In the face of the escalating plastic waste problem, it is crucial to find sustainable solutions in food packaging. While functional and economical, traditional plastic packaging contributes to long-term environmental pollution. Every year, millions of tons of plastic end up in landfills, rivers, seas, and oceans, causing irreversible damage to ecosystems. Given the increasingly stringent environmental protection requirements, such as the European "Single-Use Plastic Directive" of 2019, research on eco-friendly packaging materials is gaining new importance. Efforts in producing and modifying biodegradable films can play a crucial role in creating a more sustainable future, reducing dependence on plastic, and protecting the natural environment.

Biodegradable materials like polylactide and polycaprolactone are at the forefront of promising alternatives to synthetic polymers, which can effectively serve as innovative replacements. Despite their satisfactory properties, there is an ecological challenge associated with the difficulty of separating them from traditional plastics during the recycling process. Consequently, current research explores natural polysaccharides, such as starch, chitosan, and alginate, which are widely available and renewable resources with great potential for creating biodegradable films that could transform the packaging industry. Unfortunately, films made from polysaccharides often have inferior mechanical properties compared to their synthetic counterparts. Tensile strength, flexibility, antibacterial properties, and barrier properties are crucial factors that need improvement for these innovative and eco-friendly films to be widely adopted. To address these challenges, new technologies and modifications are being explored, such as using appropriately prepared deep eutectic solvents (DES) as additives to the polysaccharide film matrix. It is expected that such an additive would help improve mechanical properties, and bactericidal properties and would also improve antioxidant properties. As environmentally friendly solvents, they could significantly improve the physicochemical properties of the obtained materials, opening new possibilities for the production of high-performance biodegradable packaging films.

This project involves the synthesis of selected DES and their utilization in extracting bioactive components from various plants, the production of biodegradable polysaccharide films with appropriate solvents, and the comprehensive characterization and analysis of the obtained materials in terms of physicochemical, antibacterial, antioxidant, and structural properties. Additionally, tests will be conducted to evaluate the stability and integrity of food packaging using these films, focusing on the necessary standards for practical application. Ultimately, the film with the most advantageous properties will be identified through detailed data analysis using cluster analysis.

The final results of the project could revolutionize the packaging market, offering eco-friendly alternatives to traditional plastics and significantly reducing environmental pollution. Moreover, the development of packaging technologies can encourage further research in the field of sustainable materials, supporting global efforts towards environmental protection. Thus, the project's concept not only concerns urgent contemporary needs but also sets directions for future innovations in the area of eco-friendly packaging materials.