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AMBER Advancing Materials for Impact
ACTIPACK4FISH SUSTAINABLE SEAFOOD PACKAGING
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Development of active sustainable packaging materials by combining biopolymers and natural antimicrobials using spin-coating and dip-coating processes to extend the shelf-life of fish products (ACTIPACK4FISH)

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Research Challenge / Objectives

Increasing global seafood production reflects a growing consumer demand for freshly packaged fish and other seafood products[1]. Fish oils and oily fish are considered as major food sources that provide the necessary levels of Omega-3 fatty acids. However, fish/seafood products are highly perishable and deteriorate faster than meat proteins[2]. It has been reported that over 35% of all seafood is wasted through the supply chain in Europe due to spoilage and low-quality post-mortem handling[3]. Advanced active packaging materials containing antimicrobials can effectively inhibit microbial growth and prevent chemical oxidation in fish and other seafood products, thereby preserving their quality and extending their shelf life.

In this study, we focused on the development of advanced sustainable packaging materials by combining Polylactic acid (PLA) polymer with natural antimicrobials (NAMs), such as chitosan, Thyme essential oil (TEO), Articoat-DLP, and SULAC-01, using spin-coating and dip-coating techniques to synthesise thin films. These films were characterised using SEM, FTIR, TGA, and Profilometry. Antimicrobial activities of these samples were also analysed.

Results

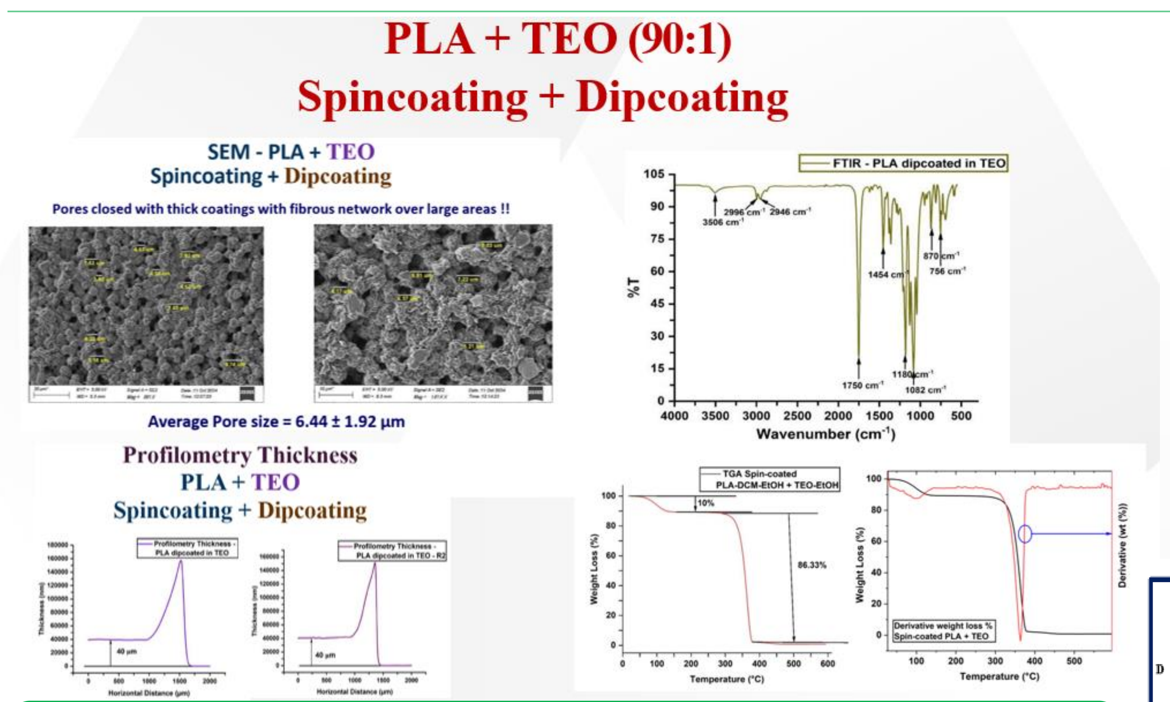

Figure 1: SEM, FTIR, Profilometry and TGA of spin-coated and dip-coated PLA + TEO

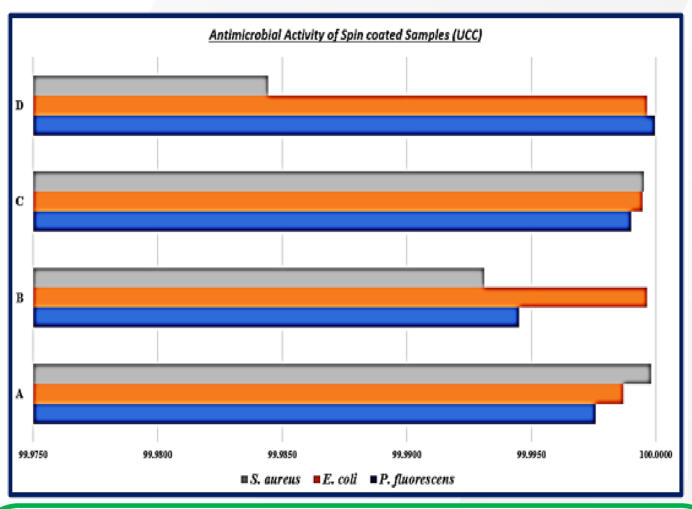

Figure 3: Antimicrobial activities of PLA + TEO, PLA + Chitosan, PLA + Articoat – DLP and PLA + SULAC - 01

