



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Lianna M. Daug	Project Number S0609
Project Title Waste Coffee Grounds as Green Inhibitor of Zinc Corrosion in Hydrochloric Acid Solution	
Abstract Objectives/Goals This project investigated the inhibitory properties of aqueous extracts of waste coffee grounds (WCG) on the corrosion of zinc in HCl. The effects of extract concentration and immersion time on the inhibition efficiency (I.E.) of WCG were studied. Methods/Materials Zinc corrosion was achieved by immersing a Zn strip in 1M HCl with and without WCG. Corrosion was measured using hydrogen gas evolution and weight loss measurements. Volume of H ₂ gas produced was determined using a gas collecting apparatus. Readings were done at 10 min. intervals for 2 hrs for Control vs low, medium, and high dose WCG. Weight loss studies were carried out for Control vs best inhibitor concentration. A pre-weighed zinc strip was immersed in HCl, and reweighed at 2 hr intervals for 24 hrs. I.E. and corrosion rate were calculated as a function of time. Results H ₂ gas evolved decreased markedly with addition of WCG. Higher concentrations led to decreasing volumes of H ₂ gas. I.E. % was determined to be 82, 86, and 91 for low, medium, and high dose WCG respectively. For the gravimetric study, weight measurements could not be done past 8 hrs for Control because the zinc was too corroded to weigh by the 10th hr. With high dose WCG, even after 24 hrs of immersion, weight loss was only 12.8g from initial weight of 37.9 grams. I.E.% of WCG extract was 93, 95, 94, and 93% for 2,4,6, and 8 hrs of immersion time. At the 8th hour, corrosion rate was 2,819 mm/year without WCG vs 213 mm/year with WCG. High I.E. was maintained through 8 hrs but could not be calculated past 8 hrs. There was good agreement between I.E. values obtained via gasometric and gravimetric methods, with 90.9 vs 92.7% I.E. for high dose WCG at the 2-hr mark. Conclusions/Discussion WCG extract was effective in inhibiting Zn corrosion in HCl. I.E. increased with higher concentrations of the extract. High I.E. was maintained through 8 hrs but no conclusions could be made for longer immersion times. This study shows evidence that WCG has good corrosion inhibiting properties and the fact that it is a readily available and eco-friendly waste product makes it an attractive alternative to currently used corrosion inhibitors.	
Summary Statement Through hydrogen gas evolution and weight loss measurements, waste coffee ground extract was proven to be an effective corrosion inhibitor of zinc in HCl, and efficiency increased with higher extract concentrations.	
Help Received My mother supervised handling of hydrochloric acid. I designed and performed the experiments myself.	