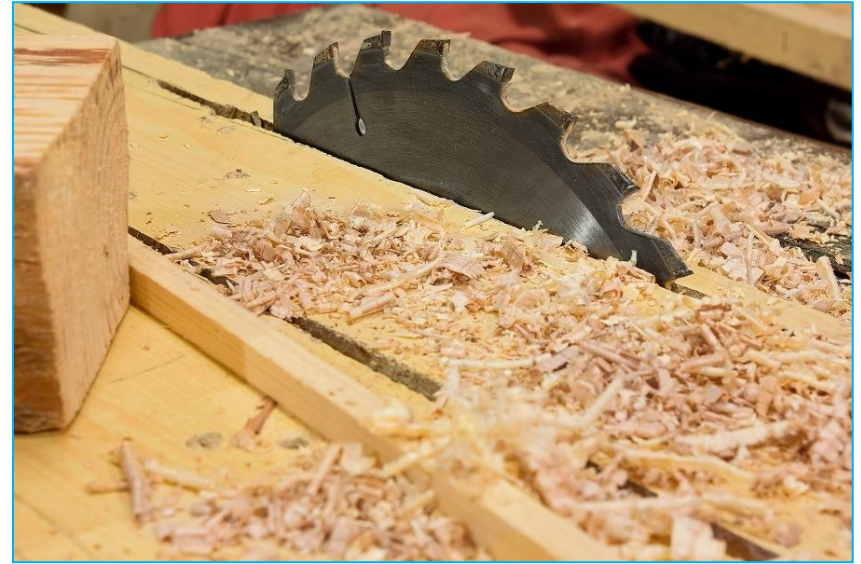


Superhydrophobic – Superoleophilic Sawdust – Polystyrene Composite Pellets for Efficient Oil-water Separation

Dr. Sanjay S. Latthe

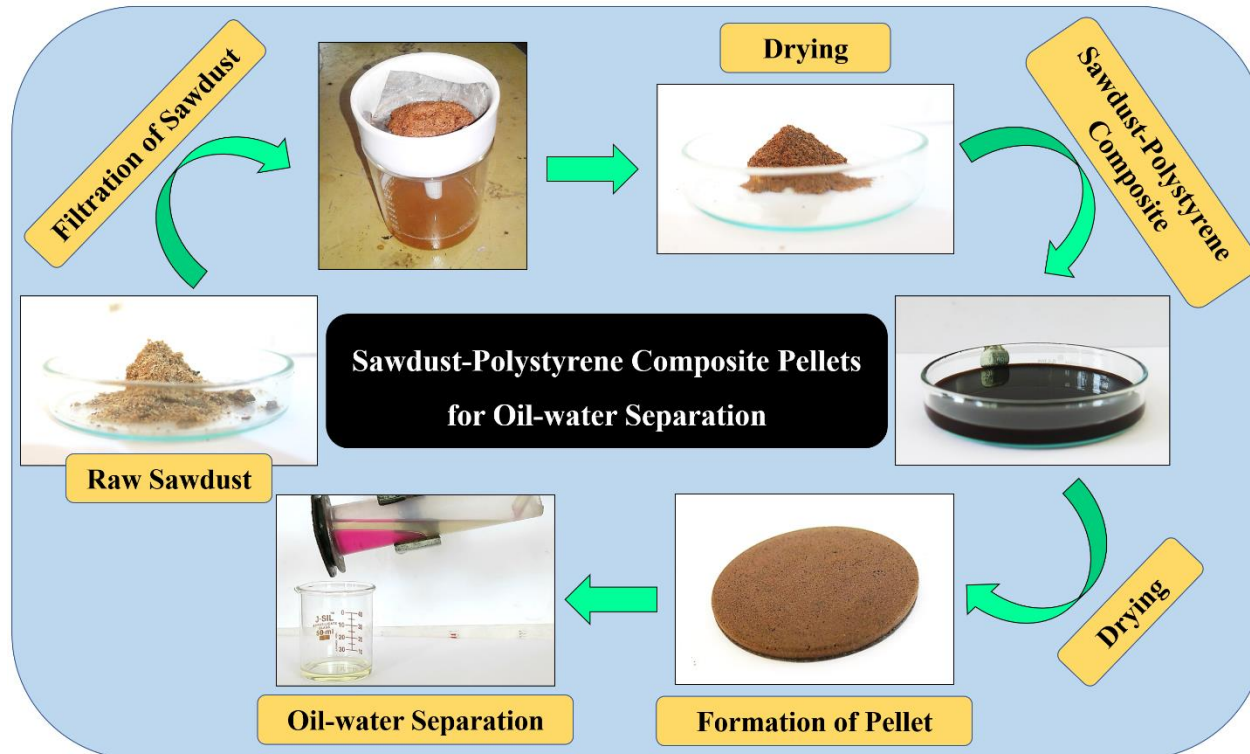
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Sawdust



Abstract of Research Work

- ❖ We utilized low-cost Sawdust-Polystyrene (SD – PS) composite and developed a facile strategy to prepare a free-standing superhydrophobic pellet for efficient oil-water separation.
- ❖ To achieve crack-free, regular and robust superhydrophobic SD – PS pellet, the concentration of polystyrene, the quantity of sawdust in polymer solution and thickness of the pellet was optimized.
- ❖ The superhydrophobic pellet exhibited oil-water separation efficiency higher than 90 % for the oils and organic liquids like hexane, kerosene, diesel and coconut oil with excellent separation cycles around 30.
- ❖ The mechanically durable superhydrophobic SD – PS pellet could separate oil from muddy as well as warm water, which are more suitable for industrial applications.



