Acrylate Polymerization: Formation of UV Curable Antimicrobial Copolymers

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With resistant strains of pathogenic microbes becoming more common, reducing bacterial contamination during surgery and in daily activity is a necessity. Bonding antimicrobial groups to UV curable monomers provides a unique approach to disinfecting dynamic surfaces. This printable plastic will be used in cooking products, urethane/polyester clothing, medical implants, waste water sanitation, and coatings for virtually any surface. Three common antimicrobial agents were chosen based on bonding capability and availability: 2-Mercaptobenzimidazole (AM1), 2,4-Dichlorophenol (AM2), and 5-Nitroisatin (AM3). Using TEA (trimethylamine), a hydrochloric acid was pulled out of antimicrobial group and acryloyl chloride. This process bonds the antimicrobial group to the 3rd carbon of the acrylic monomer. The three novel monomers were polymerized using TPO-L photoinitiator at concentrations of 1%, 5%, 10%, and 50% diluted with HEA (2-hydroxyethyl acrylate). 48 hours of UV radiation (254nm) polymerized all concentrations of the AM1 monomer, 1% & 5% concentrations of the AM2 monomer, and no AM3 monomer solutions. Polymers made of AM1 and AM2 were then tested for their antimicrobial ability; 12.6 cm^2 of the plastic surface was exposed to 50ml of inoculated E.coli broth. E.coli cell density was measured using optical density at 600nm. Higher concentrations of polymer AM1 and AM2 present in the copolymer plastic proportionately killed more cells than lower concentrations. Within 12 hours both 50% polymer AM1 and 5% polymer AM2 showed a 90% sanitation of bacteria. Scaled down from 50ml/12.6cm^2 to a drop of solution per cm^2, these copolymers will reach 90% sanitation in just 9 minutes.

Awards Won:

Second Award of $1,500