

Enhancement of Flavor Compounds in Umami Condiment Fermentation by Extruded Gluten Modification

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Abstract

Gluten is a widely available plant protein, yet its application in umami condiment fermentation is limited by its tendency to agglomerate and resist enzymatic hydrolysis. This study aimed to investigate the effects of twin-screw extrusion modification on the microstructure of gluten and its subsequent impact on fermentation efficiency and flavor metabolite formation. Gluten, blended with wheat starch and soy protein isolate (SPI) in varying ratios, was subjected to extrusion and utilized as raw material for *Aspergillus oryzae* koji and moromi fermentation over 150 days. The structural changes were analyzed using scanning electron microscopy (SEM), while flavor compounds were quantified via HPLC and GC-MS. Results demonstrated that extrusion significantly modified the gluten microstructure, transforming rough, irregular particles into smoother, porous structures. This physical alteration prevented the agglomeration observed in non-extruded control groups and facilitated the penetration of water and enzymes into the inner layers of the substrate. Consequently, the fermentation efficiency was markedly improved. The final amino acid nitrogen content in the extruded groups ranged from 0.80 g/100 mL to 1.05 g/100 mL. Furthermore, the extruded samples exhibited significantly higher levels of umami-enhancing substances, including glutamic acid, adenosine monophosphate (AMP), and guanosine monophosphate (GMP), along with increased concentrations of organic acids such as acetic and lactic acid. The addition of SPI further enriched the volatile profile of the condiment. In conclusion, extrusion modification effectively enhances the bio-utilization of gluten, accelerating fermentation and yielding a product with a superior sensory profile rich in umami and characteristic aromas. This research provides a promising strategy for the industrial production of high-quality gluten-based condiments.

Keywords

Gluten, Extrusion, Fermentation, Umami Condiment, Flavor Compounds, *Aspergillus Oryza*