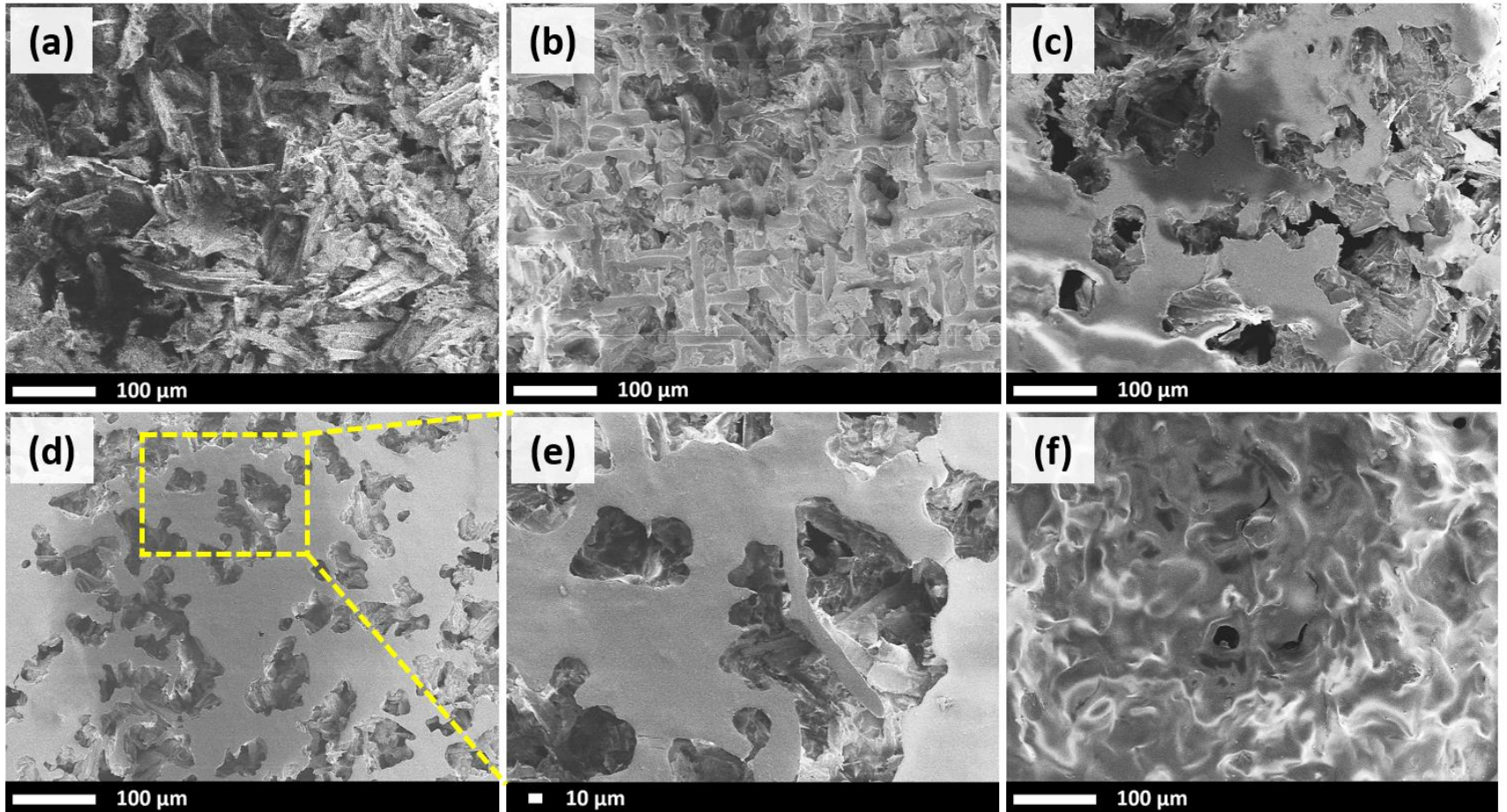
Experimental Work

Sr. No.	Samples	Polystyrene/Chloroform Concentration (mg/ml)	Sawdust Concentration in PS solution (mg/ml)
01	SP-1	50	100
02	SP-2	75	100
03	SP-3	100	100
04	SP-4	150	100

