).
7. Almasian A, Jalali ML, Fard GC, *et al.* Surfactant Grafted PDA-PAN Nanofiber: Optimization of Synthesis, Characterization and Oil Absorption Property. *Chem Eng J.* 326,1232-1241(2017).
8. Lu Y, Liu H, Gao R, *et al.* Coherent-Interface-Assembled Ag_2O-Anchored Nanofibrillated Cellulose Porous Aerogels for Radioactive Iodine Capture. *ACS Appl Mater Interfaces.* 8,29179-29185 (2016).
9. Mo J, Yang Q, Zhang N, *et al.* A review on agro-industrial waste (AIW) derived adsorbents for water and wastewater treatment. *J Environ Manag.* 227,395-405 (2018).
10. Sabir, S. Approach of Cost-Effective Adsorbents for Oil Removal from Oily Water. *Crit. Rev. Environ. Sci. Technol.* 45,1916-1945 (2015).
11. Radetic M, Ilic V, Radojevic D, et al. Efficiency of recycled wool-based nonwoven material for the removal of oils from water. *Chemosphere*. 70,525-530 (2008).

12. Zhang T, Li Z, Lü Y, et al. Recent progress and future prospects of oil-absorbing materials. *Chin J Chem Eng.* 27, 1282-1295 (2019).

13. Zhang W, Liu N, Cao Y, et al. Superwetting Porous Materials for Wastewater Treatment: From Immiscible Oil/Water Mixture to Emulsion Separation. *Adv MaterInterfaces*. 4,1600029 (2017).

14. Ge J, Zhao H.-Y, Zhu H.-W, et al. Advanced Sorbents for Oil-Spill Cleanup: Recent Advances and Future Perspectives. *Adv Mater.* 28,10459 (2016).

15. Bhushan B, Jung YC, Koch K. Micro-, nano- and hierarchical structures for superhydrophobicity, self-cleaning and low adhesion. *Philos Trans R Soc A Math Phys Eng.* 367,1631-1672 (2009).

16. Zhu Q, Chu Y, Wang Z, et al. Robust superhydrophobic polyurethane sponge as a highly reusable oil-absorption material. *J Mater Chem A*. 1,5386-5393 (2013).