

Comparative evaluation of polar and non-polar solvents in microwave-assisted extraction of cashew nut shell liquid

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Cashew nut shell liquid (CNSL) is a renewable, underutilised bioresource that offers a sustainable alternative to petrochemical-derived phenolic compounds. This study employs an open-vessel microwave-assisted extraction (MAE) method to extract CNSL from cashew nut shells (CNS) using a range of polar and non-polar solvents, aiming to enhance extraction efficiency and minimise environmental impact. The extraction process was conducted at microwave power levels ranging from 30 W to 300 W, with an extraction time of 30–40 minutes, using 150 mL of solvent. A Comparative analysis reveals that mid-polar and ketonic solvents achieve the highest yield (33-35%), beating the conventional extraction techniques in terms of selectivity, efficiency, and sustainability. Physicochemical characterization of the extracted CNSL showed pH values of 3.52–5.1, density of 0.86–0.98 g/cm³, moisture content of 0.52–1.04%, viscosity of 1780–3750 cP at 30°C, hydroxyl value of 86.55–96.11 mg NaOH/g, acid value of 12.52–16.01 mg NaOH/g, saponification value of 46.9–60.32 mg NaOH/g, and iodine value of 49.03–62.21 g I₂/100 g. High-Performance Liquid Chromatography (HPLC) analysis confirmed the characteristic phenolic composition of CNSL. These findings demonstrate that open-vessel MAE is a rapid, scalable, and environmentally benign approach for CNSL extraction, supporting the valorisation of agricultural waste and promoting CNSL as a viable feedstock for bio-based industrial applications.

Keywords: Anacardic acid, Cardanol, Cardol, CNS, CNSL, MAE

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