Optical Photographs of Sawdust Pellets

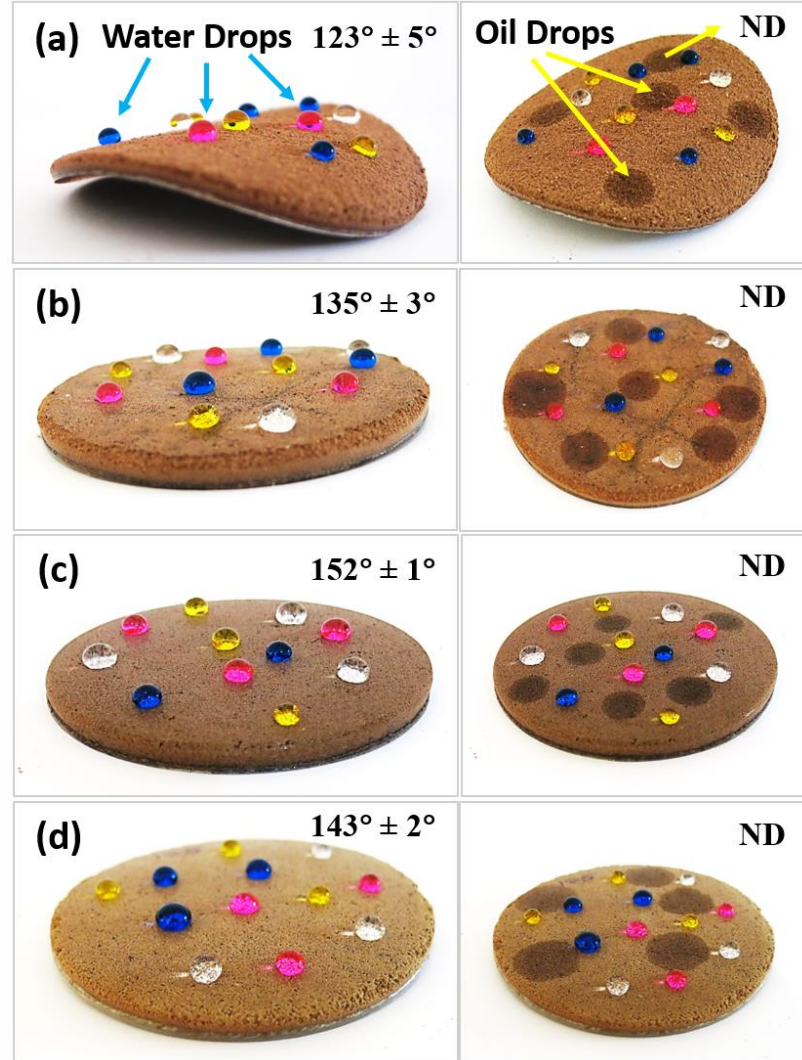
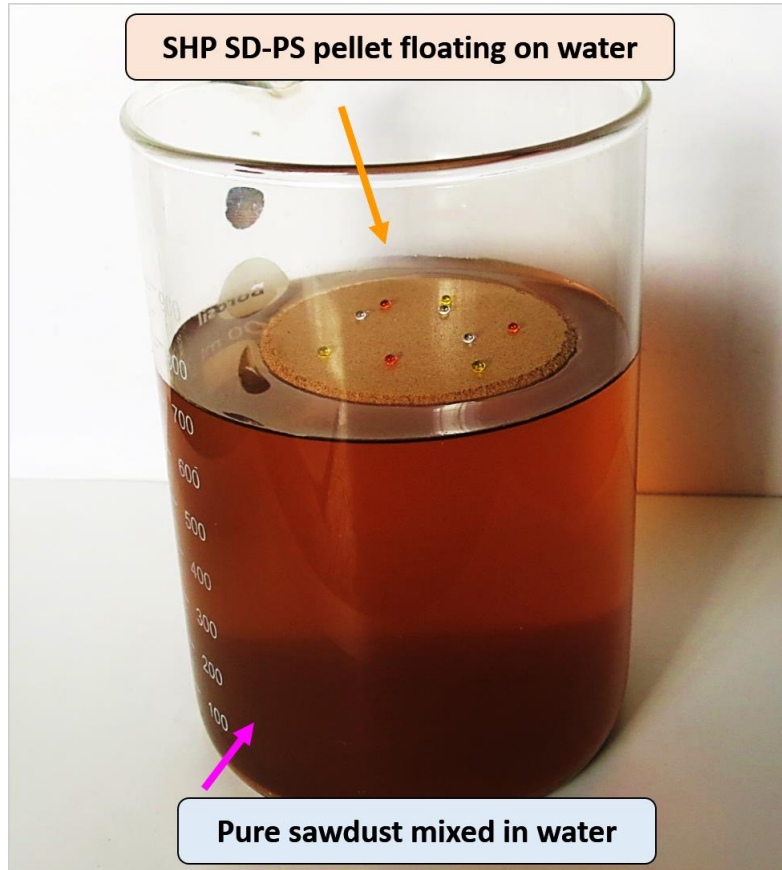


