SIIC024

COMPARATIVE STUDY ON FABRICATION OF MODIFIED COTTON FABRIC FOR OIL/WATER SEPARATION

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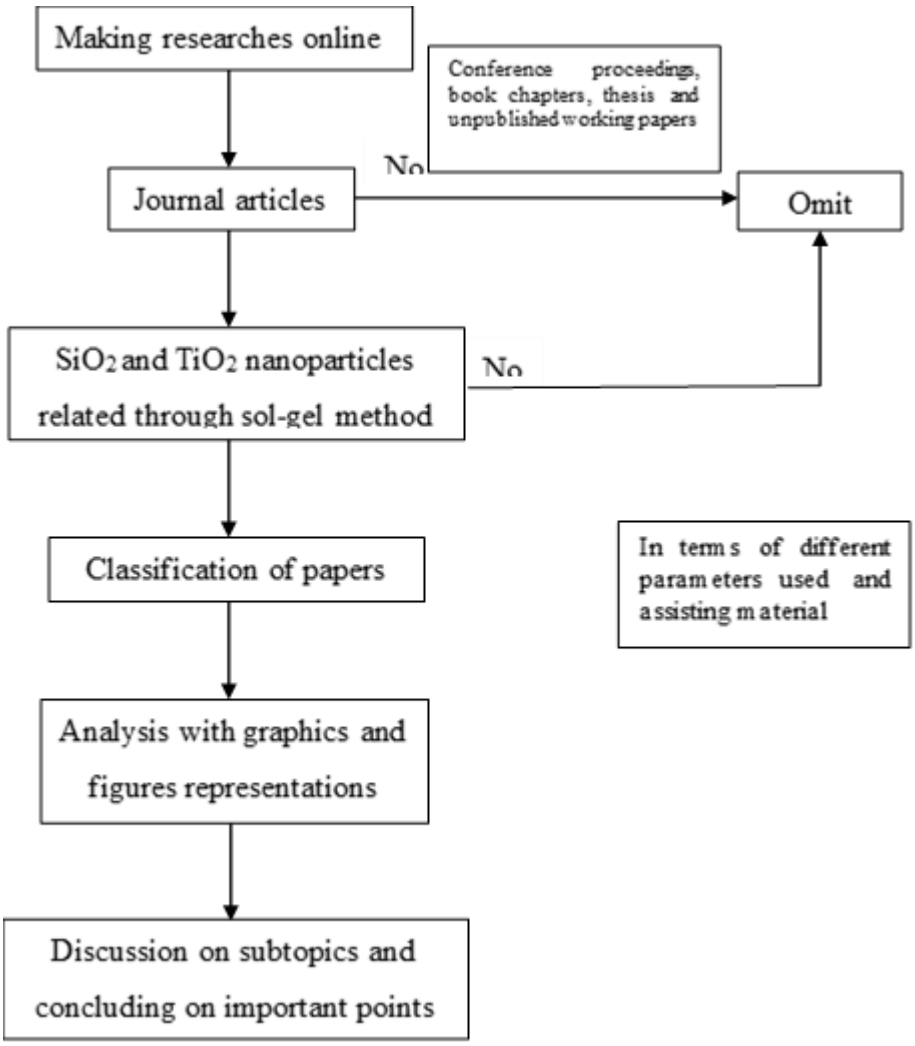
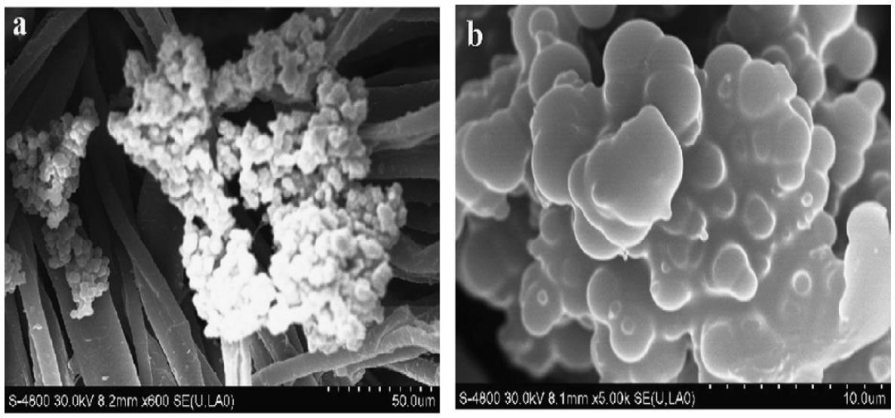
Abstract: Oil spill has become a significant water pollution all around the world. The oil particles that spread throughout the entire column of the water bodies would pose a great threat to human beings and the surrounding environment. Many conventional methods have been done in overcoming this problem. However, those conventional methods like floatation, combustion and skimming is hassle, time-consuming, expensive and would bring harmful effects to environment. Instead of cleaning out the oil spill, more problems come out and harming the environment. For that reason, absorbent material like cotton fabric has attracted a great attention scientifically due to its simplicity, cost-effective and availability. However, cotton fabric has its own shortcoming where it absorbs water and oil simultaneously due to its poor hydrophobicity surface. Therefore, fabrication of selective wettability of cotton fabric where it only absorbs oil while repelling water that has high potential in separating oil from water is needed. An approach has been made in fabricating a modified superhydrophobic cotton fabric with SiO_2 and TiO_2 nanoparticles via sol-gel method. With this modification, the cotton fabric will able to absorb oil and repel water at the same time. Hence, better separation of oil from water. This article conducts a critical state-of-the-art review in fabrication of modified cotton fabric for oil/water separation using different types of material; TiO_2 and SiO_2. In this study, different range of papers have been collected and is then distributed properly into eight different method in modifying the cotton fabric; dip coating, wet chemical deposition, electro assisted chemical deposition, spray coating, sol-gel, chemical etching, plasma processing and polymer grafting. The collected papers were reviewed by published journal, different parameters applied and characterization devices used by the previous studies. From the comparative study, it shows that the most used method by previous researchers in synthesizing nanoparticles is sol-gel method with 45.83% since the process is simple and convenient. The surface morphology and water contact angle were studied and compared by using Scanning Electron Microscope (SEM) and contact angle devices (CA) from different researches. The oil/water separation efficiency were investigated and most of the studies achieved at least 97% separation efficiency.

