Research Topics: Dr. Babu Fathepure and the Degradation of Hydrocarbons

Dr. Babu Fathepure is currently an Assistant Professor at Oklahoma State University and is particularly interested in the microbial assisted degradations of toxic chemicals. Dr. Fathepure grew up in India where he earned both a B.S. in Chemistry and M.S. in Biochemistry at Karnataka University and then moved on to earn his Ph.D. in Environmental Microbiology at the Indian Institute of Science. For his Ph.D. thesis, Dr. Fathepure worked on studying the Biogas production from methanogens and its potential use as an energy source for rural villages. Dr. Fathepure left India for a post-Doc position at Michigan State University where he worked on the anaerobic degradation of toxic chlorinates through microbial bioremediation.

Dr. Fathepure has always been interested in using microbial populations to degrade or digest materials to produce a beneficial outcome to humans. He has had a long history of using microbial communities to degrade toxic compounds (e.g. chlorinates from industrial waste and hydrocarbons from crude oil spills and processing) or using the microbes to digest unusable plant matter for energy production.

Since he has come to OSU, Dr. Fathepure has focused his research into the degradation of hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) for bioremediation purposes. Bioremediation is the process of cleaning up contaminated water, land, or waste through the use of biological processes. For Dr. Fathepure, this means using bacteria and archaea that can live in the presence of crude oil and use it as a source of carbon, therefore getting rid of it in the environment. This is no easy task for the microorganisms that can do it either. While studying the microbes found in oil fields, Dr. Fathepure found that in order to completely digest one molecule of benzene, the bacteria needed 16-17 different enzymes to catalyze the process

To add to this already difficult task, the microbes also need to be extremely halophilic, or salt loving, as the process of extracting crude oil creates hypersaline (5-35% NaCl) “produced water”. The produced water that comes from the extraction of crude oil is heavily contaminated with hydrocarbons, salt, and heavy metals and thus cannot be used for anything else. “For every barrel of crude oil that they extract from the ground, nine barrels of produced water is also made”. To clean the water, the salts and the heavy metals need to be removed through membranes that selectively prevent the heavy metals through. However, the water that comes through is still extremely toxic and has killed the four or five different species of bacteria that Dr. Fathepure uses. Because of this, the produced water has to be diluted by up to 50% before the microorganisms can even begin to grow and degrade the toxic molecules. However, this creates a new dilemma, as diluting the produced water will double the entire amount of water needed. Dr. Fathepure has come up with ingenious solution to this, which is to use waste water from other processes to dilute it, such as from a municipal waste water treatment facility.

The work that Dr. Fathepure has done to further the research into bioremediation is phenomenal. He has dedicated a large portion of his life to his research and is a great example of the ingenuity of science and the need to be able to solve important problems.