Hawai‘i Natural Energy Institute Research Highlights

Alternative Fuels

Microbial Degradation of Hydrocarbons in Marine and Estuarine Environments

OBJECTIVE AND SIGNIFICANCE: The primary objectives of this study are to identify aquatic microbes that effectively degrade hydrocarbon pollutants in estuaries and the ocean, and to elucidate the mechanisms of this degradation. This information is vital to understand and assess the extent of the environment impacts of oil and gas discharges and to develop novel strategies to mitigate these impacts.

BACKGROUND: This project is an adjunct to the APRISES Methane Hydrates task. Purposeful (e.g., for natural gas recovery) or accidental destabilization of seafloor hydrates will release methane into the oceanic water column. In addition, many commercial and DoD activities result in hydrocarbon contamination of the ocean and estuarine environments. Under these types of scenarios, bacterial and fungal communities in the water are known to play a key role in ameliorating the impacts of the polluting hydrocarbons species.

Laboratory experiments have been conducted to identify microbes that can metabolize and remove hydrocarbon contaminants from aquatic environments and to investigate the key pathways and mechanisms of this process. Figure 1 is a microscope photograph of a species of fungus found in Hawai‘i that can degrade hydrocarbons, which was isolated and identified in this study.

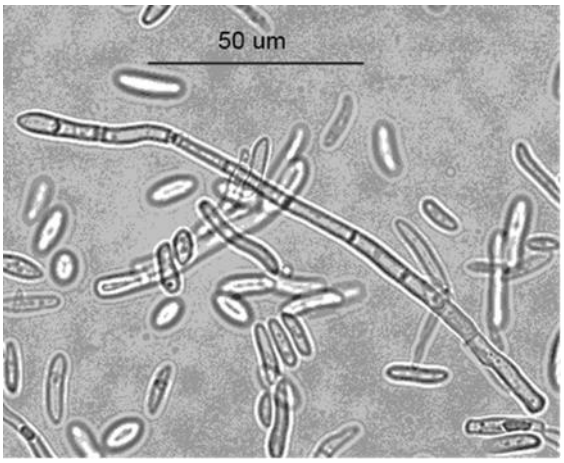

Figure 1. *Moniliella wahieum* (ATCC MYA-4962) a hydrocarbon degrading fungus that has been isolated and characterized in Hawai‘i.

PROJECT STATUS/RESULTS: This project is ongoing. Recent results are available in the following peer-reviewed publications:

1. 2020, J. Liang, et al., **Rapid granulation using CaSO4 and polymers for refractory wastewater treatment in up-flow anaerobic sludge blanket reactor**, Bioresource Technology, Vol. 305, Paper 123084.
2. 2018, Q. Wang, et al., **Treatment of petroleum wastewater using an up-flow anaerobic sludge blanket (UASB) reactor and turf soil as a support material**, Journal of Chemical Technology and Biotechnology, Vol. 93, Issue 11, pp. 3317-3325.
3. 2017, C. Ye, et al., **Cometabolic degradation of blended biodiesel by Moniliella wahieum Y12T and Byssochlamys nivea M1**, International Biodeterioration & Biodegradation, Vol. 125, pp. 166-169.
4. 2016, C-M. Chen, et al., **Laboratory studies of rice bran as a carbon source to stimulate indigenous microorganisms in oil reservoirs**, Petroleum Science, Vol. 13, Issue 3, pp. 572-583.
5. 2016, T.H. Ching, et al., **Biodegradation of biodiesel and microbiologically induced corrosion of 1018 steel by Moniliella wahieum Y12**, International Biodeterioration & Biodegradation, Vol. 108, pp. 122-126.
6. 2013, R.B. Coffin, et al., **Spatial variation in shallow sediment methane sources and cycling on the Alaskan Beaufort Sea Shelf/Slope**, Marine and Petroleum Geology, Vol. 45, pp. 186-197.
7. 2013, R.M. Harada, et al., **Diversity of Archaea communities within contaminated sand samples from Johnston Atoll**, Bioremediation Journal, Vol. 17, Issue 3, pp. 182-189.

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Contact: Brandon Yoza, byoza@hawaii.edu

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