

A PILOT PLANT FOR SUPERCRITICAL FLUID EXTRACTION OF COCOA BUTTER FROM COCOA POWDER

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Theobroma cacao is one of the most traditional natural products of tropical countries. The extraction of cocoa butter from *Theobroma* is a significant step for adding value to the original material. This process is usually accomplished by mechanical expression of the cocoa nib (the fruit removed from the shell, dried, and toasted), which leaves in the cake (the so called cocoa powder) a significant content of cocoa butter. Because of the high price of cocoa butter as compared to other raw materials in the chocolate industry, there is an economical driving force for improving this extraction process, and for producing fat-reduced cocoa powders.

We have been studying the supercritical fluid extraction of cocoa butter from cocoa powder. An experimental effort developed in a previous work allowed us to estimate the operating conditions for designing and building a pilot plant. The plant has two 6 L extractors, two cyclonic separators and CO₂ recirculation, and uses a 50 kg/h pump. The pilot plant is designed for performing extractions at pressures up to 483 bar and temperatures from -5 to 100 °C. The plant is scalable to industrial size even in mechanical details.

Experiments with cocoa powder containing 12 wt% cocoa butter show that it is possible to produce cocoa powders greatly reduced in their fat content. In a typical extraction two cocoa butters with different fatty acid profiles are obtained. One that is richer in light fatty acids is obtained up to cocoa butter concentrations in the order of 2%, an another one richer in the heavier fatty acids at less than 2%. These results indicate that the production of cocoa butters with different properties (e.g., melting point) aimed for different applications is feasible using supercritical fluids technology.

Keywords: cocoa, pilot plant, supercritical extraction, natural matter.

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