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RSST007 - DEVELOPMENT OF MUSHROOM PROTEIN HYDROLYSATE AS FLAVOUR ENHANCER: ITS PHYSICOCHEMICAL PROPERTIES AND SENSORY ACCEPTABILITY

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ABSTRACT

The increasing demand for natural and healthier flavour alternatives has spurred interest in mushroom protein hydrolysates (MPH) as potential substitutes for monosodium glutamate (MSG). This study developed MPH from *Agaricus bisporus* and *Pleurotus ostreatus* using bromelain enzyme and evaluated their physicochemical properties and flavour-enhancing potential. The hydrolysates were characterized based on degree of hydrolysis (DH), moisture, crude protein, ash, pH, colour analysis, amino acid composition using High-Performance Liquid Chromatography (HPLC) with a fluorescence detector together with amino acid column and identification of volatile compounds using gas chromatography-mass spectrometry (GCMS). Additionally, their sensory acceptability was evaluated by incorporating different concentrations (3% and 5%) of MPH into chicken soup formulations. A 9-point hedonic scale was used to assess consumer perception in terms of colour, aroma, umami, saltiness, aftertaste and overall acceptability. The results revealed that *A. bisporus* hydrolysate demonstrated a significantly higher degree of hydrolysis, crude protein, ash and total amino acids compared to *P. ostreatus*. Notably, *A. bisporus* contained higher levels of flavouractive amino acids such as glutamic acid and aspartic acid, indicating greater umami potential. However, sensory evaluation showed that MSG remained the most preferred. Among the mushroom hydrolysates, *P. ostreatus* at 3% concentration had the highest overall acceptability suggesting its suitability as a natural flavour enhancer in soup products. The novelty of this research lies in its comparative analysis of two mushroom species for hydrolysate development using enzymatic hydrolysis. Its significance is reflected in the potential application of MPH as a clean-label alternative to synthetic additives, contributing to healthier food innovation.

Keywords – mushroom protein hydrolysates, flavour enhancer, MSG, A. bisporus, P. ostreatus

INTRODUCTION

The rising demand for clean-label and natural food products has driven the development of alternative flavour enhancers that are both functional and health-promoting (Ang & Ismail– Fitry, 2019). Mushrooms, particularly *A. bisporus* and *P. ostreatus* are well-known for their nutritional value and unique umami flavour profile. Through enzymatic hydrolysis, these mushrooms can be converted into mushroom protein hydrolysates (MPH) which release amino acids and peptides that enhance savoury flavours (Ang & Ismail–Fitry, 2019; Babu et al., 2024; Kimatu et al., 2017). MPH also offers additional health-related benefits such as improved digestibility and the presence of bioactive compounds that make it a promising substitute for synthetic additives like monosodium glutamate (MSG) (Sheng et al., 2022).

Despite existing research, there is limited comparative data on the physicochemical properties and flavour-enhancing compounds of MPH derived from different mushroom species. Additionally, consumer acceptance of MPH at various concentrations in food products such as soups has not been clearly established in relation to MSG. This study was developed to address these gaps by analysing the compound profiles and sensory acceptability of MPH produced from *A. bisporus* and *P. ostreatus* with a focus on determining their suitability as natural flavour enhancers.

The motivation behind this research lies in the global shift toward healthier and more sustainable food systems. MPH offers a natural and plant-based solution that aligns with consumer trends while potentially reducing sodium content in savoury products. The identification of the potential mushroom species and suitable concentration levels for flavour enhancement supports the food industry's innovation efforts and addresses both health and sensory quality demands. This product also contributes to Sustainable Development Goals (SDG) such as SDG 3 (Good Health and Well-being), SDG 9 (Industry, Innovation and Infrastructure) and SDG 12 (Responsible Consumption and Production).

OBJECTIVE

This study was carried out with two main objectives. The first objective is to evaluate the physicochemical properties and compound profiling of mushroom protein hydrolysates (MPH) prepared from *A. bisporus* and *P. ostreatus*. This includes the analysis of degree of hydrolysis, moisture, crude protein, ash content, pH, colour, amino acid composition and volatile compounds. The second objective is to assess the sensory acceptability of soups incorporated with different concentrations of MPH in comparison to monosodium glutamate (MSG) using a 9-point hedonic scale to determine consumer preference.

METHODOLOGY

The production of mushroom protein hydrolysate (MPH) involved several stages: sample preparation, enzymatic hydrolysis, physicochemical analysis and sensory evaluation. Fresh mushrooms (*A. bisporus* and *P. ostreatus*) were cleaned, sliced and blended with water to form a slurry. Enzymatic hydrolysis was carried out by adding bromelain (0.5% w/w) to the slurry, the pH was adjusted to 6.5 and incubated at 50–60 °C for 3 hours. The enzyme was inactivated at 85 °C for 20 minutes, followed by cooling, centrifugation and collection of the supernatant. The supernatant which contains MPH was then freeze-dried at –60 °C to obtain the final powder. Physicochemical analyses were conducted to determine moisture, ash, protein, pH, colour, degree of hydrolysis and yield. Compound profiling was performed using High-Performance Liquid Chromatography (HPLC) with a fluorescence detector for amino acids and Gas Chromatography–Mass Spectrometry (GC-MS) for volatile compounds. Lastly, sensory evaluation was conducted by incorporating MPH was into chicken soup formulations at 3% and 5% concentrations. These were compared to a control sample with 3% monosodium glutamate (MSG) and a plain sample without any enhancer. Sensory acceptability was evaluated using a 9-point hedonic scale to assess umami, aroma, colour, saltiness, aftertaste and overall liking. Statistical analysis was conducted to determine significant differences among samples.

