Poster GC30

Dynamic Simulation of the Supercritical Green Coffee Beans Decaffeination Process

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The dynamic simulation of the caffeine extraction process from green coffee beans with supercritical carbon dioxide has been performed and the influence of using more than two extractors in series in the extraction time schedule was investigated.

The mass transfer mechanism of the caffeine extraction from the solid coffee beans to the supercritical solvent is assumed to be governed by diffusion and the model took into consideration the effect of having caffeine rich streams from one extractor feeding the following in the cycle. Due to the caffeine rich streams, the number of extractors operating in series, the mass flow rate and the extraction time were optimized for both Robusta and Arabica beans in order to achieve the minimum residual amount allowed of caffeine in the processed coffee beans, of 0.01% wt. Experimental data was collected in a high-pressure pilot plant equipped with four extractors of 2 L capacity each and a countercurrent absorption packed column (4.2 m high, 4 cm internal diameter and Sulzer®packing). The caffeine content in the aqueous phase leaving the separation column as well as in the processed coffee beans was analyzed by HPLC. The mass transfer equations were solved using gPROMS software with finite differences formulation. The operational procedures, discontinuities and disturbances related with the changing extractors order in the extraction process were accounted in the model by defining loops cycles.

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