Bioremediation of Tetracycline Polluted Soils: How Antibiotic Resistance Can Reduce Antibiotic Pollution in the Environment and a Solution to Groundwater Antibiotic Pollution

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Antibiotic pollution in soils and groundwater is one of the world’s most pressing problems. There are 1.4 micrograms of antibiotics per liter of freshwater and 125,000 tons of antibiotics polluted per year, resulting from vast usage by humans and livestock. These antibiotics hinder crop growth, exacerbate antibiotic resistance, and pollute groundwater. However, no commercial treatments to detoxify antibiotics in the environment exist. This project offers a novel, natural approach to breaking down antibiotic pollutants by utilizing enzymes from antibiotic resistant bacteria packaged in solid and liquid forms (granules/pellets and solution). Bacterial enzymes beta-lactamase, chloramphenicol acetyltransferase, and E. coli nitroreductase were used as catalysts in the bioremediation of tetracycline (the most common antibiotic pollutant), along with no enzyme as a control group. It was hypothesized that in the presence of E. coli nitroreductase, Escherichia coli will have the least antibiotic susceptibility to tetracycline as E. coli nitroreductase will degrade the antibiotic the most effectively. Antibiotic degradation is determined through an Epsilometer test which measures minimum inhibitory concentration (MIC) of antibiotic needed to halt bacterial growth. The solid implementation of the bacterial enzymes confirmed the hypothesis as E. coli nitroreductase had the highest MIC (1.015625), most effectively degrading the antibiotic. However, the liquid implementation refuted the hypothesis, finding that chloramphenicol acetyltransferase produced the highest average MIC (0.69642857). This project yields a promising solution to antibiotic soil pollution in the environment that is not only effective, but both environmentally feasible and friendly.

Awards Won:

Third Award of $1,000