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Hygienic coatings by UV curing of diacrylic oligomers with added triclosan

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Abstract Hygienic coatings have been obtained by UV photopolymerization of mixtures of urethane-diacrylate, tri-propylene-glycol diacrylate and 2,4,4′-trichloro-2′-hydroxydiphenylether (Triclosan). UV-dried coatings containing a weight fraction of Triclosan as low as 0.001 submitted to tests for antimicrobial activity evaluation with *Escherichia coli* colonies have shown the complete elimination of living bacteria in the thin liquid layer in contact with the film surface. A persistent biocide activity can also be observed after a prolonged water treatment of the coating. The biocide release from the coating has been studied through contact with water–ethanol mixtures of different compositions. The maximum release rate has been observed at an ethanol weight fraction of 0.85, where the crosslinked films show the maximum swelling. The phenomena can be explained on the basis of the interaction between the liquid and the polymer network through the Hansen solubility parameters.

Keywords Urethane-acrylate, Networks, Biocide, Films, Photopolymerization

Introduction

The crosslinking of an acrylic formulation through UV curing is well known as an environmental-friendly technology because it offers many advantages, the principal being the VOC-free formulation and the high speed of the drying process.

Antimicrobials are chemicals that influence the growth of microbial flora and they are frequently used in health care to reduce the transmission of pathogenic agents.

The inclusion of antimicrobial agents in a polymer matrix is of great importance in coating technology, where antimicrobial agents are classically used to protect the coating film from the aggression of the bio-environment. They play a key role in packaging materials for the preservation of products such as foods, beverages, cosmetics, and pharmaceutical formulations.[1,2]

Antimicrobial agents are also used in hygienic coatings to confer sterilizing properties to the surrounding environment.[3] To date, these coatings constitute a limited fraction of the potential industrial production but they could be developed, taking into account that the benefit of the antimicrobial property is not just to preserve the treated material against microbiological degradation, but also to provide health-related benefits when stringent hygiene measures are necessary, such as in high-care areas of medical institutions or in pharmaceutical or food industries.

Hygienic coatings can play an increasing role not only in helping to keep food premises, food store rooms, food equipment, and other food-contact materials clean and fit for their purposes, but also for products designed to be in continuous contact with the human body, such as medical devices.[4]

Chemicals with biocidal properties solubilized in the coating can confer antimicrobial properties, if they are allowed to migrate through the polymeric matrix and reach a sufficient concentration on the surface to perform their action,[5] but the efficiency of an antimicrobial agent contained in a polymer matrix cannot be

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