Biocomposites in food packaging, water remediation and wound management

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The increasing volumes of plastic wastes that are accumulating in our planet are making more and more necessary the use of alternative naturally-derived and/or biodegradable polymeric materials. Here we will present fully biodegradable biocomposites that derive from natural resources like polysaccharides by vegetable wastes or proteins by animals. The preparation of the biocomposites is done with green methods, that among other advantages, they reassure that the intrinsic properties of the starting materials are transferred to the final biocomposites. In this way we can obtain biocomposites with antioxidant, antibacterial or anti-inflammatory properties. On the top, we can tune the biodegradation time of the developed materials, in order to control the delivery of active principles they incorporate to their adjacent environment.

Using the abovementioned materials and techniques, we engineer biocomposites that can be used either as active food packaging materials or in water remediation applications or finally in would management for protection and active healing. Some examples of the materials that will be presented in this conference follow: For food packaging applications we produce biocomposites of biodegradable polymers (i.e. PLA, PDMS, PCL, PVA, Starch, etc.) with high loading of vegetable wastes (coca shell, orange peel, parsley stems, spent coffee, etc.) that are prepared by extrusion and injection molding techniques, easily scalable for high volumes production. [1] These materials are approved for food contact, can protect the food due to high oxygen barrier properties and in some cases also due to antioxidant action. For water remediation we use biocomposites of bioplastics, like silk fibroin, or keratin combined with vegetable wastes, like orange peel or spent coffee, in order to develop foams that can interact with water and adsorb pollutants like heavy metals, oily substances, or dyes (Figure 1). [2] Finally, for the development of active scaffolds for protection and active healing of wounds we develop biocomposites by natural matrices, like alginates, silk fibroin, hyaluronic acid, keratin, etc. and we tune their degradation time while in contact with the wounds, in order to deliver in controlled times active principles, like drugs or natural antioxidant or antibacterial agents.

References

[1] T. N. Tran, I. S. Bayer, J. A. Heredia-Guerrero, M. Frugone, M. Lagomarsino, F. Maggio, A. Athanassiou, Macromol. Mater. Eng. 302 (2017) 1700219.
[2] A. A. Chavan, J. Pinto, I. Liakos, I. S. Bayer, S. Lauciello, A. Athanassiou, D. Fragouli, ACS Sustainable Chemistry & Engineering 4 (2016) 5495

Figures

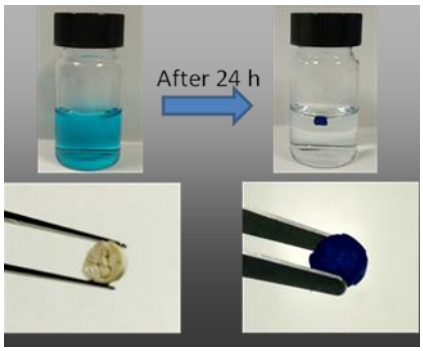

Figure 1: Biocomposite foam with orange peel for efficient dyes removal from water