Implications/Future Applications

MTBE contamination to our environment is an issue that is of much controversy. Although there are new banns being implemented to restrict the use of the chemical, the spread of its contamination to our environment is still uncertain. The greatest irony in the implementation of MTBE is that it was designed in order to help the environment. Inevitably we exchange “clean air for dirty water.”

Phytoremediation is a generally new concept towards treatment of pollution. More research must be done in order for it to gain widespread acceptance. The bottom line is that pollution must be approached with environmentally friendly forms of treatment. Chemical spills should not be cleaned up with chemical solvents. The purpose of our project was to devise a method and treatment plan for cleaning polluted water by natural means.

Although our results were inconclusive and our soybean and broad bean failed to show a significant impact through phytoremediation, we gained an extreme amount of knowledge and laid the groundwork for future research in this field. For this experiment, we essentially had to “reinvent the wheel.” Only one other experiment had been conducted in this field of study, and brand new methods, apparatuses, and sampling procedures had to be devised in order to conduct our experiment.

We built a model for an experimental template for future research. Our most significant metric is the development of our experimental procedure. We were able to create an apparatus to maintain a closed system for the MTBE by having an air-tight bottle, and a septum membrane from which to extract our sample solutions. We also developed a sampling method using the GC/MS machine by equilibrating the temperature of the machine to MTBE’s boiling point. We also devised a way of sampling the “headspace” or air space above the solution because the liquid contained too many impurities to obtain an accurate reading of the concentration. We justified this method by using Henry’s law constant, which states that the relationship between the concentration of a chemical in gaseous form is proportional to the amount in aqueous form. Also, in the interpretation of our data, we also had to construct our own standard curve of known concentrations of MTBE versus their peak areas of integration. We also discovered that the soybean did overwhelmingly well at 1,000 ppm concentration of MTBE. Although research shows that this is the maximum concentrations that plants can withstand, we hope to perform future research that shows soybean can survive in concentrations above and beyond this level.

We hope to continue our experimenting in this field at Cal State University at Hayward. The information we learned from this initial experiment has been vital towards future experimentation in this area. We hope to begin working with another species of legume, bush bean, which has also been a proven phytoremediator of toxic chemicals. In addition to, we hope to develop a method to analyze the chemical concentrations within the plants themselves by grinding plant material frozen by liquid nitrogen.

We hope that someday the data obtained from our research will be a useful method towards approaching pollution in our environment. Rather than installing expensive filtration systems or imposing potent chemical solvents, why not plant a field of soybean plants? Our approach towards remediation of pollution in the environment should not be limited to the gasoline additive MTBE. Several other applications towards this method should be acknowledged.