

Enzymatic Coagulation of Chickpea-Based Plant Beverage Using Artichoke-Derived Enzyme

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This study aims to evaluate the potential of enzymatic extract derived from artichoke to induce coagulation in a plant-based beverage formulated from chickpeas. The goal is to explore plant-based alternatives to traditional animal rennet for the development of clean-label dairy-free products.

To obtain the enzymatic extract, dried artichoke flowers were homogenized in 50 mL of 50 mM sodium citrate buffer at pH 5.0. The homogenate was then centrifuged at 8500 rpm for 30 minutes. The resulting supernatant, containing crude enzymatic extract, was collected and used directly for the coagulation trials. The enzymatic extract was subsequently characterized for its proteolytic activity, milk-clotting activity, and bioactive compound content (Total polyphenols and flavonoids).

The chickpea-based beverage was prepared by soaking, grinding, cooking and filtering chickpeas to obtain a smooth plant beverage.

The chickpea-based plant beverage was prepared by soaking, grinding, and filtering chickpeas. Enzymatic coagulation trials were conducted using a Central Composite Design (CCD) as part of a Response Surface Methodology (RSM) approach. Three independent variables were studied: enzyme concentration, coagulation time, and temperature. The effects of these parameters on coagulation efficiency were evaluated through pH monitoring, Texture, Electrical conductivity and Turbidity.

The enzymatic extract obtained showed high proteolytic and coagulant activities (1290.32 U/mg and 81.63 RU/mL respectively), confirming its potential as a natural coagulant. In addition, the extract was found to be rich in antioxidant compounds, notably total phenolics (296.21 mg EAG/g) and flavonoids (265.13 g ER/g), which contribute to its functional value.

The statistical analysis of the response surface model allowed the determination of an optimal combination of the three factors, leading to favorable coagulation conditions, which are 2571.82 U/mg of enzyme, during 3 minutes at 60° C.

Under these optimal conditions, the coagulated beverage exhibited low final pH, increased turbidity, high gel firmness (texture), and significant reduction in conductivity, indicating effective protein network formation and aggregation.

The final coagulated product was characterized by a high protein content (8.82%), notable retention of bioactive compounds such as total polyphenols (339.51 mg EAG/ g) and flavonoids (294.9 mg ER/ g), and a good yield of curd formation (38.13%). These results highlight the technological and nutritional potential of chickpea-based plant beverages coagulated with a natural, plant-derived enzyme.

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