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Faba bean tofu - the role of salt coagulants on curd formation and water-mobility

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Abstract

Faba bean (Vicia faba L.) is emerging as promising candidate to contribute to a more sustainable food system due to its high protein content (25–35% d.b.), soil nitrogen-fixing benefits, and substantial global production of 6.77 million metric tons in 2022 [1][2]. Despite this potential, faba bean remains largely unexplored for established plant-based food applications including the production of tofu. Currently, there is no systematic characterisation of coagulant influence on structure and texture, equivalent to that established for soy-based tofu.

This study investigated the effect of coagulant type ($CaSO_4$, $MgSO_4$, and $MgCl_2$) and concentration (5, 10, and 20 $mmol \cdot L^{-1}$) on curd formation, microstructure, water mobility, and textural properties of faba bean tofu produced via a traditional process. Mild aqueous extraction from dehulled and split faba bean seeds yielded protein-rich milk (64.1% protein content, 77.8% recovery d.b.), confirming the feasibility of adapting conventional tofu-making to faba bean processing.

All three coagulants achieved high protein recovery from the milk (84.7–91.7%), but produced distinct gel networks. $CaSO_4$ generated open networks with high water mobility (NMR T_2 relaxation times up to 836.1 ms) and decreasing water-holding capacity with increasing concentration. $MgCl_2$ produced compact networks with restricted water mobility (T_2 25.9–35.7 ms) and high water-holding capacity. These microstructural differences translated directly into textural variation in pressed tofu: $CaSO_4$ yielded the firmest products (hardness 5.6 N), while magnesium salts produced softer tofu (hardness 2.4–3.2 N), as measured by Texture Profile Analysis at 50% deformation.

This work establishes faba bean as a viable soybean alternative for tofu production, demonstrating that coagulant selection is a critical lever for tailoring product texture across a wide range from soft, high-moisture to firm gels.

References

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