Morphology of Sawdust Pellets



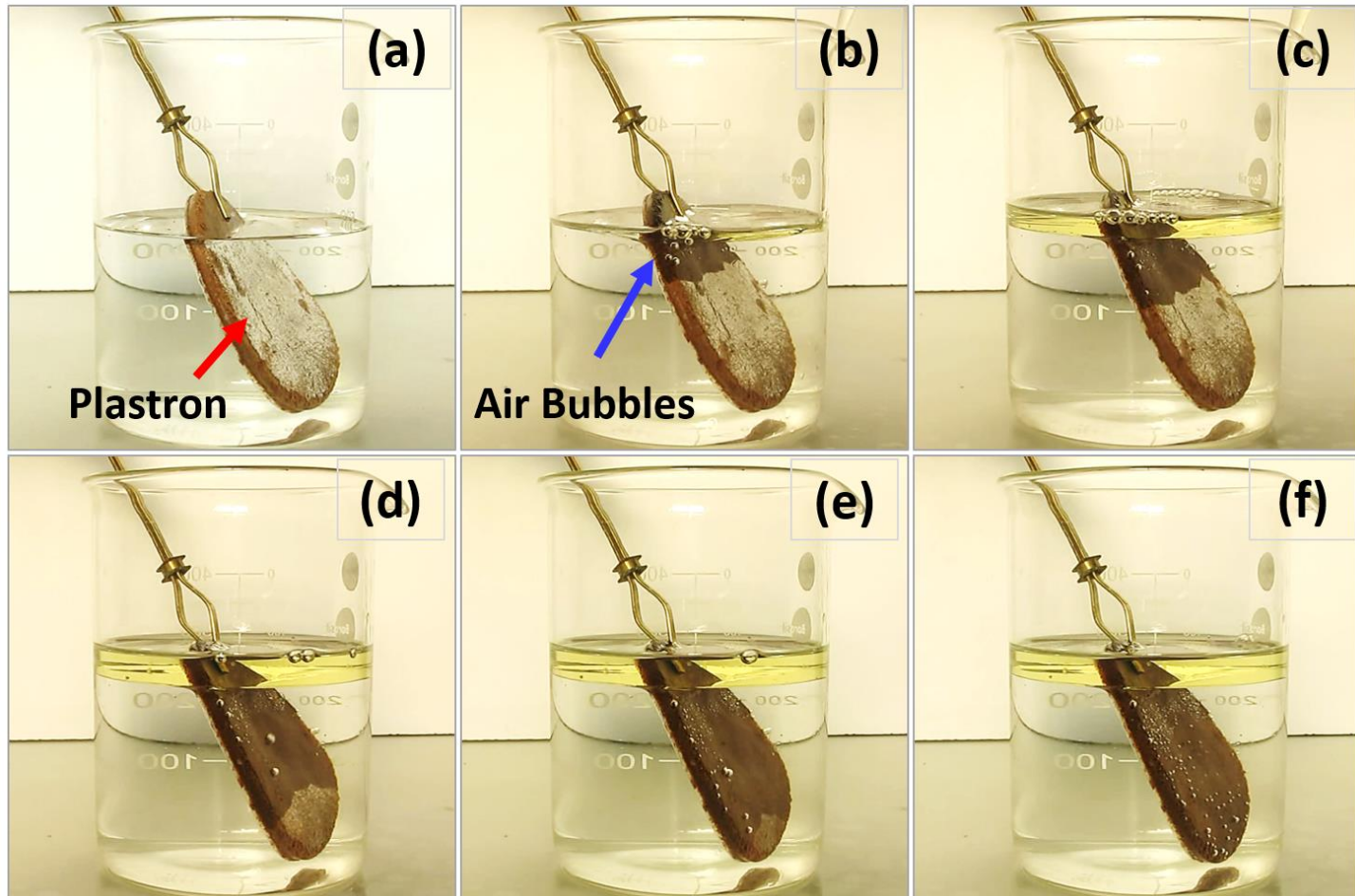
FE-SEM images of (a) filtered raw sawdust, (b) SP-1, (c) SP-2, (d) SP-3, (e) magnified image of SP-3, and (f) SP-4 composite pellet, respectively.

