1.21 Gigawatts: Optimizing Electrical Efficiency to Improve Water Quality through Electrocoagulation, a Green Technology

Trees, Jeff (School: Trees Family Home School)

Guerrero, Garrett (School: Guerrero Home School)

“Clean, accessible water for all” and “affordable, reliable, modern energy” are two of the United Nations’ sustainable development goals. Electrocoagulation (EC), a form of green technology using electricity for decontamination, can help meet these goals for everyone. This study investigated the effects of voltage and time on EC using tap water. An EC system was designed and constructed using a polypropylene chamber and aluminum heatsinks. The system ran for 60 minutes at 3, 6, 12, 18, and 24 volts, with readings taken every 5 minutes. The dependent variable was magnesium level in parts per billion (ppb). Results supported the alternative hypothesis in that contaminant levels decreased in relation to the voltage applied and the time spent coagulating: All pairwise t-tests between the untreated water and the means for each voltage group were significant ($p<.05$). Regression analyses showed that for 3,6,12, and 18 volts, there was a linear relationship between time and contaminant level ($p<.05$). Analysis of slope values for each regression line showed that the 12 Volt group had the most rapid decline in magnesium values. The 24 Volt group appeared to have an exponential decline in magnesium levels rather than a linear decline rate. The researchers concluded that electrocoagulation was successful at lower voltages and could achieve low contaminant levels if given enough time. Future research could explore the time taken to reach a zero contaminant level. Researchers can apply this information to the use of green energy sources to power the EC system.