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Drying of red bell pepper to produce paprika powder by coating process using maltodextrin and milk protein concentrate

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Extended Abstract

Introduction: Paprika, a powder derived from the drying and grinding of red bell peppers, is widely used in the food industry for coloring and flavoring purposes. It is rich in carotenoids, primarily capsanthin and capsorubin, which provide its characteristic color and potential health benefits. However, during the drying and processing of paprika, several challenges such as color degradation, loss of flavor compounds, and the development of bitter-tasting substances can compromise the quality of the product. This study focuses on optimizing the foam mat drying process of paprika using maltodextrin and milk protein concentrate as foaming agents to minimize the degradation of color and enhance the overall quality of the paprika powder.

Methods: The study employed a response surface methodology (RSM) to examine the effect of three variables maltodextrin concentration (0-10%), milk protein concentrate concentration (0-10%), and microwave power intensity (400-800 watts)—on the physical properties of paprika foam and powder. The experiments were designed using the central composite design (CCD) method, and the effects on the foam's color, stability, porosity, moisture content, yield, and morphology were evaluated. The foam was prepared by mixing paprika pulp with varying

concentrations of the foaming agents and then dried using a microwave at the specified power levels. The powder was then analyzed for its physicochemical properties, including its color, stability, porosity, moisture content, yield, and antioxidant activity.

Results: The study found that increasing the concentration of maltodextrin in the foam significantly improved the lightness (L*) and yellowness (b*) of the powder, with values ranging from 21.12 to 21.48 for L* and from 10.4 to 8.19 for b*. The porosity of the foam increased linearly with the milk protein concentration, although a quadratic effect indicated that higher concentrations eventually decreased porosity. Foam stability and color parameters (a* and b*) also increased with higher milk protein concentrate concentrations. Yield increased significantly with higher milk protein concentrate levels, while higher microwave power tended to decrease yield. Scanning electron microscopy (SEM) images revealed that the optimal sample, which consisted of 10% maltodextrin, 10% milk protein concentrate, and a microwave power of 400W, exhibited finer particles with smoother, softer, and scaly surfaces.

Discussion: The results suggest that maltodextrin and milk protein concentrate play crucial roles in improving the texture and color quality of paprika powder. Maltodextrin, as a foaming agent, helped enhance the color attributes of the foam by trapping air within the structure, thus increasing porosity and improving the lightness and yellowness of the final powder. The milk protein concentrate contributed to the structural stability of the foam, maintaining its porosity and improving the color stability during drying. The increased porosity and foam stability were linked to better retention of air, which in turn led to a reduction in drying time and an improvement in the powder's texture. Moreover, higher concentrations of milk protein concentrate facilitated better retention of the powder's antioxidant properties and total phenol content. However, higher microwave power negatively affected the yield, which may be attributed to faster drying that led to lower moisture retention.

Conclusion: The foam mat drying process with maltodextrin and milk protein concentrate as foaming agents proved to be an effective method for enhancing the quality of paprika powder. The study found that the optimal conditions for producing high-quality paprika powder were 10% maltodextrin, 10% milk protein concentrate, and 400W microwave power. Under these conditions, the paprika powder exhibited desirable color properties, high porosity, and improved stability. This research highlights the importance of optimizing drying parameters to maintain the nutritional and functional qualities of paprika, offering valuable insights for the food industry to produce superior-quality paprika powder with enhanced sensory and functional properties.

Keywords: Paprika powder, Microwave, Milk protein concentrate, Maltodextrin, Foam mat