THERMAL AND NON-THERMAL EXTRACTION AND PASTEURIZATION OF RED DRAGON FRUIT JUICE

by

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THESIS

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ABSTRACT

This thesis entitled “Thermal and non- thermal extraction and pasteurization of red dragon fruit juice” investigates the application of novel non-thermal and thermal processing technologies—pulsed electric field (PEF), ultrasound (US), and retort pasteurization—for enhancing juice extraction, preservation, and storage stability in red dragon fruit (*Hylocereus polyrhizus*). Due to the fruit's high perishability and complex pulp structure, traditional extraction methods often compromise juice yield and quality. The study aimed to (1) optimize US and PEF pretreatment parameters to maximize juice extraction, (2) evaluate PEF and retort pasteurization for quality preservation and enzyme inactivation, and (3) assess the shelf life of treated juices during refrigerated storage. Experimental results revealed that US pretreatment (40 % amplitude and 10 min treatment time) significantly enhanced juice yield (72.83%) and retention of bioactive compounds - betacyanins (10.08%), total phenolics (19.13%), and antioxidant activity (12.33%) - outperforming PEF pretreatment. PEF pasteurization (40 kV/cm, 21 μs, 600 pulses) effectively inactivated polyphenol oxidase (14.6%) and peroxidase (7.2%) while preserving nutritional quality. Retort pasteurization (90°C, 5 min) provided superior microbial stability, retaining over 90% of phenolics and antioxidant activity post-processing. Storage studies over two months confirmed better retention of betacyanins and antioxidant activity in PEF-treated juice, though retort pasteurization better controlled microbial growth. FTIR analysis and sensory evaluation supported the preservation of molecular and sensory quality in both treatments. Economic analysis indicated that both PEF and retort pasteurization are commercially viable, as they exhibit equal benefit-cost ratios. The findings establish ultrasound-assisted extraction and PEF pasteurization as promising technologies for producing high-quality, functional dragon fruit juice, while retort processing offers cost-effective shelf life extension. This research provides a foundation for scaling innovative processing methods in the functional beverage industry.