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PROCESS OPTIMIZATION OF WATER JET EXTRACTION OF POMEGRANATE ARILS USING RESPONSE SURFACE METHODOLOGY

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ABSTRACT Jet impinging method was employed for extracting arils from pomegranate fruit. The method is based on extracting the arils with the help of water jets while broken open pomegranate is in motion during jet impinging. Response surface methodology was used to determine the optimum processing conditions that yield maximum extracted arils and minimum mechanical damage to them. The independent variables were water pressure, nozzle diameter, reciprocating speed of nozzle, number of nozzles, and speed of pomegranate conveyor. The coefficient of determination, R^2 values for extraction efficiency and percentage of damaged arils were greater than 0.900. The complex interaction of these variables was investigated and two quadratic mathematical models were derived for the prediction of extraction efficiency and damage amount. The analysis of variance showed that nozzle diameter was the most significant factor affecting extraction efficiency and integrity of arils. An increase in water pressure, number of nozzles and/or decrease in nozzle diameter, conveyor speed, resulted in an increase in extraction efficiency and also increase of damaged arils. Based on surface and contour plots, optimum conditions for water jet extraction of pomegranate aril were: water pressure 327 kPa, nozzle diameter 4.3 mm, reciprocating speed of nozzle 36 cm/s, conveyor speed 1.1 cm/s and three nozzles. This study showed that RSM could effectively be applied for the modeling of extraction process and to find an operating optimum condition to achieve maximum extraction efficiency and minimum damage of arils.

Keywords: Water jet, Extraction, Pomegranate arils, RSM, Punica garanatum