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Natural clay nanotubes for oil spill bioremediation through pickering emulsions

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Deriving motivation with terrible tragedies like the Deepwater Horizon oil spill (2010), this study introduces halloysite clay nanotubes as an eco-friendly, inexpensive and effective mitigation agent for oceanic oil spill bioremediation. Halloysite clay nanotubes are an indigenous material naturally mined in quantities exceeding 50,000 tons a year and is available at a few dollars per kilogram. These clay tubes are able to stabilize oil-in-water pickering emulsions in sea water conditions. Splitting an oil slick on top of the ocean into emulsion droplets with diameters in the range of micrometers thousand-times increases the surface area of crude oil available for biodegradation by thousand times. We optimised pickering emulsification with both pristine and hydrophobized halloysite nanotubes. The hydrophobization was carried out by silanization under optimized reaction conditions and concentrations with octadecyltrimethoxysilane (ODTMS). We have shown that attachment of alkane-degrading *Alcanivorax borkumensis* bacteria on halloysite stabilized emulsions drastically increased in comparison to less biofrinedly emulsions formed with industrial Corexit surfactant. The number of bacteria on halloysite covered oil-water interface increased 30 times over 3 days and was much larger than on surfactant-stabilised emulsions. This increased proliferation concurs with the enhanced metabolic activity displayed by such hydrocarboboclastic bacteria in presence of halloysite. The enhanced growth and activity of oil-degrading bacteria on halloysite pickering emulsions opens up the development of halloysite tubule clay as an efficient and realistic material for oil spill bioremediation.

Biography

A Panchal is a Doctoral candidate in Micro and Nano systems technology at Louisiana Tech University. He has completed his Masters in Biomedical Engineering from the same university and Bachelors in Pharmaceutical Technology from Institute of Chemical Technology, Mumbai, India. He works with the nano-assembly research group headed by Prof. Yuri Lvov and specialises in applications of halloysite nanotubes in oil spill bioremediation, hair care and drug delivery.

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