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Optimization of Extracted Pectin Yield from Discarded Lime (*Citrus aurantifolia* L.) Peels Using Response Surface Methodology

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Abstract

Pectin is a valuable structural polysaccharide, important as an ingredient in food industry that can be extracted from discarded citrus peels. Extraction of pectin from discarded lime peels and yield optimization open new avenue for waste management in fruit processing industry through giving value for waste in Sri Lanka to develop a green and economically viable waste valorization approach. The current study aims optimization of extraction conditions (pH; 1.5,2.25,3.0, extraction temperature; 80,90,100 °C and extraction time; 0.5,1.0,1.5 hours) in citric acid (0.5 N) assisted pectin extraction using lime (*Citrus aurantifolia* L.) peels and the optimization was done using three level three factor box-behnken design in response surface methodology. The Minitab 21 statistical software was used for the analysis and 15 different combinations of independent variables were tested. According to the model summary, the predicted yield can be offed by $\pm 2.08\%$ from the actual value and 97.92% of yield variability is explained by the model, exhibiting the excellent model fit. Moreover, the model can predict new data points with an accuracy of 96.33%. According to the analysis of variance (ANOVA), there was a significant ($p < 0.05$) linear (pH and temperature) and interaction effects between temperature and time on pectin yield. Under optimized conditions (pH 2.23,80 °C,1.5 hours), experimentally $42.35 \pm 0.15\%$ of pectin yield was obtained, agreeing with the predicted value (43.15%). The characterization of the extracted pectin was also done using methoxyl content ($3.4 \pm 0.8\%$), equivalent weight (319.3 ± 51.6 g/mol), total anhydrouronic acid content ($75.1 \pm 12.8\%$), degree of esterification ($25.2 \pm 2.4\%$) and emulsifying activity ($53.2 \pm 2.3\%$). Moreover, the FTIR spectroscopy confirms the presence of pectin with the characteristic peaks related to pectin. The current study provides insight to maximize the pectin yield using citric acid assisted extraction method by optimizing extraction conditions; pH, temperature and time as a sustainable solution for waste management of discarded citrus peels in the food industry and turn waste into money as an avenue for new industry in Sri Lanka.

Keywords: *Extraction optimization, Pectin, Response surface methodology, Box-behnken design, Yield*