# How Can Changing the Reduction Potential in a Water Sample Affect Potential Arsenic Contamination and Zinc Deficiency in Rice?

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The growth and consumption of rice accounts for about 20% of global caloric intake. Much of the world's rice is contaminated with arsenic. Arsenic poisoning poses a significant risk to human health and long-term exposure to arsenic can cause cancer. In comparison to other agricultural commodities, the process of growing rice is much more likely to result in arsenic contamination. Typically, arsenic tends not to dissolve into solution and instead prefers to cling onto iron minerals in soil. However, the presence of standing water and certain organic compounds found in fertilizers will cause arsenic to enter solution. Unfortunately, the environment for growing rice provides nearly the perfect conditions for arsenic to dissolve, since rice paddies are characterized by standing water, and fertilizers are often applied to aid in the growing process. However, the dissolution of arsenic isn't the only factor which leads to arsenic contamination. As rice grows, it uses phytate compounds to bring zinc into the plant. If there isn't enough zinc available, then other elements fill zinc's place in the phytate, and more phytates are created in an attempt to bring enough zinc into the plant. This leads to the introduction of arsenic into the rice plant. If arsenic could be completely removed from the soil and water, then there would be no risk of arsenic contamination at all. This is unlikely to be accomplished easily. If instead we could find chemical conditions where the concentration of zinc is maximized and the concentration of arsenic is minimized, then we can reduce the risk of arsenic contamination as only zinc will should be brought into the plant, and the odds of arsenic being incorporated into a phytate will be low. This project will use a chemical equilibrium modelling program called Visual MINTEQ to analyze water sample data from the Minnesota Department of Natural Resources. This analysis will be performed by using Visual MINTEQ to simulate different conditions in the water samples in order to see at which reduction potentials the most amount of zinc is dissolved, and the least amount of arsenic remains in solution.