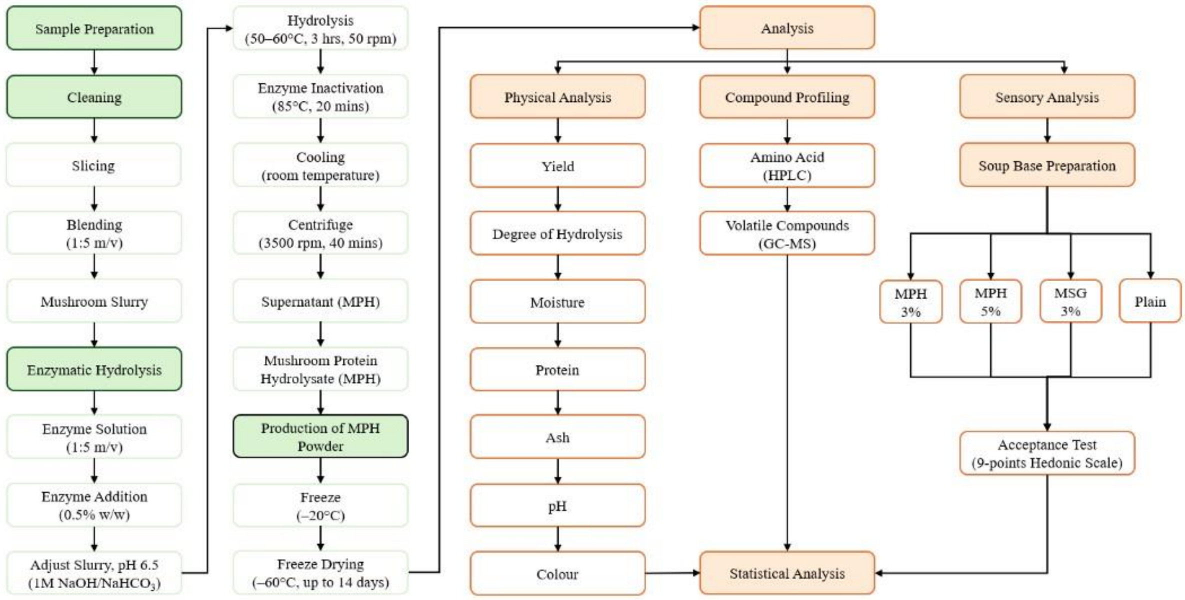

Figure 1: Overall experimental design of development of mushroom protein hydrolysate

RESULTS AND DISCUSSION

The physicochemical analysis of mushroom protein hydrolysates (MPH) revealed notable differences between the two mushroom species. *A. bisporus* hydrolysate demonstrated a higher degree of hydrolysis, crude protein, ash content and total amino acid concentration compared to *P. ostreatus*. The moisture content for both hydrolysates fell within the recommended range of 5–8% (Rubina & Aivars, 2021) with slightly higher levels attributed to the naturally porous and fibrous structure of mushroom tissues which contributes to increased moisture retention during drying (Sharma et al., 2024). Although ash content is not directly flavour-active, it plays a role in the nutritional value and may influence the perceived saltiness due to the presence of soluble minerals and their contribution to the ionic strength of the hydrolysate (Granite, 2024). Additionally, amino acid profiling using High Performance Liquid Chromatography (HPLC) with a fluorescence detector showed that *A. bisporus* contained higher levels of glutamic acid and aspartic acid, both of which are associated with umami taste enhancement. Volatile compound analysis using Gas Chromatography–Mass Spectrometry (GC-MS) revealed that *A. bisporus* exhibited higher levels of fatty acid esters, contributing to a creamier and milder aroma profile. In contrast, *P. ostreatus* showed a greater presence of phenolic compounds that result in a more intense and bitter aromatic character.

Sensory evaluation was conducted by incorporating MPH into chicken soup formulations at 3% and 5% concentrations alongside a plain control and a 3% MSG as negative and positive control. Among all samples, MSG was the most preferred. However, *P. ostreatus* at 3% concentration received the highest scores among the MPH samples particularly in terms of overall acceptability which suggest a more balanced flavour profile. Despite *A. bisporus* showing higher levels of flavour-active compounds, the sensory results indicate that consumer perception may favour the milder characteristics of *P. ostreatus* at lower concentration levels. These findings support the potential of MPH as a natural alternative to synthetic flavour enhancers with each mushroom species offering unique functional and sensory advantages for application in savoury food products.

CONCLUSION

This study successfully evaluated the physicochemical properties and sensory acceptability of mushroom protein hydrolysates (MPH) derived from *A. bisporus* and *P. ostreatus* as natural alternatives to monosodium glutamate (MSG). The findings revealed that *A. bisporus* hydrolysate exhibited a higher degree of hydrolysis, protein content, ash and total amino acids including glutamic acid and aspartic acid suggesting its stronger flavour enhancing potential. However, sensory evaluation results showed that *P. ostreatus* at 3% concentration achieved the highest overall acceptability among MPH samples despite MSG still being the most preferred. This highlights the potential of *P. ostreatus* to serve as a natural flavour enhancer in savoury soup formulations. Overall, the study demonstrates that mushroom protein hydrolysates offer promising clean-label alternatives to synthetic flavour enhancers with each mushroom species presenting unique functional and sensory advantages. These findings support the development of healthier and more sustainable food products in line with current consumer trends.

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