

Tutor's Summary and Review of the Doctoral Thesis

Doctoral Candidate: Shweta Gautam

Dissertation Title: *Natural Antioxidants and Their Use in Food Technology*

Study Programme: Chemistry and Technology of Foodstuffs (N0724A290012)

Faculty: Faculty of Technology, Tomas Bata University in Zlín

Supervisor: Prof. Ing. Lubomír Lapčík, Ph.D.

Co-supervisor: doc. Ing. Barbora Lapčíková, Ph.D.

The doctoral thesis submitted by Shweta Gautam represents a comprehensive and well-executed study in the interdisciplinary field of food packaging technology, biomaterials, and applied antioxidant systems. The main objective of the work was the development of an innovative, crosslinked, polysaccharide-based biodegradable packaging material incorporating encapsulated essential oils (EOs), with the aim of enhancing food preservation through the natural antioxidant properties of these active components.

The thesis is structured in a logical and coherent manner, progressing from the conceptual design of the biopolymer films, through a robust phase of formulation and characterisation, to the final application on real food matrices (ground chicken and beef). The scientific methodology applied throughout the thesis is sound and includes experimental design based on mathematical modelling, an extensive suite of physicochemical and mechanical tests, and advanced multivariate analysis for data interpretation.

The results demonstrate that the developed films exhibit desirable technological and functional properties, including strong antioxidant capacity, high resistance to water vapour, moderate mechanical strength, and effective antimicrobial activity against gram-negative bacteria. Particularly noteworthy is the study's application phase, which confirms the films' efficacy in delaying oxidative spoilage and microbial growth in meat products, highlighting their potential for replacing conventional plastic packaging.

The doctoral candidate has shown a high level of independence, critical thinking, and technical competence throughout her research work. This is further evidenced by her active participation as a co-investigator in five internal grant agency (IGA) projects, international research experience, and an impressive scientific record. To date, she has published **10 peer-reviewed journal articles**, contributed to **3 papers in international conference proceedings**, and has actively collaborated on multiple multidisciplinary research outputs.

The thesis is written in clear and technically accurate language, and the candidate demonstrates a deep understanding of the current challenges and advancements in sustainable food packaging and the use of natural antioxidants in food systems. The scientific contribution of the work is

original and significant, offering valuable insights and applicable results for future industrial implementation.

In conclusion, the doctoral thesis meets the requirements set forth by the Czech higher education law (§47 of Act No. 111/1998 Coll., on Higher Education Institutions and on Amendments and Supplements to Some Other Acts) for the award of the academic degree of "Doctor" (Ph.D.). I fully support the submission of this thesis for defence and recommend its acceptance.

Zlín, 16 June 2025

Prof. Ing. Lubomír Lapčík, Ph.D.

Doctoral Supervisor

Faculty of Technology, Tomas Bata University in Zlín