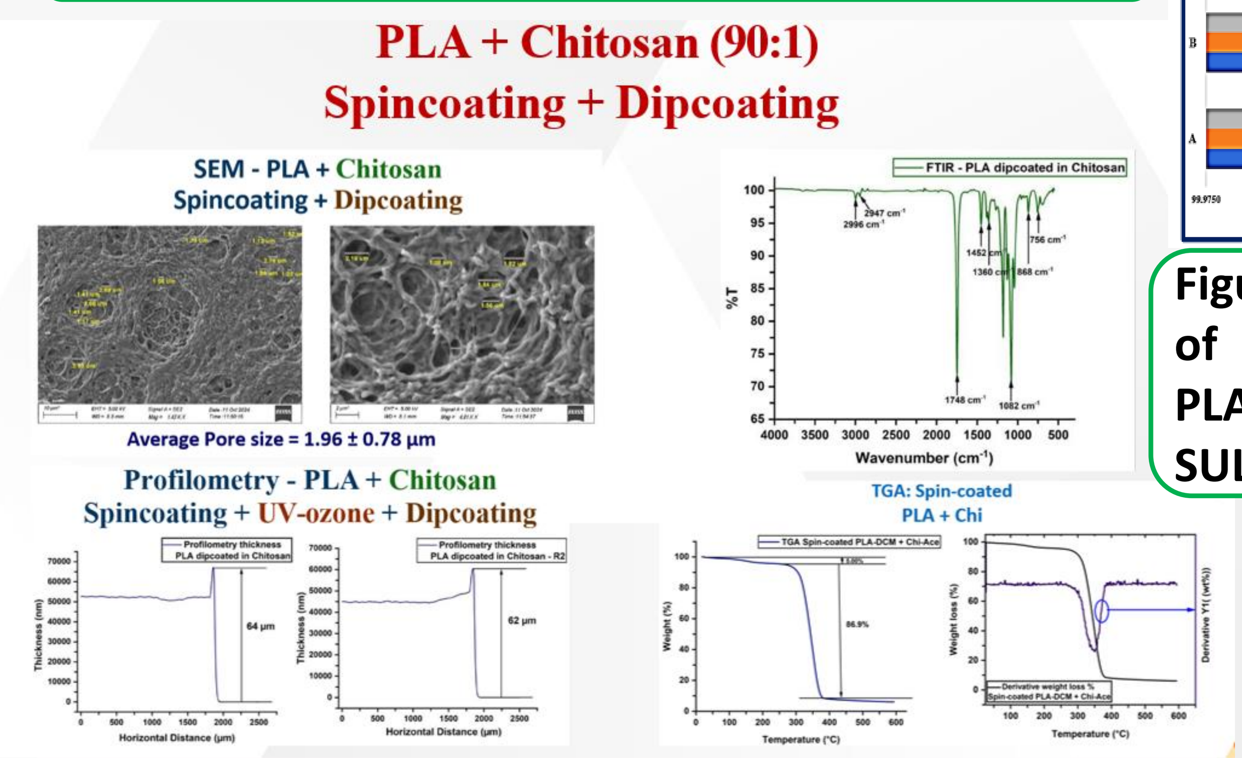

Figure 2: SEM, FTIR, Profilometry and TGA of spin-coated and dip-coated PLA + Chitosan