***Keywords*:** superhydrophobic, sol-gel, silica and titanium dioxide, cotton fabric, oil/water separation

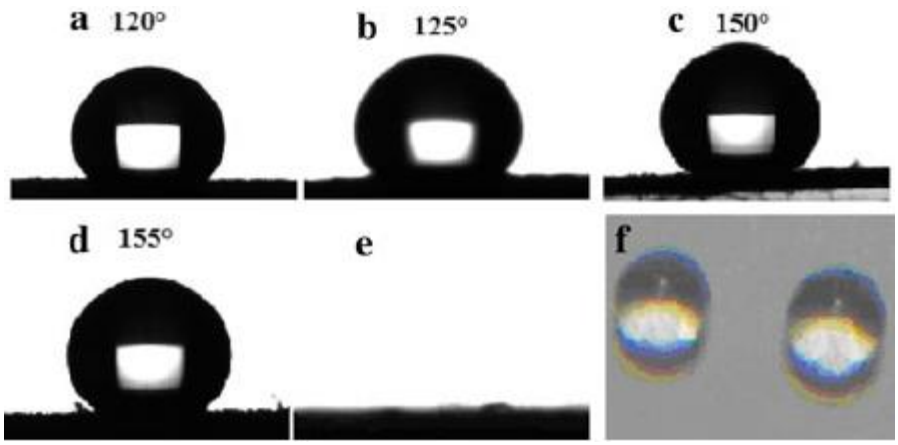
Methodology:



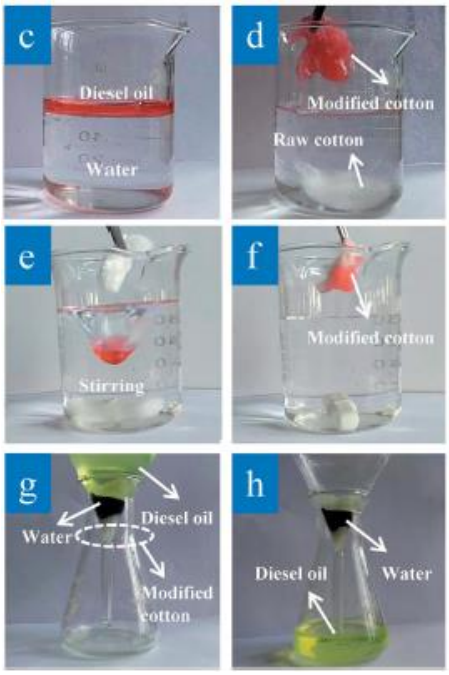
Results:



SEM images of TiO_2 on cotton fabric (a) and (b) with different magnification [35]



Water contact angle on the modified OTMS-TiO_2 cotton fabric [36]



Oil Separation Performance Test [55]

Conclusion

From the comparison study, it can be concluded that sol-gel is a suitable method in synthesizing metal oxide nanoparticles like SiO_2 and TiO_2 with its simplicity, time saving and low-cost. Previous studies show that the fabrication of modified cotton fabric through sol-gel able to exhibit a high hydrophobicity property and excellent in repelling water. At least 130° of water contact angle was obtained on the modified surface with a nice sphere shape while oil was completely spread and absorbed into the cotton fabric giving 0° contact angle from earlier studies. Study on the parameter of the heat treatment temperature shows that it plays a vital role in controlling the nanoparticles size and porosity on both of the coating materials, SiO_2 and TiO_2. With an average 97 % separation efficiency in separating oil from water, this result is encouraged enough to apply this superhydrophobic-superoleophilic cotton fabric in the large-scale cleaning of oil spills on water surfaces.