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Ultrasound, Proteases, and Aging on Lees affect Protein Stability and Nitrogenous Flavor-Related Compounds in Malvazija Istarska Wine

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The aim of this study was to evaluate the impact of different technological interventions on protein stability, pathogen-related (PR) protein concentrations, and the levels of amino acids and oligopeptides associated with umami flavor and the kokumi effect in Malvazija istarska wine. Grape juice was treated with ultrasound (US), Aspergillopepsin I enzyme (E), or their combination (US+E), with untreated juice as a control (C). After fermentation, produced wines were aged on fine lees with bâtonnage for 3.5 months. Protein stability was assessed by determining bentonite requirements using the standard heat test, with additional evaluation via quick heat and cold tannin tests. High-performance liquid chromatography (HPLC-DAD) was used to carry out PR protein analysis, while amino acids and oligopeptides were analyzed by ultra-high-performance liquid chromatography/mass spectrometry (UHPLC-MS/MS). Wines fermented with Aspergillopepsin I (E and US+E) required significantly lower bentonite doses for stabilization compared with C and US wines. Aging on lees further reduced bentonite requirements in C, E, and US wines. PR protein concentrations, particularly those of the chitinase family, showed a parallel decline, mirroring the reduced bentonite needs. E and US+E treatments yielded the highest concentrations of most amino acids and oligopeptides. In particular, E treatment significantly increased L-glutamic acid, a key contributor to umami taste, compared with C and US, and also elevated total kokumi oligopeptides relative to C. Aging on lees altered amino compound profiles in E and US+E wines, including a reduction in total tripeptides and kokumi oligopeptides, though γ-Glu-Val-Gly, the most potent kokumi compound, remained unaffected.

Keywords:
Bentonite, Pathogen-related proteins, Aspergillopepsin I, Umami flavor, Kokumi effect, Malvazija istarska

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