Optical Photographs of Sawdust Pellets



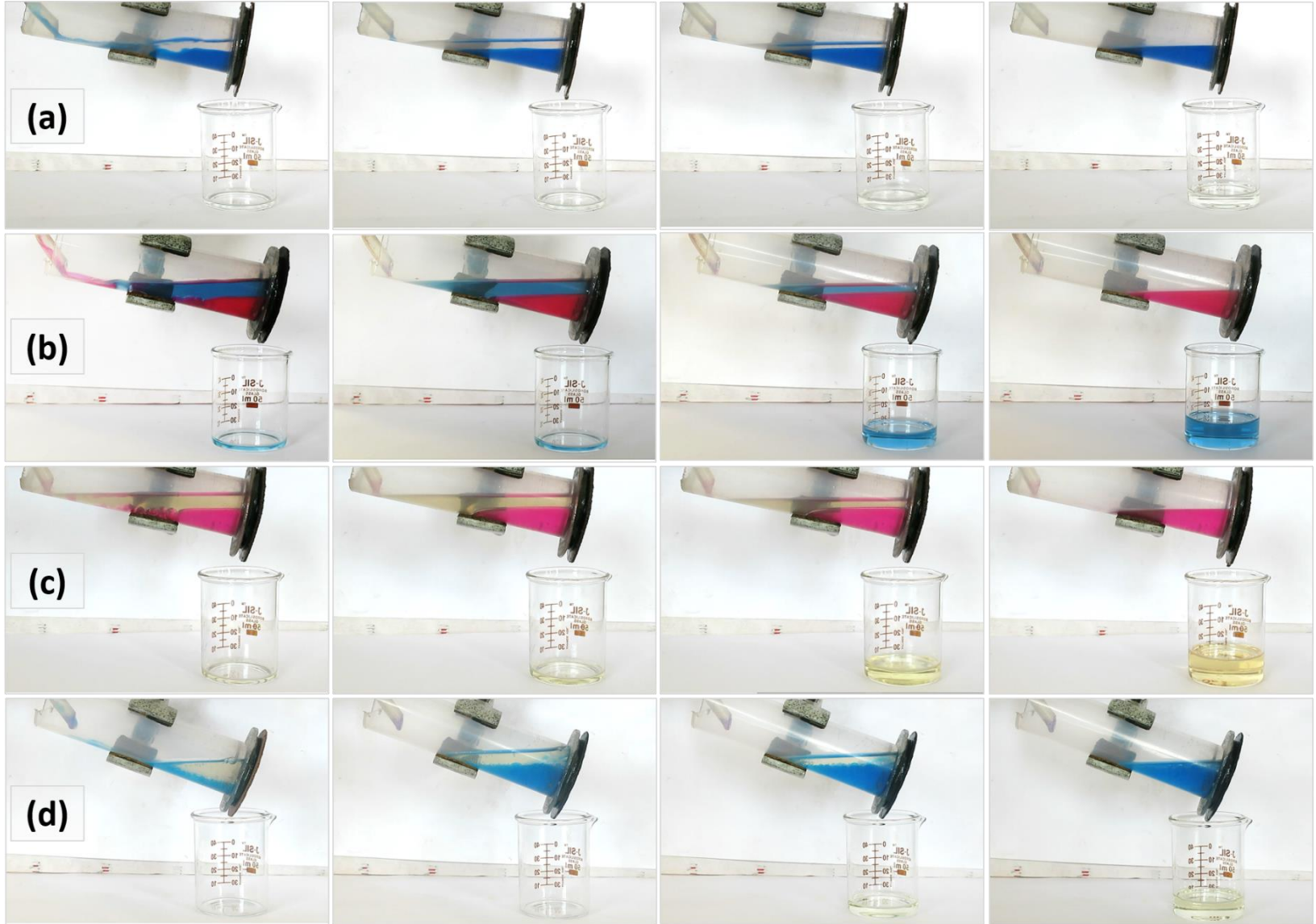
Photographs of water and oil drops on (a) SP-1, (b) SP-2, (c) SP-3, and (d) SP-4 composite pellets, respectively. Note: ND- Not Detected for oil contact angle.

Plastron Layer on Sawdust Pellets



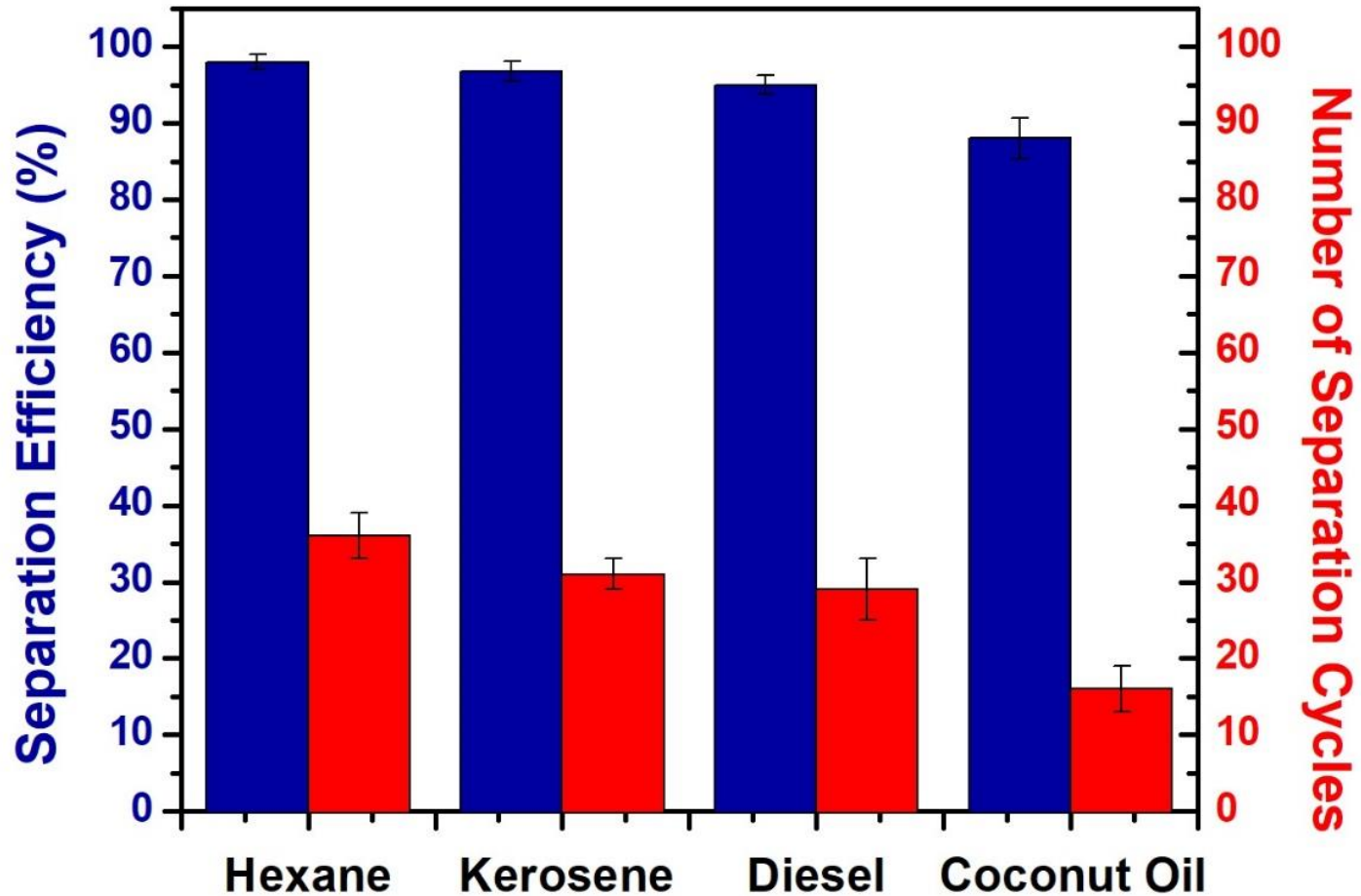
Photographs of (a) Shiny plastron layer on SP-3 pellet and (b-f) disappearance of plastron layer due to oil-water interface on pellet.

