

Coffee Oil extraction by Supercritical Carbon Dioxide. Pilot plant experimental study and extractor operation modeling.

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Spent coffee grounds remains as a solid residue after the extraction of coffee and constitutes the second-largest commodity in the world, which generates more than 6M tons of spent coffee grounds per year. It is a wet lignocellulosic biomass with concentrations of water higher than 60%. Until now it is considered a waste and its main use is its energy recovery. Its extractive composition is around 20%, with an oil concentration around 14% dried biomass. The high-water content is an important limitation to valorize the oil. Our research group use physical procedures to reduce the humidity that opens a sustainable way for oil and wet lignocellulosic biomass valorization (1)

Spent coffee grounds was extracted in a pilot plant for 1,5kg loads. The experiments were conducted at 50 °C and 300 bar, at two different flow rates 5 kg/h and 10 kg/h. The coffee oil yield was found as 14,0 wt.% and 16.7 wt.%, respectively. FTIR, oxidative stability and fatty acid composition characterization were conducted. Extraction curves were modeled by an open access phenomenological model (2). According to the model, external and internal mass transfer coefficients multiplied by the specific exchange area were found as 15.00 and 0.04 min⁻¹, respectively. After its validation the model allows to calculate the oil concentration profile in the solid and SC-CO₂ phase (3).

References

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