SIIC051

INVESTIGATION OF MODIFIED ALUMINA FOR REMEDIATION OF CONTAMINATED OIL: A REVIEW

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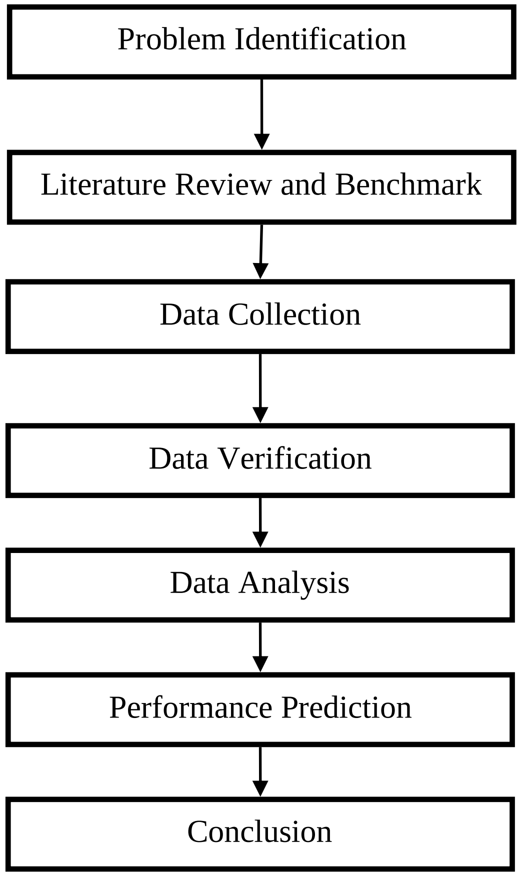
Abstract:
Increases in human population and industrial activity unavoidably have produced large volume of oily wastewater and increased in demand for clean water. The performance of conventional methods in wastewater treatments showing insignificant effect as its drawbacks to the environment such as large volume of sludge produced and high cost of reagents. However, adsorption by alumina have shown a promising potential to be developed as new material for wastewater treatment attributed by its modifiable surface area and high sorption capacity. Sol-gel method is highlighted as the modification route for materials' morphology and topography due to its simplicity. In this review, data for the effect and performance of modified alumina sucrose templated via sol-gel method is collected, analyzed, compared, and predicted. Review discovered that surfactants does affect material porosity and alumina templated with sucrose demonstrated high porosity. Alumina-sucrose templated with 491 m2/g surface area, 0.62 cm3/g pore volume, and 4.20 nm pore diameter is predicted to have better removal performance with removal of >83% oil and grease, >87.83% COD, and >86.6% BOD, compared to non-modified alumina. From review, surface modification with surfactant templated is proven improve material's morphology and performance.

***Keywords*:**
Alumina, Sucrose, Adsorption, Oil removal, Sol-gel method

Objectives:

- To compare the effect of different surfactant-alumina onto the porous structure of alumina by sol-gel method.
- To compare the effect of modified porous alumina by sucrose as surfactant in remediation of oil-contaminated water through adsorption technique.

Methodology:



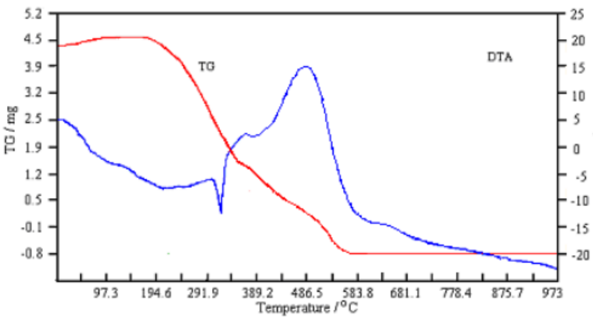
Results:

Table 2: Effect of different surfactants to alumina.

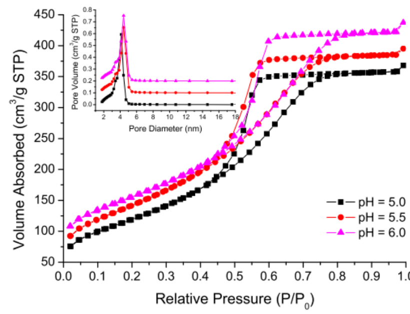
Material	**Surfactant used**	**Properties**			**Ref.**
		Avg. Surface area (m^2/g)	Avg. pore diameter, Å (nm)	Total pore volume, V (cm^3/g)	
Cationic	DTAB	656	2.1	0.45	[51]
	TTAB	593	2.3	0.52	[51]
	HTAB	690	2.0	0.47	[51]
	OTAB	520	5.7	0.58	[51]
	CTAB	348	5.85	0.416	[52]
Anionic	SDBS	412	20-30	-	[53]
	Na(AOT)	276	120-180	-	[54]
	SDS	215	5.2	0.23	[55]
	Sodium lauroyl glutamate	268	3.7	0.45	[56]
	Lauric Acid	412	4.2	0.44	[57]
Non-ionic	Starch	299	5.7	0.58	[58]

Glucose	404	4.1	0.53	[58]
Pluronic 123	316.7	6.72	0.532	[59]
β-Cyclodextrin	260	6.9	0.66	[58]
PEG	267	9.3	0.64	[55]

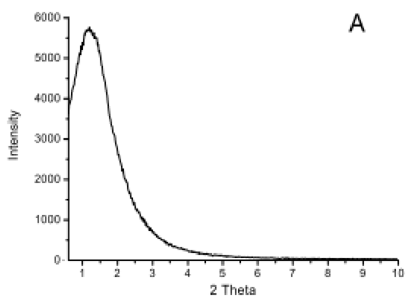
TG-DTA curves of as-symthesizes alumina



N2 adsorption/desorption isotherms for alumina



XDR pattern of sample after calcined at 873 K.



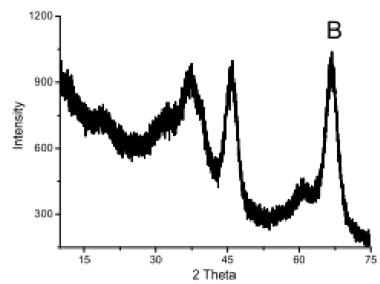


Table 3: The properties of alumina and its performance in removing oil.

Surfactant	Avg. Surface area, m2/g	Avg. Pore diameter, nm	Total pore volume, cm3/g	Removal (%)
No surfactant	477	1.27	0.4365	83 – oil & grease, 87.83 – COD, 86.6 – BOD
Surose	491	4.20	0.62	>83 – oil & grease, >87.83 – COD, >86.6 – BOD

Conclusion:

From the review, it is proven that surfactant-templated affect porous structure of alumina by sol-gel method. Templating cationic (e.g. CTAB), anionic (e.g. SDS), and non-ionic (e.g. starch) surfactant using sol-gel method proven affect the morphology and topography of alumina. Sucrose as surfactant does affect the performance of alumina in removing oil as it designs material's morphology. Alumina with sucrose-templated is predicted to has better performance in removing oil compared to non-templated alumina.