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Microbial response and process stability under sodium reduction in Castelvetrano table olives

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Table olives are widely consumed throughout the Mediterranean basin. The main processing styles (Greek, Seville, Californian, and Castelvetrano) rely heavily on sodium-based agents (NaOH/NaCl), with public health implications, given the world health organization (WHO) recommendations to reduce sodium intake, and for the management of saline effluents. In the framework of responsible, sustainable, and socially inclusive innovation co-developed by industry and academia, this study examines the technical and microbiological feasibility of partially or fully replacing sodium with potassium (KOH/KCl) in the Castelvetrano process, which typically results in higher sodium levels than the Greek or Sevillian methods. Three treatments were prepared in triplicate: a sodium-based control (CS), total replacement with potassium (CP), and a 1:1 sodium-potassium substitution (CSP). Over 180 days, microbiological [absence/presence of spoilage and pathogenic microorganisms; dynamics of lactic acid bacteria (LAB) and yeasts] and physicochemical parameters (pH and salinity) were monitored. Sodium reduction, whether total or partial, proved technologically feasible. Microbiological stability was observed, with no detection of spoilage or pathogenic microorganisms. LAB and yeast populations followed trends comparable to the control, indicating that beneficial microbes adapt effectively to KCl/KOH environments. The pH and salinity profiles closely matched the control, consistent with findings reported for other non-Castelvetrano styles. These results support the feasibility of reformulating table olives for improved health profiles while preserving the technological and traditional characteristics of the Castelvetrano method. Benefits may extend to salt-sensitive populations (e.g. individuals with hypertension) and to environmental management through reduced saline wastewater loads. The co-creation approach between industry and the SAAF Department, demonstrate high transferability of the method, fostering transparency, traceability, and constructive engagement with stakeholders (consumers, operators, and regulatory bodies), in alignment with the principles of Responsible Research and Innovation. Future work will address sensory performance, regulatory assessments, and life cycle environmental and economic impacts to support large-scale industrial adoption.

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