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A comparative study of supercritical fluid extraction and accelerated solvent extraction of lipophilic compounds from lignocellulosic biomass

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The Box-Behnken experimental design technique investigated a comparative study of supercritical fluid extraction (SFE) and accelerated solvent extraction (ASE) of lipophilic compounds from pinewood sawdust. A response surface methodology was used to examine the effect of independent parameters and optimize the extraction yield of lipophilic compounds. The results showed that the increase in extraction temperature used for ASE positively influenced the yield of lipophilic compounds, whereas an increase in the flow rate of the cosolvent at temperature 50 °C, and pressure of 300 bar increased the yield achieved by SFE. The experimental data's quadratic polynomial models gave a coefficient of determination (R2) of 0.87 and 0.80 for ASE and SFE, respectively. The optimum conditions of ASE were temperature (160 °C), static time (12.5 mins), and static cycle (1), which resulted in a maximum yield of 4.2%. The optimum SFE conditions were temperature (50 °C), pressure (300 bar), carbon dioxide (CO_2) flow rate (3.2 ml/min), and a 2 ml/min cosolvent flow rate that yielded 2.5% lipophilic compounds. ASE yielded higher extraction efficiency than SFE. Fourier transform infra-red (FTIR) spectroscopy and thermal analyses TGA/DSC evaluated the ultimate analyses of the lipophilic extracts. The FTIR results confirmed the presence of aliphatic groups, hydroxyl groups, and carboxyl groups. The thermal analysis showed that the degradation temperature of the lipophilic compounds occurred between 250 and 450 °C. Thereafter, Pyrolysis-Gas Chromatography Mass Spectrometry (Py-GC/MS) was used to identify the lipophilic compounds, which showed that the extracts were rich in fatty acids and terpenes.