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FLUIDIZED BED ROASTING MODIFYING THE MICROSTRUCTURE OF COCOA NIBS AND IMPROVING COCOA BUTTER QUALITY

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Abstract

The extraction of butter from cocoa seeds involves various processing steps that weak the lipid-storing cell walls of cocoa cotyledons. Roasting is particularly critical, making cocoa nibs porous and brittle. In this study, the degree of disruption of the microstructure of cocoa nibs, and the quality and aroma profile of cocoa butter, were evaluated using two roasting techniques, forced convective oven, and fluidized bed. Fluidized bed roasting, recognized for its energy efficiency and low-footprint synthesis, was more than 10 times faster than oven roasting. This technique allowed a fast release of steam when parenchyma cell walls were still in a glassy state, while oven roasting caused gradual physical modification allowing the cell wall to become more elastic. Consequently, when using fluidizing bed technique, small pores of unroasted cocoa nibs swelled and coalesced to produce more large-sized ones. 3-D microscopic image analysis showed a total porosity in unroasted cocoa beans of 8.5 $\pm$ 2.0% (v/v): this value doubled upon oven roasting and triplicated upon fluidized bed roasting. The higher porosity in fast-roasted nibs was reflected in the lowest densities and highest cocoa butter yield. Cocoa butter obtained from fluidized-bed roasted cocoa showed a higher presence of pyrazines and 3-methylbutanal, and a lower concentration of hydroperoxides, thus enhancing the chocolate flavor and quality. In this paper, we showed that pore-structure of cocoa nibs is a key quality descriptor of roasting processing, and we concluded by energetic and quality considerations that fluidized bed roasting of cocoa nibs should be preferred over conventional roasting.

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