

Process study of caffeine supercritical extraction from yerba-mate

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ABSTRACT

In view of a paradigm shift from the traditional studies involving the production of natural products using supercritical extraction, which focus on laboratory and pilot scales, this paper proposed to extrapolate the results of the pilot scale to design an industrial unit for extraction of caffeine from the yerba-mate. The process of supercritical extraction, using CO₂ as a solvent, has been extensively studied, but there are fewer works about scale-up. Therefore, this work proposes to study the industrial supercritical fluid extraction of caffeine from yerba-mate to produce decaffeinated yerba-mate, an innovative product in the market, and caffeine, a product that has equal or even more value in the market than the main product. Design basis of this work are the experimental results of supercritical extraction in pilot scale and the appliance of a scale-up method based on the maintenance of the solvent mass flow and the raw-material mass flow proportion. Thus, process data sheet of main equipment were generated: extraction vessel, heat exchanger and high pressure pump. The maximum daily caffeine extraction capacity was estimated at 2 tons and the solvent mass flow rate of 20 ton.h⁻¹ was obtained from the equation residence time of the solvent, maintaining constant the porosity of the 0.79 bed obtained in scale pilot. In addition, a process flow diagram was proposed for an industrial scale plant supercritical extraction of caffeine from yerba-mate.

Keywords: *Ilex paraguariensis*, decaffeination, supercritical extraction, industrial scale