

SOCIALIST REPUBLIC OF VIETNAM

Independence – Freedom – Happiness

Danang, May 31, 2026

REPORT ON THE NOVEL CONTRIBUTIONS OF THE DOCTORAL DISSERTATION

Dissertation title: *Extraction and evaluation of the prebiotic activity of polysaccharides derived from mushroom mycelia (Cordyceps militaris and Trametes versicolor) and their biomass application in food supplement.*

Major: Food Technology

Major Code: 9.54.01.01

Doctoral candidate name: Ms. Nguyen Thi Bich Hang

Cohort: K2021

Academic supervisor 1:

- Name: Assoc. Prof. Dr. Dang Minh Nhat
- Affiliation: University of Science and Technology, The University of Danang

Academic supervisor 2:

- Name: Dr. Nguyen Hoang Dung
- Affiliation: Institute of Tropical Biology, Vietnam Academy of Science and Technology

Training Institution: University of Science and Technology, The University of Danang

NOVEL CONTRIBUTIONS OF THE DOCTORAL DISSERTATION

Academic contributions:

Systematization of scientific knowledge on submerged cultivation technology: The dissertation established several optimal technological conditions for the submerged cultivation of *Cordyceps militaris* and *Trametes versicolor* to promote the biosynthesis of polysaccharide-rich fungal biomass. These findings provide an important scientific basis for elucidating the effects of environmental factors (pH, carbon sources, and nitrogen sources) on biomass accumulation and intracellular polysaccharide production in fungal cells.

Elucidation of the effectiveness of sequential extraction techniques: The study demonstrated the superiority of sequential extraction methods in fractionating polysaccharides according to their structural characteristics and solubility properties. A notable novel finding is that the acid-extracted polysaccharide fraction (A-PS), which has received limited attention in previous studies, exhibited the most promising prebiotic activity, as evidenced by the highest Prebiotic Index (PI) values for several probiotic strains. This discovery opens a new avenue for exploiting tightly bound polysaccharides present in fungal cell walls.

Providing a scientific foundation for the discovery of novel bioactive polysaccharides: The

research outcomes establish a foundation for further purification, isolation, and identification of novel polysaccharides derived from fungal mycelial biomass, particularly those possessing distinctive antioxidant and prebiotic properties.

Confirmation of the prebiotic potential of fungal mycelial biomass: The dissertation provides reliable experimental evidence demonstrating that fungal mycelial biomass functions as an effective prebiotic substrate. It selectively stimulates the growth of beneficial microorganisms, including *Lactobacillus* pp. and *Bifidobacterium* spp., while inhibiting pathogenic bacteria such as *Escherichia coli* and *Staphylococcus aureus* through the production of short-chain fatty acids (acetic, propionic, and butyric acids).

Practical contributions:

Proposing a technological solution for sustainable raw material production: The dissertation demonstrated the feasibility of submerged cultivation for producing fungal mycelial biomass as a valuable source of organic raw materials for food and pharmaceutical applications. This approach offers several advantages, including stable production, high productivity, short cultivation cycles, ease of industrial-scale implementation, controllable cultivation conditions, and compatibility with automation systems. These findings provide an important foundation for diversifying raw material production models beyond traditional fruiting-body cultivation.

Diversification of prebiotic sources for industrial applications: While commercially available prebiotics are currently derived primarily from plant sources (e.g., fructooligosaccharides and inulin) and marine algae (e.g., fucoidan and carrageenan), the results of this dissertation indicate that fungal mycelial biomass represents a promising alternative source of prebiotics. Furthermore, cultivation conditions can be precisely controlled to facilitate large-scale industrial production.

Successful development of a probiotic-rich fermented beverage with enhanced antioxidant activity: The dissertation successfully developed a technological process for producing a fermented beverage from *Pleurotus* mushrooms supplemented with *Trametes versicolor* mycelial biomass. The resulting product not only satisfied food safety requirements but also demonstrated the successful integration of prebiotic components (mushroom mycelia) and probiotic microorganisms (fermentative bacteria) to create a high-value functional food product with strong potential for technology transfer and commercial application.

Supervisors

Doctoral candidate

Assoc.Prof.Dr. Dang Minh Nhat

Dr. Nguyen Hoang Dung

Nguyen Thi Bich Hang