Oil – water Separation by Superhydrophobic Sawdust Pellets



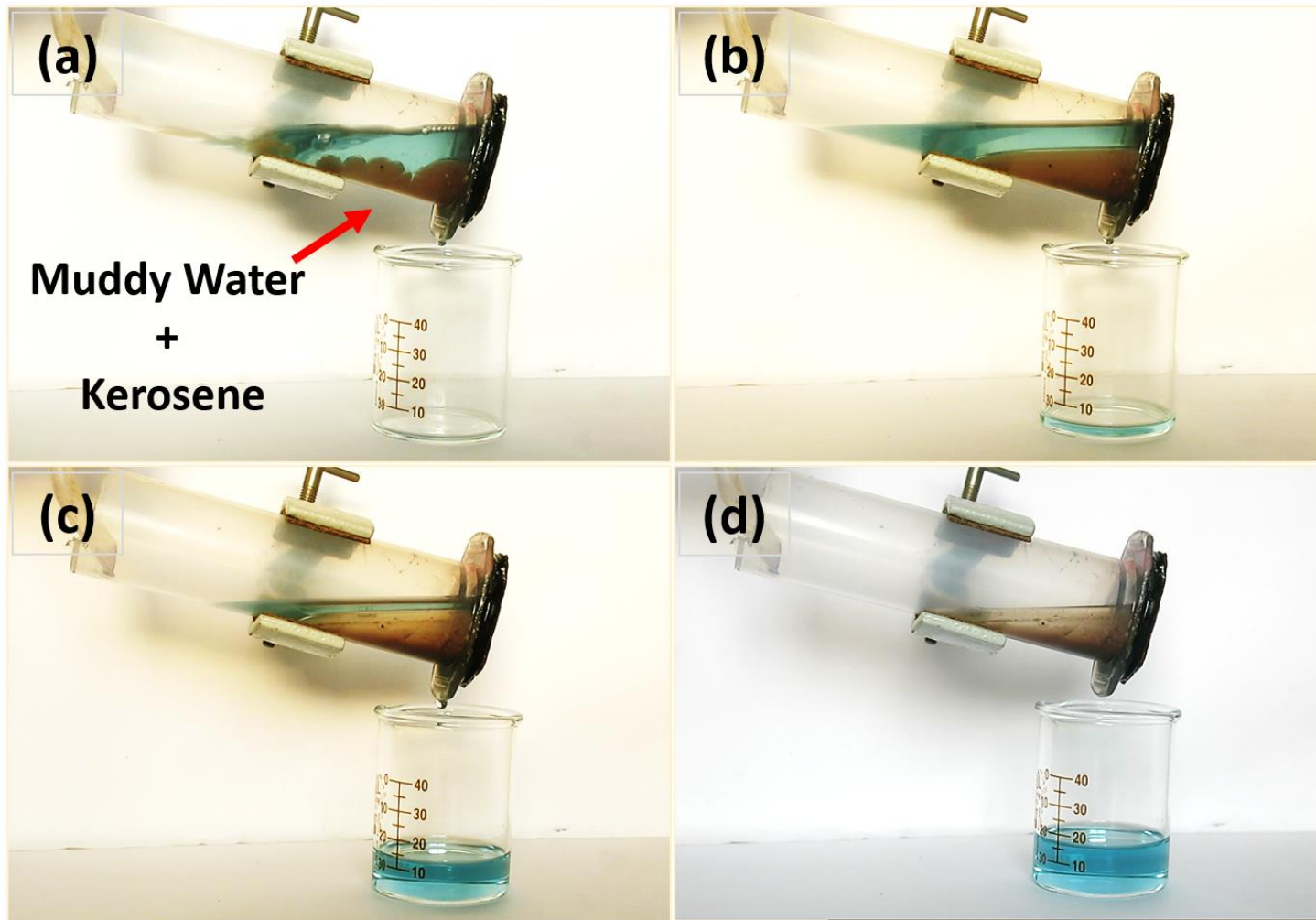
Oil-water separation by SP-3 pellets, (a) hexane, (b) kerosene, (c) diesel, and (d) coconut oil

