SIIC098

A REVIEW ON THE ROLE OF TAILORING SURFACTANT IN SILICA FOR OILY WASTEWATER REMEDIATION

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Abstract:

The oil wastewater may contribute to toxicity effects which affecting ground water resources. In addition, it is also responsible in emitting foul odor. There are several separation techniques which can solve the pollution such as adsorption. Most of the previous researches showed a promising result in using activated carbon as an adsorbent to reduce the concentration of oily wastewater, where the COD and BOD values are reported to be very low. However, it is anticipated in using silica as a replacement for activated carbon, due to its physical and chemical properties are comparable with activated carbon. To improve the ability of silica as a novel adsorbent in oily wastewater, various types of surfactant were analysed in this research work. The surface of silica nanoparticles that was modified with various surfactants such as cetyltrimethylammonium bromide (CTAB), cetyltrimethylammonium chloride (CTAC), cetylpyridinium chloride (CPC) and cetylpyridinium bromide (CPB), under various preparation methods have been studied. Studies shows that the efficiency of oily wastewater remediation can be increased with the presence of porous materials. The pore structure of the materials is very important to determine the ability to perform adsorption. The objectives of this research are; i) to analyze the effect of various types of surfactants that were modified on porous silica adsorbent and ii) to study the effect of different preparation methods in tailoring the surfactants on porous silica adsorbent toward oily wastewater application. Optimum conditions and possible surface modification mechanism for silica nanoparticles have been discussed. Based on the study, it reveals that silica-CTAB modified was the most promising materials for adsorption purpose It is found that modified silica-CTAB has the highest size of pore and the surface area which are 0.98 nm and 840 m^2/g respectively. It is also showing that sol-gel method is the most effective preparation method because it can create very fine powders and produces compositions not possible by solid-state fusion. In conclusion, the addition of surfactant in the silica matrix affects the porosity of porous silica by increasing the surface area and pore volume.

***Keywords*:**

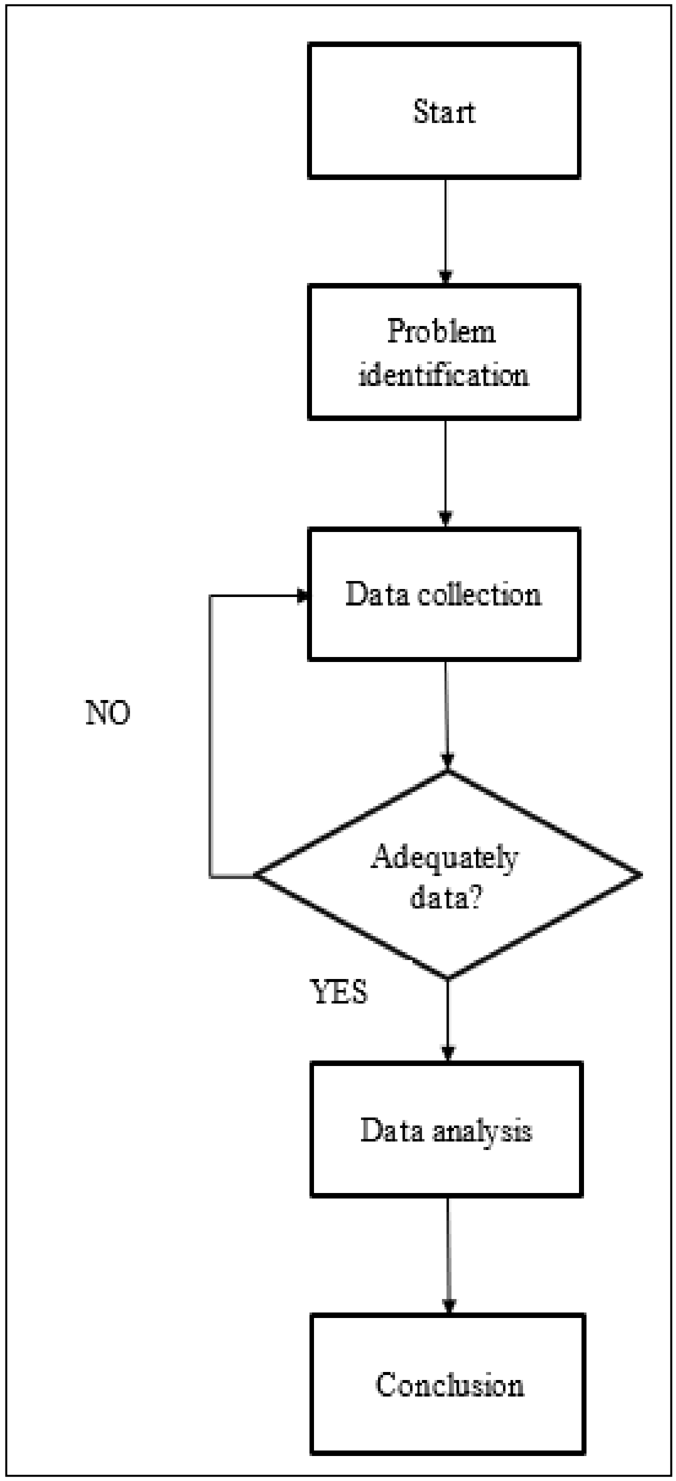
Surfactants, Silica, Porosity, Adsorption, Oily wastewater.

