



CALIFORNIA STATE SCIENCE FAIR  
2003 PROJECT SUMMARY

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<b>Project Title</b> Organic Chemistry without Solvents	
<b>Abstract</b> <b>Objectives/Goals</b> The purpose of this experiment is to investigate "solvent-free" aldol condensation reactions. Solvent-free reactions in industry would reduce costs because there are fewer steps than a reaction with solvents. There are also fewer dangerous by-products to get rid of, making solvent-free reactions environmentally friendly. It is hypothesized that the chemicals Veratraldehyde and 1-Indanone will react with the catalyst NaOH when ground together in a mortar and pestle without solvents. <b>Methods/Materials</b> The chemicals Veratraldehyde and 1-Indanone were ground together with a base catalyst NaOH in a mortar and pestle. Samples of the mixture were taken at specific time intervals and tested with thin-layer chromatography (TLC). Different concentrations of hexane and ethanol were used in the TLC chamber to shorten or heighten the difference between the spots seen on the TLC slides. Rf values for the slides were calculated to compare the original chemicals with the new product. NMR was used after the experiment to verify results. <b>Results</b> The TLC slides show that the reaction between Veratraldehyde and 1-Indanone appears to have reacted completely and formed a single product. However, the NMR, which is more accurate, shows that the reaction went approximately 90% to completion and formed equal quantities of two isomers which are alpha, beta unsaturated ketones (or enones). <b>Conclusions/Discussion</b> This experiment shows that a solvent-free aldol condensation reaction is possible, establishing that the hypothesis is correct. This solvent-free method is possibly the start of a huge renovation to present techniques in organic synthesis if the method works for other chemicals.	
<b>Summary Statement</b> I proved that environmentally friendly, "solvent-free" aldol condensation reactions are possible.	
<b>Help Received</b> Dr. Geoffrey Dreyer of Applied Biosystems (and a Science Buddies Advisor) answered my questions by email when I needed help. Varian, Inc., Palo Alto, California, donated time on a MERCURYplus NMR spectrometer, and Dr. Jarrett Farias assisted me in running the machine.	