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Synthesis of Vanillin

Abstract

A three-step synthesis of vanillin was attempted. Vanillin is particularly noteworthy due to its vanilla fragrance and use in food for sensory appeal. In the first step, an alcohol was acetylated using acetic anhydride to make isoeugenyl acetate. Next, isoeugenyl acetate was converted to vanillin acetate via oxidation using a non-traditional reagent called PP/4CSP. The final step consisted of the hydrolysis of vanillin acetate into vanillin using $\text{KF}/\text{Al}_2\text{O}_3$ as a catalyst.

What is interesting about this particular reaction scheme is that it was performed mostly in the absence of solvent. Additionally, we found the first step of the reaction to be an inefficient adaptation of an aspirin synthesis scheme involving solid starting materials. This reaction probably did not work due to the fact that our reactant, isoeugenol, was in liquid form and the scheme from which the first step was adapted started with solids.

Green modifications to the reaction scheme involved changing the reagents in our first step. In this step, acetic acid, acetic anhydride and sulfuric acid were replaced with acetyl chloride. This was considered to be a greener alternative because much less reagent was required for the reaction to occur. This cut back on the number of materials used and eliminated unnecessary waste product. Another green modification was the use of propylene glycol as a solvent in the third step of the reaction. Propylene glycol is a relatively cheap solvent and poses few safety hazards. We also proposed that the addition of a solvent might help to speed up the reaction due to more efficient mixing.