Objectives:

- To analyze the effect of various types of surfactant modified on porous silica adsorbent for oily wastewater application.

- To study the effect of preparation methods in tailoring the surfactant on porous silica adsorbent towards oily wastewater application.

Methodology:

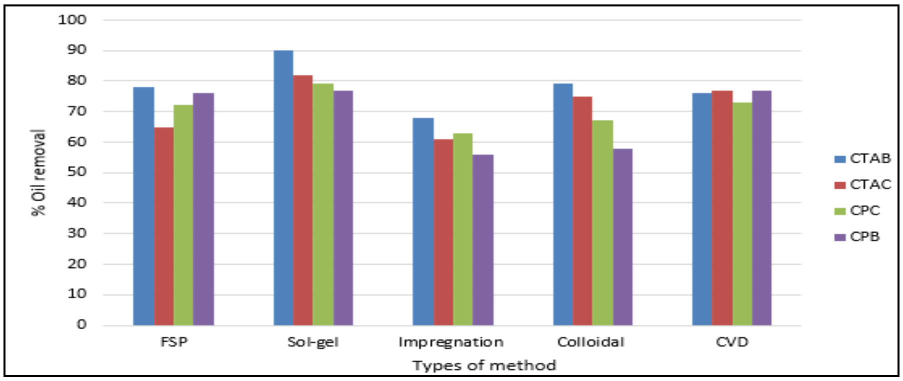


Results:

TGA		
Samples	**Final temperature (°C)**	**Weight loss (wt%)**
CTAB	950	6.3
CTAC	900	4.57
CPC	950	6.2
CPB	950	7.5

Nitrogen Sorption				
Surfactants	**Characteristics**			
	Surface area (cm^2/g)	Pore volume (cm^3/g)	Pore size (nm)	Oil removal (%)
CTAB	840	3.93	0.98	90
CTAC	753	3.45	0.86	82
CPC	629	2.92	0.73	79
CPB	453	0.69	0.16	77

Oil removal by different method.



Conclusion:

This review provides an overview of the wide range of sorbent materials investigated for oily wastewater with particular emphasis on silica-like hydrophobic aerogels. The review shows that various workers have successfully prepared hydrophobic silica aerogels to incorporate chemical functionality using various modification procedures. The first objective to determine the effect of the various surfactant and the silica on the alteration of the porous structure of silica was achieved. The findings of the nitrogen sorption analyze show the big difference between silica sample with CTAB, CTAC, CPC and CPB in pore volume and BET surface area. The differences can also be identified via the isothermic plot shown by both samples. The determination for the effect of porosity of surfactant-templated silica on the treatment of oil-water emulsion through adsorption process also had been observed. The difference in oil-water emulsion absorption value can be recognized before and after treatment, and the difference is notable. This study brought some advancement by using sol-gel technique as a tool for customizing the silica pore size using surfactants as a guide by base catalyzed sol. Last but not least, the findings also showed that mesoporous organosilicates are better in extracting oil from the oil-water mixture than pure siliceous mesoporous content. Adsorption by mesoporous organosilicate oil remediation from oil water mixture provided evidence of the adsorbents' ability to extract oil from the oil-water mixture. The effects of surfactant loading over the silicate depend on the nature of the surfactant. Comparing the mesoporous organosilicates prepared with those prepared using cationic and neutral surfactant, the cationic prepared surfactant demonstrates a higher capacity to absorb oils from the water system.