Oil Separation Efficiency of Sawdust Pellets



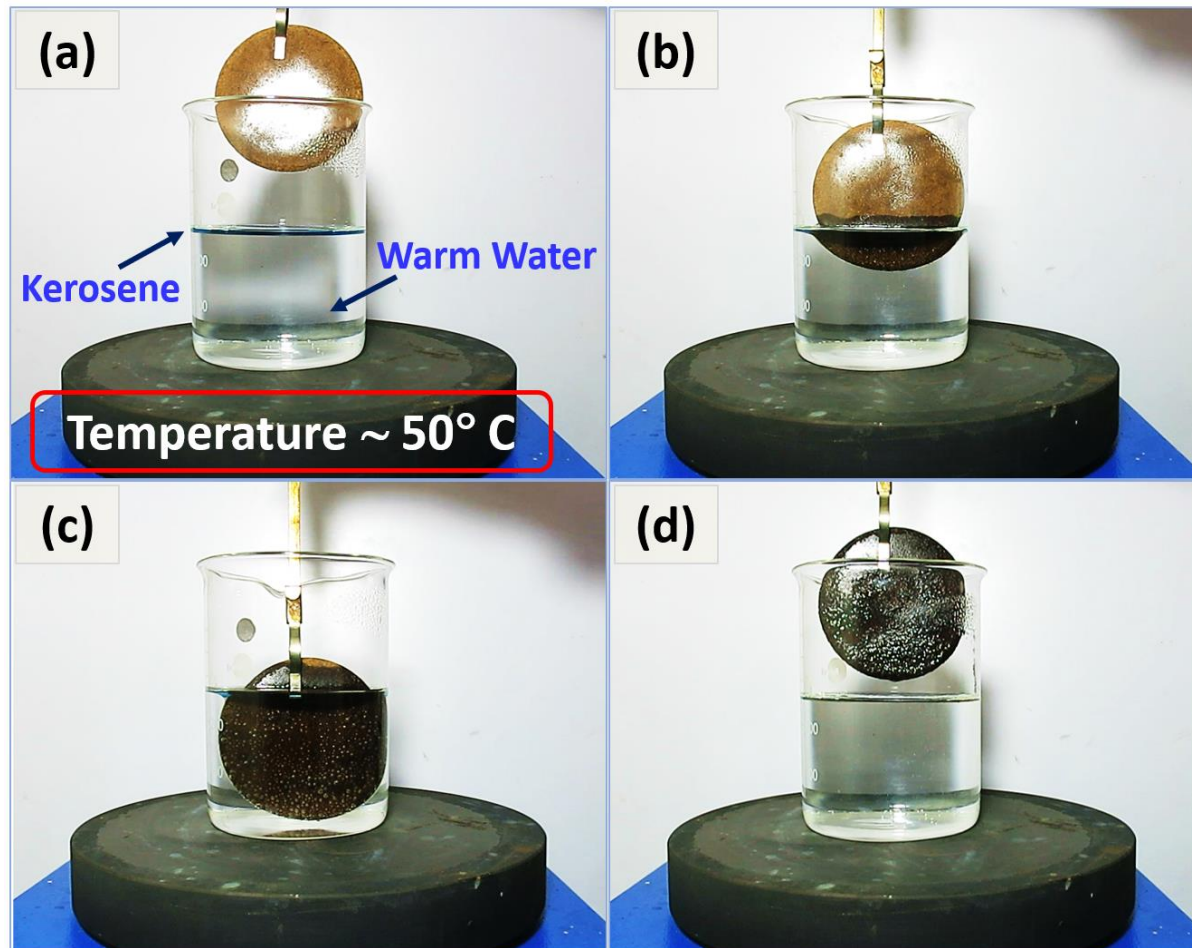
Separation efficiency and recycle ability of various oil-water mixtures by the superhydrophobic SP-3 pellet.

