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Development and characterization of active food packaging films based on low density polyethylene and natural antioxidant curcumin

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Oxidation is considered as the foremost cause of food quality deterioration. Oxidation reactions cause nutrients' degradation, lipids' rancidity and discoloration in the food, resulting in the decrease of the shelf life of the packaged products. Therefore, the development of active packaging materials that are able to prevent the oxidation and enhance the shelf life of the food products while maintaining their nutritional quality is extremely significant in the food technology. The usage of synthetic antioxidants is currently limited by the United States Food and Drug Administration (USFDA) as well as by European Regulation due to possible harmful effects on the human health and environment. As a result, there is an increasing trend in the use of antioxidants based on natural resources in the food packaging. In the present study, active films of Low Density Poly-Ethylene (LDPE) containing the natural antioxidant curcumin have been designed and developed. Chemical, thermal, mechanical and other physical properties, including wetting behavior, oxygen permeability and water vapour permeability, of the developed biocomposite films were systematically carried out. The addition of curcumin did not alter the melting behavior of the active films. The incorporation of curcumin showed strong interaction with the LDPE polymer matrix hence improved the tensile modulus, up to 21.24% and the water vapour barrier property by 51.48%. The antioxidant potential of the active films was evaluated against 2,2-Diphenyl-1-picrylhydrazyl free radical and the results proved their excellent antioxidant activity. The attained results altogether indicate that the active films based on LDPE and curcumin are ideal candidates for active food packaging.

Recent Publications

1. M Ramos, A Jiménez, M Peltzer and M C Garrigós (2012) Characterization and antimicrobial activity studies of polypropylene films with carvacrol and thymol for active packaging. *J. Food Eng.* 109(3):513–519.
2. J Li, J Miao, J Wu, S Chen and Q Zhang (2014) Preparation and characterization of active gelatin-based films incorporated with natural antioxidants. *Food Hydrocoll.* 37:166–173.
3. M Ghaani, C A Cozzolino, G Castelli, and S Farris (2016) An overview of the intelligent packaging technologies in the food sector. *Trends Food Sci. Technol.* 51:1–11.
4. M Moudache, M Colon, C Nerín and F Zaidi (2016) Phenolic content and antioxidant activity of olive by-products and antioxidant film containing olive leaf extract. *Food Chem.* 212:521–527.
5. D A P De Abreu, P P Losada, J Maroto and J M Cruz (2011) Natural antioxidant active packaging film and its effect on lipid damage in frozen blue shark (*Prionace glauca*). *Innov. Food Sci. Emerg. Technol.* 12(1):50–55.

Biography

Jasim Zia is a PhD student in the group of Smart Materials, at the Italian Institute of Technology and in the Department of Informatics, Bioengineering, Robotics and Systems Engineering (DIBRIS) at the University of Genoa, Italy. He has completed his Master's degree at National Textile University, Pakistan, Textile Engineering Department and his undergraduate degree at The University of Faisalabad, Pakistan, Textile Engineering Department. He worked on the development of shape memory polymer composites for his Master's thesis. He worked as a Research Associate and studied natural fiber reinforced composites at National Textile University, Pakistan. His research interests include Biocomposites, Bioplastics and Food Packaging Materials.

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