

The Impact of Edible Red Fungus, *Monascus* sp., in Sourdough

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Structured Abstract

Background: Sourdough (SD) bread is increasingly popular due to its nutritional advantages, such as improved digestibility and gut health. However, its dull appearance and presence of gluten can reduce its appeal to certain consumers. Concurrently, there is a growing demand for clean-labels, and naturally derived food ingredients. *Monascus* sp., an edible red fungus traditionally used in Asian fermented foods. *Monascus* sp., which produces red pigment, has gained attention due to its ability to synthesise natural pigments, enzymes, and bioactive compounds with potential gluten-degrading properties. Despite this promise, its growth and pigment production are influenced by environmental factors such as temperature and pH, limiting its application in SD bread.

Methods: This study aimed to optimise *Monascus* growth and pigment synthesis under varying conditions and evaluate the impact of its incorporation in SD bread. *Monascus* was cultured on potato dextrose agar (PDA), and its growth was assessed across a range of temperatures and pH levels. An SD starter was developed using *Lactobacillus paracasei* and yeast, *Saccharomyces cerevisiae*, under controlled fermentation. Due to safety concerns, red yeast rice (RYR) powder was used instead of live fungal culture for bread incorporation. Gas chromatography-mass spectrometry (GC-MS) was used to analyse fermentation metabolites. A sensory evaluation was conducted by 22 testers.

Results: Optimal growth and pigment production for *Monascus* occurred at 30°C and pH 5.5. SD bread enhanced with RYR powder (referred to as MonaLoaf) showed significant improvements in crust thickness, crumb colour, volume, and aroma. Sensory evaluation revealed that 81.8% of testers preferred MonaLoaf due to its appealing appearance and unique flavour. GC-MS analysis confirmed the presence of distinctive bioactive metabolites associated with *Monascus* fermentation.

Conclusion: The incorporation of *Monascus* into SD bread enhanced both visual and sensory attributes, alongside the presence of beneficial bioactive compounds. MonaLoaf shows the potential of *Monascus* as a valuable natural ingredient in functional and clean-label bakery products.

Keywords: Enhanced sourdough, *Monascus*, MonaLoaf, natural pigment, sensory analysis

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