

Synthesis of Natural Carboxylic Acids and Alcohols from *Cinnamon cassia* Oil via Green Chemistry Approach

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Abstract

This study focuses on the synthesis of five industrially valuable organic compounds—benzoic acid, benzyl alcohol, cinnamyl alcohol, phenylpropanol, and cinnamic acid—using cinnamaldehyde and benzaldehyde, which naturally occur in *Cinnamomum cassia* oil, as starting materials. In accordance with the principles of green chemistry, environmentally benign solvents such as water and ethanol were used as reaction media, with potassium permanganate selected as the oxidation agent and sodium borohydride as the reducing agent. Within the experimental design, various reaction parameters were optimized, including the molar ratios of catalysts to substrates, resulting in high product yields ranging from 60% to 90% for all target compounds. The use of water as the primary solvent significantly reduces environmental toxicity and provides economic advantages. Except for phenylpropanol synthesis, all reactions were successfully carried out in aqueous media.

The synthesized compounds have wide application potential in pharmaceutical, cosmetic, and food industries. The findings demonstrate that several commercially valuable organic molecules can be obtained from a single natural raw material, thus enhancing the environmental and economic feasibility of green chemistry-based synthetic methodologies. Structural elucidation of the five target compounds was achieved using ¹H-NMR and ¹³C-NMR spectra, GC chromatograms, and MS spectra. Additionally, Modified Green Analytical Procedure Index (MoGAPI) and Blue Applicability Grade Index (BAGI) scores related to GC-MS analyses are presented in our work [1]. These results indicate strong compliance with the core principles of green analytical chemistry.

Keywords:

Benzoic acid; benzyl alcohol; phenylpropanol; cassia cinnamon oil; cinnamic acid; cinnamyl alcohol; green chemistry

References

[1] Özokan, G., Bilginer, A., Gümüş, M.K. Synthesis of Natural Carboxylic Acids and Alcohols from Cinnamon cassia Oil via Green Chemistry. *Processes* 2025, 13, 2002. <https://doi.org/10.3390/pr1307200>