Plasma treatment of polymeric nanocomposites prepared with silver and copper nanoparticles.

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Abstract

Silver and copper nanoparticles present outstanding antibacterial properties [1-2], and have been used for many years in medical applications. The metallic particle attacks the cellular wall of the bacteria and inhibits its growth. However, it is not recommendable to use these metallic nanoparticles on their own, thus nanoparticles can be combined with different polymers in order to prepare nanocomposites with good antibacterial properties.

In this study, silver and copper nanoparticles were used to prepare polymericnanocomposites. Nanocomposites were prepared by two methods, in one case; silver nanocomposites were mixed by melting with polypropylene. In the other side, copper nanoparticles were mixed with acrylic monomer and an initiator, the nanocompositewas prepared by photopolymerization. It was found that by increasing the amount of nanoparticles the speed of photopolymerization was affected negatively. In both methods of preparation, films of the nanocomposite were obtained. Nanocomposites of Polypropylene were exposed to an argon plasma, whilst nanocomposites of acrylate were exposed to an air plasma, in both cases the time of treatment was 90 minutes and the input plasma power of 100W.The plasma treatment removed part of the polymer of the surface, leaving the nanoparticles more exposed. The nanocomposites were tested with the bacteria; *Pseudomonas aeruginosa*. The nanocomposites were analysed by thermogravimetrical analysis, EDS, atomic force microscopy (AFM). The results showed that metallic nanoparticles increased the thermal stability of the polymers. It was also found that the polymeric films exposed to plasma presented higher antibacterial properties, since plasma treatment removed part of the superficial polymer and left metallic nanoparticles more exposed to the surface, to our knowledge, these observations has not been published before. In Figure 1 is presented the percentage of bacterial inhibition of PPnanocomposites, it is appreciated that plasma treated nanocompositespresented the highest values of inhibition.

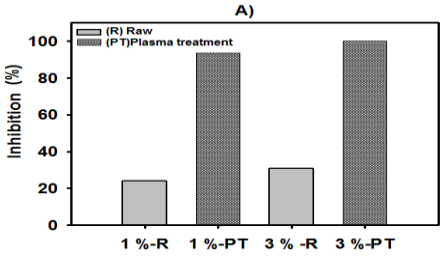

Figure 1. Nanocomposites of polypropylene with 1 and 3% of silver nanoparticlestested with*Pseudomonas aeruginosa.*

References

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