As waste water treatment plants across the country are nearing the end of their lifetime, research on alternative methods of treatment are being considered. Among them is electrocoagulation. By applying electric current to a donor electrode the natural charge of nutrient matter is chemically reduced and causes the matter to destabilize. This destabilization causes the nutrients to combine and form larger particles. Most literature found on electrocoagulation pertained to industrial uses and very little research has been done with the influent of waste water treatment plants. This study will look at the feasibility of EC for primary treatment of wastewater.

In the beginning phase, 2 L batch testing was used in order to test for optimal removal rates. The variables that were manipulated include flow rate of the influent through the EC, amount of polymer added, amount of amperage applied, and electrode type. Ultimately the viability of EC as a municipal waste water treatment will be measured by the removal rates of COD, PO4, NO3, NH4 and bacteria such as E. Coli and coliform. They will be compared to conventional and chemically enhanced primary treatments. Based on what was gathered from the literature, the EC process will provide better removal of COD, PO4, NH4, and NO3 as well as remove E. Coli effectively.

The materials for the EC machine were provided by Powell Water in Centennial, Colorado. The treated raw waste influent came directly from Mines Park residences on the CSM campus. Once the optimal ranges for our variables were found in batch testing, we applied them to our continuous system. The optimal rates for our variables are as follows: amperage of 2 A, a flow rate of 0.5 L/min, and our polymer pump was run at 10.7 mL/min continuously. During testing it was discovered that 0.5 L/min was too slow of a flow rate and causing blockage in the unit. The flow rate was doubled to 1.0 L/min. Addition parameters were recorded as well such as voltage for power input, pH, conductivity, and temperature of influent and effluent. Where conductivity was depleted after going through the EC, temperature and pH rose by 4 degrees Celsius and 2 points higher in pH. Influent was collected when actual filling of carboy happened and effluent was extracted from the excess storage when a carboy was finished. The only by-product that caused hassle was foam. Foam was found to be best removed manually by ladle. On average around 15 g/L of foam were produced in our continuous runs. The amount of by-product produced by the EC can cause problems for feasibility. The EC unit had to be cleaned every night to reduce deposits of sludge and acid was applied when needed.

In the end, removal of PO4 was most effective with up to 99.9% of phosphate removed. Carbon Oxygen Demand was also well removed. Ammonia and nitrate were less consistent in removal and was sometimes more abundant after the treatment. Compared to chemical and conventional processes EC was the most effective at removal of coliform and E. Coli. Electrocoagulation most effectively removes COD, PO4, and E. Coli compared to the conventional and chemically enhanced treatment. Further studies could look at larger scale treatment, treating EC effluent in secondary treatment and comparing inputs with conventional

primary effluent, using monopoles on the electrodes, foam reduction techniques, and nitrogen removal.