

## **Potential Application of Crude Carotenoids Extracted from Mango, Papaya and Banana Peels as Natural Colourants in Jelly Based Products**

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The optimum conditions for extracting crude carotenoids from industrial fruit wastes were investigated in this study. A 3-factor-3-level Box-Behnken design of response surface methodology was employed to determine the effect of ethanol concentration, temperature and time on yield of crude carotenoids extracted from mango, papaya and banana peels. Extracting with 50% ethanol at 25 °C for 90 min, 50% ethanol at 42.4 °C for 30 min and 57.7% ethanol at 60 °C for 5 h resulted in optimum yields of crude carotenoids from mango peel (82.8%), papaya peel (62.2%) and banana peel (75.9%) respectively. The major pigments in the crude carotenoid extracted from mango, papaya and banana peels were  $\beta$ -cryptoxanthin,  $\beta$ -carotene and lutein respectively, as revealed by thin layer chromatography with 5% methanol in toluene as the mobile phase and activated silica as the stationary phase. The crude carotenoid extracts stabilized with polysorbate 80 was mixed with maltodextrin by vortexing. The mixture was homogenized and spray dried to obtain microencapsulated particles, which were found to be small, granular and well defined as revealed by scanning electron microscopy. The microencapsulated crude carotenoids were vacuum packaged in pouches made of metalized polyethylene terephthalate laminated with linear low density polyethylene and stored at 30, 4 and -20°C for 15 days in dark to determine their thermal stability during storage. Change in absorbance measured at 424, 452 and 445 nm for microencapsulated mango, papaya and banana crude carotenoids revealed 96.8, 95.2 and 98.3% stability on day 15 in storage at 30 °C respectively. Storage at 4 °C and -20 °C further increased their stability. Comparison of L\* a\* b\* values of jelly containing microencapsulated mango, papaya and banana crude carotenoids and the market samples containing artificial colourants revealed the potential use of microcapsules for imparting colour in jelly based products.

**Keywords:** Box-behnken design, Carotenoids, Microencapsulation