Peer Review

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Dr. Hoff

Faculty Interview

During my faculty interview, I had a chance to learn about Babu Fathepure’s research and what he is working on in his lab. The lab focuses on aerobic and anerobic biodegradation of petroleum hydrocarbons in hypersaline environments. Hypersaline environments characteristically present salt concentrations higher than 35 g.L-1. Although high salt concentrations constitute a stressful agent for most of the known living organisms, hypersaline environments can harbor wide varieties of biological communities. The organisms that grow best in these environments are called halophiles, while the ones whose optimal growth occur in non-saline media but are able to grow under hypersaline conditions are called halotolerant organisms. Scientific knowledge on halophilic and halotolerant microorganisms have been improved because of increasing views of their application in industrial production bioprocesses, such as hypersaline wastewater treatments. The lab uses genome-based tools to characterize hydrocarbon degrading microbial communities and their metabolic capacity. They are trying to isolate novel hydrocarbon degrading bacteria and archaea and study their ecology, physiology and molecular mechanisms of hydrocarbon degradation at while being at a high level of salinity.

A significant portion of oil from the recent Deepwater Horizon (DH) oil spill in the Gulf of Mexico was transported to the shoreline, where it may have severe ecological and economic consequences. Microorganisms with the capacity to degrade hydrocarbons are among the best-studied microbial groups in applied and environmental microbiology. Indeed, more than 200 bacterial, algal, and fungal genera, encompassing over 500 species have been recognized as capable of hydrocarbon degradation. Much progress has been made to determine the response of specific bacterial family to oil contamination in the marine environments impacted by oil spills. However, our ability to understand and predict the dynamics of bacterial communities responding to environmental stimuli such as the presence of oil contamination remains in the beginning stages. Another area the lab focuses on is degradation of plant lignin using bacteria and fungi for enhanced saccharification and efficient biofuel production. They use genomic and proteomic approach to understand lignin-active genes and enzymes involved in the delignification of plant biomass. Lignin is a material found in the secondary wall of plants.

Lignin is a necessary agent to be present in second-generation bioenergy crops as it has to protect the plants and perform its functions. However, this lignin has to be degraded or extracted from plants in pretreatments for the generation of bioenergy. These biofuels need huge energy, time, cost, and potential for pretreatment processes. As the biomass is mainly composed of cellulose, lignin, and hemicelluloses, it needs to be treated for removal and extraction of hemicelluloses and lignin, respectively. Biofuel generation is dependent on the quality of biomass used. This aspect is considered important because it has the potential for the production of biofuel. Therefore, biomass can act as a sustainable resource that has the ability to diminish the use of fossil fuels for energy production.

Bibliography

* Professor Fathepure
* NCBI website