The Feasibility of the Extraction of (2E)-3-phenylprop-2-enal from Cinnamomum cassia Bark Using Water and Aqueous Ethanol as Solvents in Distillation

Trinh, Aaron (School: Canyon del Oro High School)

The inner bark of the Chinese cinnamon tree Cinnamomum cassia is commonly processed into cinnamon sticks. The chemical compound that gives cinnamon sticks their flavor and odor is (2E)-3-phenylprop-2-enal (also known as cinnamaldehyde), an aldehyde with the formula C9H8O. Cinnamaldehyde has several industrial uses: an antimicrobial substance, a steel corrosion inhibitor, and a flavoring agent in confectioneries. To obtain (2E)-3-phenylprop-2-enal, steam distillations are employed. Steam distillation involves heating cinnamon bark with water for five to ten hours for maximum yield. The goal of this investigation was to increase the extraction efficiency by determining the effect of solvent composition on the yield of (2E)-3- phenylprop-2-enal extracted from a set mass of cinnamon sticks. This project involved three treatments: a control where water was used as the solvent and two experimental treatments where 25% and 50% aqueous ethanol were used as solvents. The control successfully validated the experimental setup, yielding 603.0mg of cinnamaldehyde on average, while the two ethanol treatments demonstrated that aqueous ethanol is not a viable solvent for extracting cinnamaldehyde. Further literature research suggested that the azeotropic nature of aqueous ethanol caused the vapor pressure of the liquid mixture to decrease, which prevented the vaporization and distillation of the cinnamaldehyde when heating the flask. Future experiments should explore the effects of pure solvents on the extraction of cinnamaldehyde, since pure solvents will minimize the amount of azeotropic interaction between a mixture of solvents and could yield valuable information regarding distillation efficiency with respect to new solvents.

Awards Won: