NEW POLYMER NANOCOMPOSITES FOR PACKAGING WITH ANTIMICROBIAL OR BARRIER PROPERTIES

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Nanotechnology involves the study and use of materials at an extremely small scale -at sizes of millionths of a millimetre- and exploits the fact that some materials have different properties at this ultra small scale from those at a larger scale. In fact, the reinforcement of polymer matrices with nano-size particles of different geometries has become very important for a wide range of applications and improved properties such as, electrical, mechanical, barrier and antimicrobial properties of the plastics.

Nanocomposite technology paves the way for packaging innovation in the flexible film and plastic container industries, offering enhanced properties such as greater barrier protection, increased shelf life and lighter-weight materials. Nanoparticles allow for much lower loading levels than traditional fillers to achieve optimum performance. Usually, additional levels of nanofillers are less than 5 percent, which significantly impacts the weight reduction of nanocomposite films. This dispersion process results in a high aspect ratio and surface area, creating higher-performance plastics than with conventional fillers.

The barrier properties improvement that can result from incorporation of relatively small quantities of nanoclay materials is shown to be substantial. Such excellent barrier characteristics have resulted in considerable interest in nanoclay composites in food packaging applications, both flexible and rigid. Specific examples include packaging for processed meats, cheese, cereals and boil-in-the-bag foods, also extrusion-coating applications in association with paperboard for fruit juice and dairy products, together with co-extrusion processes for the manufacture of beer and carbonated drinks bottles. The use of nanocomposite formulations would be expected to enhance considerably the shelf life of many types of food.

An antimicrobial property is also an outstanding property of some reinforced plastics. Metal particles and metal oxides have been used in packaging for some years. Antimicrobial protection has long been imparted by coating the surface of a material with a liquid or powder disinfectant. More recently, antimicrobial plastics have been used in consumer products such as toothbrushes, mattress pads and children's toys. Antimicrobial plastics are composed of polymers mixed with special disinfectants. The plastic slowly releases the disinfectant over time, killing pathogens that come in contact with its surface.

Over the last years GAIKER-IK4 has been working in the development of new polymer nanocomposites produced by melt compounding with barrier and antimicrobial properties for packaging. In this review, new advanced thermoplastic composites with specific functionalities will be shown: i) for nanocomposites with antimicrobial properties, ZnO nanoparticles content as low as 0.5 wt% of in the plastics show good antibacterial activity against *E. coli* and *St. Aureus* but no antifungal activity is observed.

Results also show better biocide behaviour of ZnO nanoparticles in PA if compared with in PE and ii) nanocomposites based in PP and reinforced with nanoclays show enhanced barrier properties up to 20 % compared to neat polymer [1].

References:

[1] D.A. Pereira de Abreu, P. Paseiro Losada, I. Angulo and J.M. Cruz, European Polymer Journal, **6** (2007) 2229.

Figures:

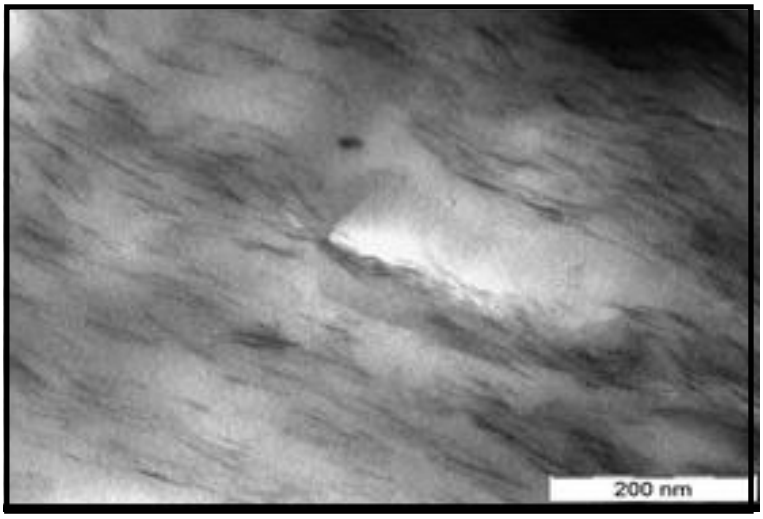

Figure1. Exfoliated nanoclays

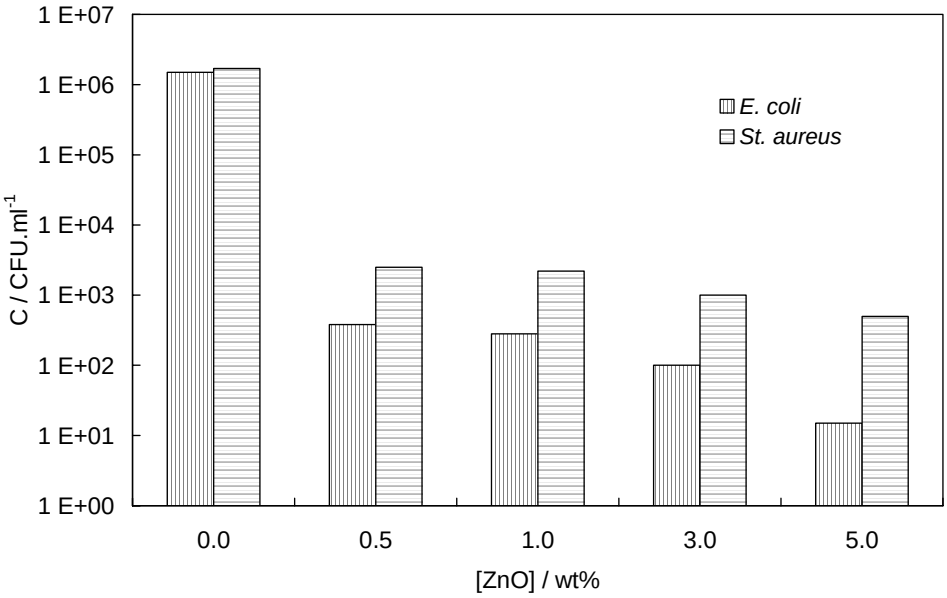

Figure 2. The effect of ZnO nanoparticles in the antimicrobial activity of PA/ZnO nanocomposites after 48 h.