

ABSTRACT:

Nanodiamond-Enhanced Packaging: A Step Toward Sustainable Food Preservation

K. Piotrowska¹, J. Kornacka², T. Bacalova³, L. Svobodová³, M. Mrozek³, T. Niemiec¹,
M. Sosnowska⁴, K. Mitura²

¹Warsaw University of Life Sciences, Poland.

²Koszalin University of Technology, Poland,

³Technical University of Liberec, Czech Republic

The preservation of food products is a critical concern in the food industry. Packaging has been used for decades to protect food from mechanical damage, oxygen and light. However, changing lifestyles, including less and less time for shopping and preparing meals, and increasing expectations regarding food quality, have led to the development of active packaging. During the lecture, the potential applications of nanotechnology for this purpose will be discussed. Subsequently, the results of our research on the development of carbon nanoparticle-based packaging will be presented, focusing on food films and containers enriched with nanodiamonds. As part of the study, surface characterization was performed using confocal, fluorescence, and scanning electron microscopy (SEM). In vitro tests were conducted to evaluate the antibacterial and antioxidant properties of the materials. A simulation of natural food spoilage processes in the developed packaging was also conducted. For this purpose, biological tests were employed, including the assessment of lipid rancidity using a titration method, as well as the determination of oxidation products and antioxidant properties via spectrophotometric analysis.

The results demonstrated that the nanoparticle-enriched materials primarily exhibited antioxidant properties and reduced lipid rancidity, while their antibacterial effect was less pronounced. This suggests a wide range of practical applications, particularly for products rich in unsaturated fats, which are highly susceptible to oxidation processes.

[1] R.K. Gupta, F.A. el Gawad, E.A.E. Ali, et. al., Measurement: Food, 13, 100131 (2024).