Methodology

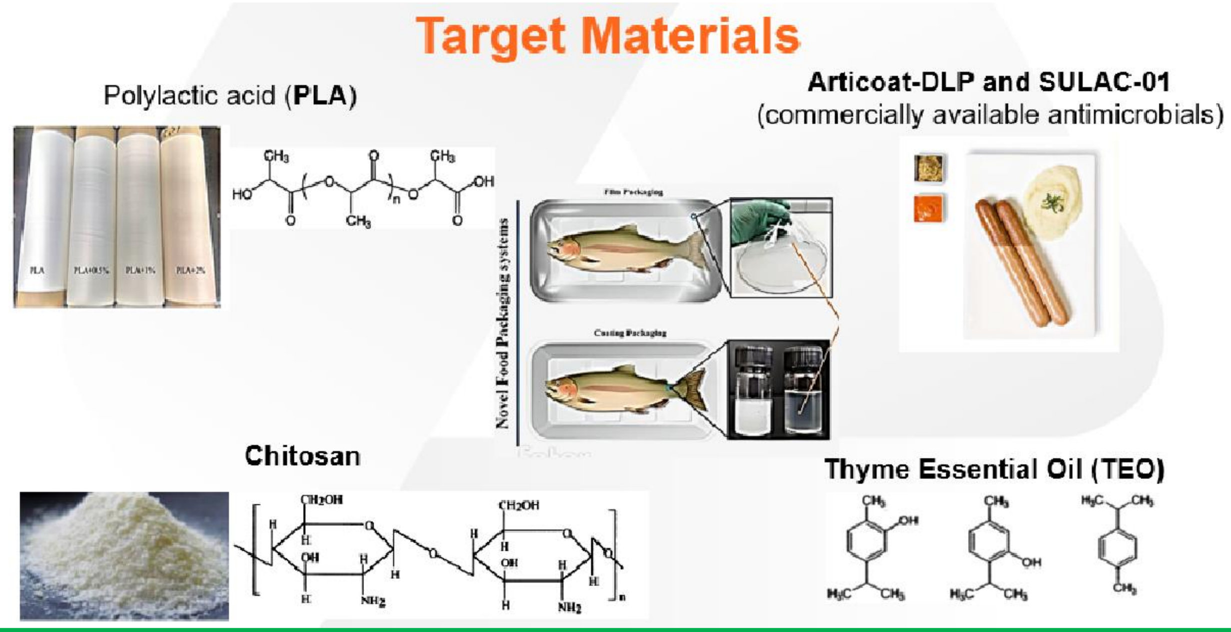

Figure 4: Target Materials – PLA polymer and natural antimicrobials, including Articoat-DLP, SULAC-01, Chitosan and Thyme essential oil (TEO) used in this project

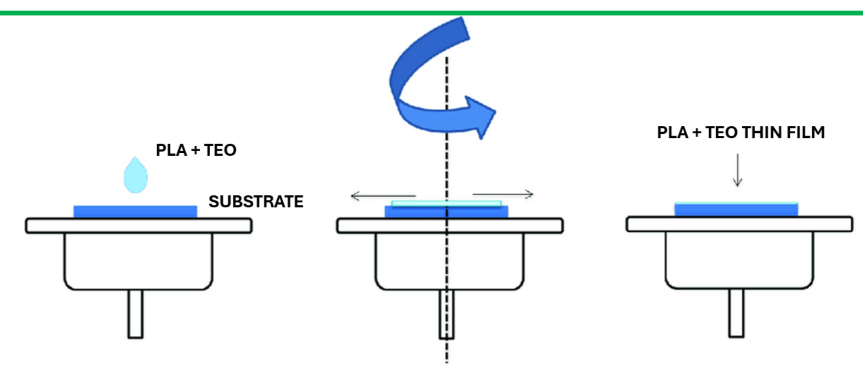

Figure 5: Schematic of spin-coating PLA + TEO on a substrate

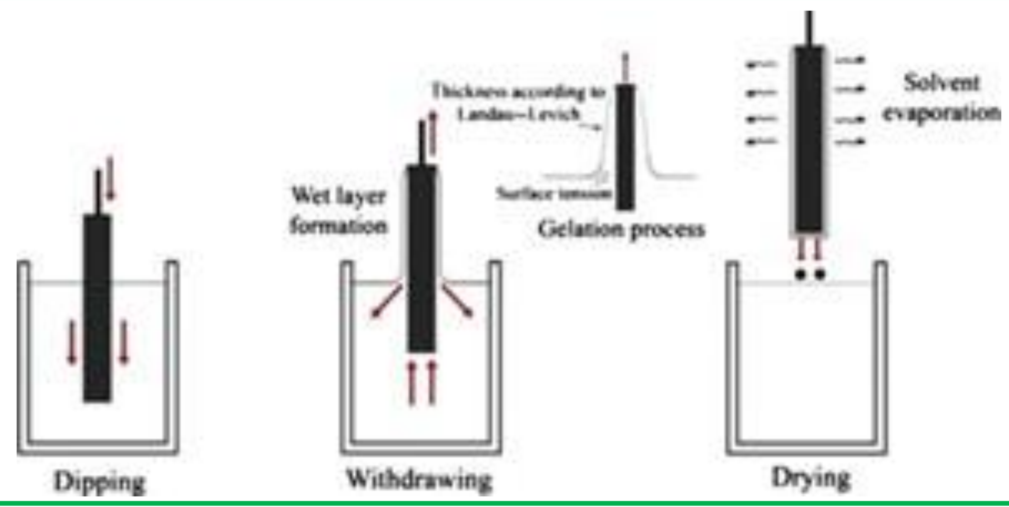

Figure 6: Schematic of steps involved in a dip-coating process

Conclusion & Future Work

- Incorporation of SULAC-01 in PLA (90:1) showed the highest activity against *S.aureus*, and incorporation of TEO in PLA (90:1) showed the highest activity against *P.fluorescens* (close to 100% reduction).
- Reduction in the concentration of NAMs leads to a reduction in the antimicrobial activity. Minimum concentration of NAMs determined.
- Thickness can be reduced not only to avoid material wastage but also to synthesise strong adherent films.
- Solvent-casting method can be used to produce thicker films for easier scalability.

References

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This research is funded by the Department of Agriculture, Food and Marines with the project reference number 2021R412. This research is co-supported by Advanced Materials Biotechnology and Engineering Research Centre (AMBER) under Taighde Éireann – Research Ireland Research Centre grant funding Tai12/RC/2278_P2.
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