Research Open

Aquaculture and Fisheries Studies

Volume 6 Issue 1

Short Article

Superwetting Materials with Different Dimensions are Used in the Study of Oil-Water Separation

Peng Pi*, Zhiying Ren*, Yu Yang, Weiping Chen and Youxi Lin

School of Mechanical Engineering and Automation, Institute of Metal Rubber & Vibration Noise, Fuzhou University, Fuzhou 350116, People's Republic of China

Corresponding author: Peng Pi, Zhiying Ren, School of Mechanical Engineering and Automation, Institute of Metal Rubber & Vibration Noise, Fuzhou University, Fuzhou 350116, People's Republic of China

Received: December 06, 2024; **Accepted:** December 08, 2024; **Published:** December 14, 2024

Introduction

With global warming, the shortage of water resources is aggravated, and a large amount of oily wastewater produced by the petroleum industry poses a threat to the ecological environment. The traditional oil-water separation methods have some problems, such as low efficiency, long cycle, complicated operation and secondary pollution. The appearance of ultra-wetting materials has brought new hope for solving these problems. This paper focuses on the application of ultra-wetting materials in the field of oil and water separation, introduces the limitations of traditional separation methods, expounds the research progress of ultra-wetting materials, wetting theory, and discusses various types of ultra-wetting materials in detail, and finally summarizes the shortcomings of existing materials and looks forward to the future.

Superwetting Oil-Water Separation Material

Super Hydrophobic - Super Oil Wet Material

Summarizing this type of material, compared with the previous two, its three-dimensional structure is equivalent to a random stacking of multi-level two-dimensional materials, which significantly enhances separation efficiency. Additionally, small oil droplets undergo demulsification, coalescence, and separation within the internal space, thereby achieving emulsion separation and efficient "dewatering". However, for most non-metallic substrates, further research is needed to explore and improve their mechanical stability, reusability, and durability.

Super Hydrophilic - Underwater Super Oil Phobic Material

In summary, in the realm of superhydrophilic–underwater superoleophobic three-dimensional materials, there still exist a series of application issues such as structural instability, poor overall wear resistance, and susceptibility to contamination in complex environments. These issues serve as inspirations for targeted solutions in subsequent development efforts. Additionally, practical applications of the material are often limited by factors such as synthetic preparation methods. Nevertheless, overall, these "oil-removing" type three-dimensional wetting materials exhibit higher emulsion separation performance compared with two-dimensional materials.

Superhydrophobic - Superoleophobic Materials

According to the previous discussion, three-dimensional materials can utilize porous nickel foam substrates, directly forming micro-nano rough structures on the three-dimensional framework. Compared with two-dimensional materials where particles adhere to the surface and are combined with binders, this approach offers superior performance and a more efficient preparation process. For non-metallic substrate materials, the three-dimensional structure provides sufficient space to accommodate inorganic hybrid polymers, forming a unique porous structure and significantly enhancing their mechanical strength.

"Special" Ultra-Wetting Materials

Compared with two-dimensional materials, three-dimensional "special" superwetting materials exhibit enhanced water absorption capabilities. Additionally, the selection of these materials increasingly considers the application of green, biodegradable materials. To address common oil–water separation clogging issues, porous superamphiphilic materials offer a fundamental solution, with aerogel materials selectively capturing the water phase to improve separation performance.

Smart Switchable Superwetting Material

Two-dimensional switchable superwetting materials focus on reusability and recyclability while conserving energy. They achieve on-demand emulsion separation under external stimuli, effectively addressing the single-use issue of one dimensional materials. Additionally, the in situ growth method overcomes the stability problems common in most superwetting materials.

Summary and Outlook

In the future, green and biodegradable base materials have enormous development potential and prospects. The green recycling of materials for renewable use is a key direction for future research. However, current recycled materials still exhibit some apparent disadvantages: cumbersome and complex recycling processes, high energy input, poor durability, and a short lifespan during use. The future aims to combine repairability, self-cleaning, high corrosion resistance, and material recycling to form a completely new industrial chain and breakthrough direction in technology development.

Citation:

Pi P, Ren Z, Yang Y, Chen W, Lin Y (2024) Superwetting Materials with Different Dimensions are Used in the Study of Oil-Water Separation. *Aquac Fish Stud* Volume 6(1): 1-2.