

Evaluation of sustainable fining strategies using non-animal proteins in Port wine clarification

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Background: Fining remains a key technological step in Port wine production, traditionally relying on animal-derived proteins to improve visual quality and stability [1]. Increasing regulatory pressure, sustainability concerns and evolving consumer preferences have intensified the search for allergen-free and non-animal alternatives [2]. **Objectives:** This work aimed to evaluate the clarification efficiency and economic impact of non-animal-based fining agents applied to different Port wine styles. **Methods:** Eleven fining treatments were evaluated, including ten alternative agents of plant, yeast and fungal origin and gelatine as reference. Trials were carried out on White, Ruby and Tawny Reserve Port wines, testing three dosage levels per agent within commercial recommendations. Bentonite (45 g/hL) was applied to limit overfining, and appropriate controls were included. Clarification performance was assessed by spectrophotometric measurement of colour intensity (CI), and an economic analysis was conducted based on dosages identified as effective and market prices. **Results:** Among the tested alternatives, liquid pea protein and solid yeast-derived protein exhibited the highest reductions in CI across the evaluated wines. However, both alternatives resulted in substantially higher treatment costs compared with gelatine, with increases ranging from approximately 4-fold to 24-fold higher, depending on wine style. **Conclusions:** Non-animal fining agents can provide clarification performances comparable to gelatine, although their current economic impact remains a relevant limitation. Nevertheless, the results support the identification of promising candidates for industrial-scale validation and contribute to the development of more sustainable and vegan-compatible Port wine production.

Keywords: sustainable fining; Port wine; non-animal proteins; clarification; economic assessment

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