MICROENCAPSULATION OF ULTRASOUND EXTRACTED JAMUN JUICE BY SPRAY DRYING

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ABSTRACT OF THESIS

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ABSTRACT

Jamun (*Syzygium cuminii*) is an under-utilized fruit tree from Indian subcontinent. The promising values of phytochemicals, minerals and vitamins gives a great therapeutic value for jamun. Jamun is a seasonal fruit. To reduce its post-harvest losses, various value-added products can be produced from jamun's pulp, juice, and seeds. Processing and preservation techniques must be adopted to ensure the availability of jamun throughout the year. Common unit operations to be performed in jamun processing include juice extraction and drying. Though jamun contains 80% pulp, conventional extraction methods yield relatively low juice. Therefore, an improved extraction method is essential to enhance both yield and nutritional quality. Ultrasound, a promising "green technology," offers an efficient alternative for juice extraction, while spray drying is one of the best drying techniques for liquid foods. The process parameters for ultrasound-assisted extraction of jamun juice were optimized based on the quality attributes of the extracted juice. Three levels of US treatment temperature (10,20,30°C), exposure time (30,60,90 mins) were selected for extraction study. A solid - liquid ratio of 2:1 was fixed based on the preliminary trials of extraction. The response variables selected were pH, TSS, acidity, total phenolic content, total anthocyanin content, antioxidant activity and yield, respectively. Central composite design was framed for the experimental design. Optimization of process variables for extraction process was done based on the quality attributes of the extracted jamun juice. The optimized process variables for juice extraction were determined to be a treatment temperature of 30°C, an extraction time of 60 minutes and a solid-to-liquid ratio of 2:1. For spray drying, Box- Behnken design was selected as the experimental design with three process variables of inlet air temperature (140,150,160°C), feed rate (8,10,12 rpm) and carrier concentration of (15,20,25%). From the preliminary trials conducted, maltodextrin and gum arabic, used as carrier materials, were found to be most effective for spray drying jamun fruit juice when combined in a 3:1 ratio. The response variables selected for spray drying were powder yield, moisture content, water activity, bulk density, tapped bulk density, wettability, dispersibility, solubility, total anthocyanin content and total colour difference. The process optimization for ultrasound extracted,

spray dried jamun juice powder identified the optimal variables as an inlet air temperature of 160°C, a feed rate of 10 rpm, and a carrier concentration of 21%. The optimized sample contained a powder yield of 65%, moisture content of 3.9% water activity of 0.29, bulk density of 0.29 g/cm^3, tapped bulk density of 0.43 g/cm^3, wettability of 71 seconds, dispersibility of 92%, solubility of 96%, total anthocyanin content of 690 mg/100 mg, and a total colour difference of 46, respectively. The SEM images showed that the ultrasound treated powder contained smaller sized particles compared to the untreated powder. FTIR analysis confirms that the optimized powder contains important phenolic groups, as indicated by the presence of various bonds in the spectrum. The encapsulation efficiency of the anthocyanins was achieved as 96%. The proximate composition of the optimized spray-dried jamun juice powder was found to be 354.76 kcal of energy, 81.1% carbohydrate, 4.9% protein, 1.5% total fat, 24.56% total sugar, 1.2% total ash, and 0.3% fibre, respectively. Sensory evaluation showed that the optimized powder sample had high acceptability with a satisfactory score of 7.85. After 90 days of storage, samples stored under metalized polyester pouches provided good results based on quality parameters. The benefit-cost ratio of the US extracted jamun juice powder spray drying was found to be 1.1:1 with payback period of 2.84 years.