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RESEARCH PAPER

Antimicrobial activity of nanocomposite films for storage of foods

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SUMMARY : Food packaging plays a major role in the food supply chain and performs tasks of fulfilling demands of manufacturers and consumers. Polymers are widely used in the food packaging industry because of its flexibility, mechanical strength and low cost. In order to prevent the contamination by undesirable microbes, novel packaging technologies like antimicrobial packaging are developed which prolongs the shelf-life of fresh foods. Nanotechnology is expected to play the greatest and most immediate role in the development of new food packaging materials. A key purpose of antimicrobial nano packaging is to control growth of microorganisms unlike conventional food packaging systems which are used for shelf life extension, quality maintenance, and safety assurance. Antimicrobial compounds are coated, blended or immobilized on the surface of polymer films. The present study was undertaken for developing and evaluating nanocomposite films incorporated with titanium oxide (TiO_2) as antimicrobial agent by melt compounding. Different polymer based nanocomposite films of (1-2 per cent) concentration and thicknesses were fabricated and fresh cut carrots were stored in the developed films without spoilage.

KEY WORDS : Food packaging, Antimicrobial nano packaging, Nanocomposite films

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Antimicrobial packaging is an emerging technology that has significant impact on shelf-life extension and food safety. It is a type of active packaging that reduces, inhibits or retards the growth of microorganism which contaminates the packaged food. Antimicrobial agents in particular can be incorporated into a packaging system which can be achieved by simple blending with the packaging materials, as well as immobilisation or coating depending on the characteristics of packaging systems, antimicrobial agents and the food (Yang *et al*., 2010). The antimicrobial film when placed on a solid agar medium containing the test microorganism, a clear zone surrounding the film indicated the antimicrobial diffusion from the film and lack of growth under the film (Appendini and Hotchkins, 2002).

Nanocomposites are a new class of mineral-field plastics that contain relatively small amounts (<10%) of nanometer-sized particles. The particles, due to their extremely high aspect ratios (about 100-15000) and high surface area (750-800 m^2/g) promise to improve structural, mechanical, flame retardant, thermal and barrier properties (Arora and Padua, 2010). Nano packaging can also be designed to release antimicrobials, antioxidants, enzymes, flavours and neutraceuticals to extend the shelf life of food products. Wang *et al.* (2010) reported that the cells of *E. coli* attached by the TiO_2 nanoparticles had severe damage. The present study was undertaken with the objectives of developing high density polyethylene and polypropylene based polymer films of 60 and 80µ thicknesses with (1-2%) titanium oxide as antimicrobial agent by melt compounding and evaluating the antimicrobial and mechanical properties of nanocomposite films for storage of foods.

EXPERIMENTAL METHODS

Fabrication of nanocomposite films:

High density polyethylene (HDPE) and polypropylene (PP) polymer pellets procured from M/s. Reliance Industries Limited, Mumbai and titanium oxide powder from M/s Sigma

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