Oil Separation from Muddy Water by Superhydrophobic Sawdust Pellets



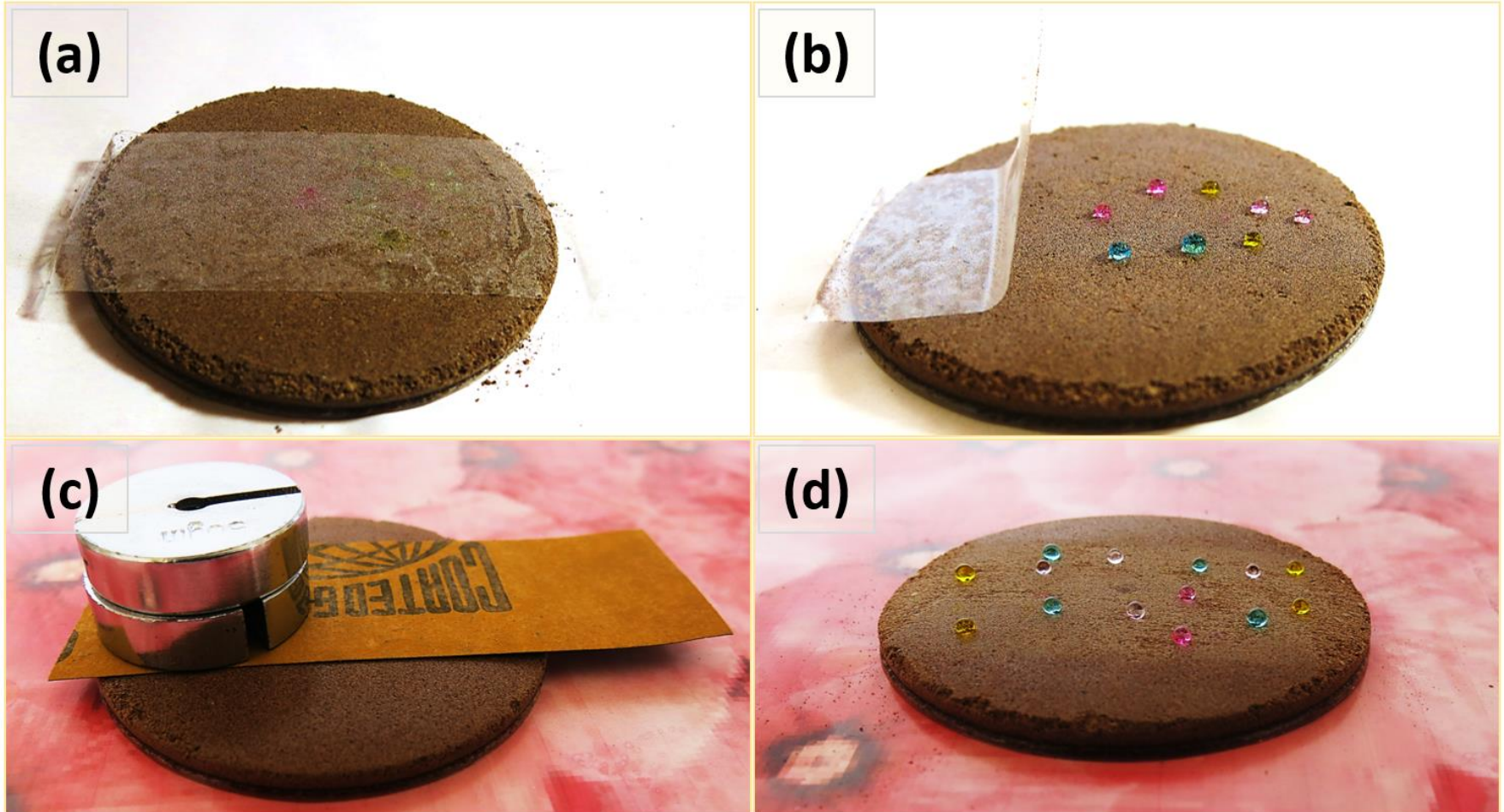
Muddy water - kerosene separation by superhydrophobic SP-3 pellet at before separation (a), after 3 min of separation (b), after 8 min of separation (c), and after 12 min of separation (d).

Oil Separation from Hot Water by Superhydrophobic Sawdust Pellets



Oil separation from warm water ($\sim 50^{\circ}\text{C}$) by superhydrophobic SP-3 pellet at (a) before absorption, (b and c) partial and complete immersion, (d) after removal from the mixture of warm water and kerosene oil.

Mechanical Stability of Superhydrophobic Sawdust Pellets



Adhesive tape test at (a) before and (b) after peeling the tape. Similarly, sandpaper abrasion test at (c) before and (d) after 50 cycles on superhydrophobic SP-3 pellet.

Pristine Part

Scratched Part



Conclusions

- ❑ Sawdust is quite abundantly and cheaply available in sawmills.
- ❑ We made use of sawdust and polystyrene to fabricate a facile superhydrophobic pellets for efficient oil-water separation.
- ❑ Such pellets can be fabricated at large scale for industrial use due to its very low fabrication cost compared to available superhydrophobic materials.
- ❑ Our fabricated superhydrophobic SP-3 pellet perform excellent separation of various oils from the oil-water mixture with higher separation efficiency.
- ❑ Moreover, the fabricated substrate maintains an excellent stability for the continuous recycling cycles of oil-water separation and also illustrate an excellent durability by maintaining the superhydrophobic property even after carrying-out the adhesive tape and sandpaper abrasion tests.
- ❑ In addition, we also checked the real practical applicability of the superhydrophobic SP-3 pellet with muddy water-kerosene oil separation.
- ❑ The obtained results demonstrate excellent separation of kerosene oil even mixed in the muddy and warm water. In addition, an excellent separation behaviour of hexane, diesel, and coconut oil highlight the important superhydrophobic SP-3 pellet for various oil-water separation.