



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Ashley R. Lo	Project Number S0512
Project Title The Removal of Alcohol from the Body through Esterification	
Abstract Objectives/Goals The objective is to determine if organic acids can react effectively with ethanol in an esterification reaction, and possibly be used to eliminate alcohol from the human body. Methods/Materials Ethanol reacts with acetic acid to form water and ethyl acetate, an ester commonly found in food products. The reaction was tested in vitro, using initial concentrations of ethanol ranging from 0.4 M to 1.0 M, which represent the average molarity of ethanol in beer. In separate beakers, a specified volume and concentration of ethanol was added to the same volume and concentration of acetic acid. After 5 minutes of vigorous stirring and 30 total minutes of reaction time, titrations were performed using potassium permanganate at 50-60 degrees Celsius, to find the amount of ethanol remaining in each beaker. Final molarities of ethanol were compared to the initial, and percent decreases were calculated. Results Using initial concentrations of reactants between 0.4 M and 1.0 M, an ethanol decrease of 80-90% was yielded consistently across four trials. These results are fairly similar to the theoretical ethanol decrease (79-86%) for molarities of ethanol and acetic acid between 0.4 M and 1.0 M, calculated using the equation $C_2H_5OH + CH_3COOH \rightarrow H_2O + CH_3COOCH_2CH_3$, and the known equilibrium constant of 45. Experimental results also indicated that, consistent with what was expected, there was a positive correlation between the initial concentrations of the reactants and the % of ethanol decrease at equilibrium. Conclusions/Discussion Results indicate that acetic acid can be an effective remedy for intoxication. However, drinking vinegar will result in esophagus damage due to the acidity. Also, after ethanol has entered the bloodstream, which starts to happen 30 minutes after consumption, it is too late to synthetically remove it. If the results of this experiment are to be used commercially, or developed into an effective drug, an organic acid that is already a solid, such as citric acid, or another solid compound containing the acetate ion, such as potassium acetate, must be made into capsules. These capsules can be swallowed like vitamins immediately before alcohol consumption.	
Summary Statement Increasing the rate of alcohol elimination from the human stomach through an esterification reaction between ethanol and an organic acid, thus expediting sobriety.	
Help Received Experimental supervision and academic advising in Torrey Pines High School under Dr. Belyea; Academic advising from Dr. Lo (Dad, professor at UCSD); Mom helped compile poster	