Using Genetically Modified Microorganisms for Bioremediation of Hazardous Substances

Rep. Jada Wilson

Bioremediation of unwanted hazardous substances can be degraded by genetically engineered microbes. This method of degradation can be helpful because once the bacterium have been modified, the modification could make the bacterium resistant to a certain substance or it could allow the increase in speed of the remediation process that already naturally happen. Although bioremediation by genetically modified bacteria studies are mostly only limited to laboratory experiments, this method has ecological advances that prove to be effective in the reduction of hazardous substances. In order to specify which feature the bacteria will have the bacteria must undergo mutations in CYP which is an enzyme that plays a major role in drug metabolism. Another method used to insert the wanted feature is achieved by producing recombinant plasmids. These plasmids can then be used to insert whatever gene or mutation is wanted. The biggest issue with using microbes is the uncertainty of what the effect will be on the biodiversity of other microbes. Since these bacteria have recombinant plasmids this could cause problems with the diversity of the microbes especially when the bacterium decides to reproduce. A suggestion could be to insert killer genes into the plasmid so that once the bacterium has done its job it will kill itself and this could also help if the plasmid were to be transferred to a separate bacteria so that the bacteria would die immediately.

Hussain, I. , et al. (2018) "Microbe and Plant Assisted-Remediation of Organic Xenobiotics and its Enhancement by Genetically Modified Organisms and Recombinant Technology: A Review". Science of the Total Environment. 628-629:1582-1599.

This article is a review article that discusses the not only degradation by microbes but also by plants as well. This article discusses the key ways that this remediation can happen and it directs to research articles along with many review articles.

Ford, C., Sayler, G. & Burlage, R (1999). “Containment of a genetically engineered microorganism during a field bioremediation application.”Appl Microbiol Biotechnol 51:397. https://doi.org/10.1007/s002530051409

This research article conducts an experiment just to see how the bacteria disperses. This was done by using using the lux gene in order to visualize the dispersion of the bacterium that are actively degrading naphthalene.

Chunyan Yang, Lin Xu, Limin Yan & Yanhua Xu (2010) “Construction of a genetically engineered microorganism with high tolerance to arsenite and strong arsenite oxidative ability”, Journal of Environmental Science and Health, Part A, 45:740-745

This research article targets the genes that encode the small and large subunits of arsenite oxidase. These genes are targeted in order to allow the microorganism to have a high tolerance to arsenite along with a strong oxidative ability for arsenite.

Pandey, G. , Paul, D. , Jain, R. K. (2005) "Conceptualizing "Suicidal Genetically Engineered Microorganisms" for Bioremediation Applications." Biochemical and Biophysical Research Communications. 327:637-639.

This article discusses some of the suggestions that could be implemented to help mitigate some of the risks associated with releasing the microbes into the environment.