Preparation and characterization of polymer nanocomposites with titanium dioxide nanoparticles

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Titanium dioxide nanoparticles (TiO2) has been attracting a special interest, because, due to this capacity to absorb the ultraviolet radiation (UV), it can be used so much to protect the polymer matrix as to accelerate the photodegradation, if used in rutile covered form or anatase not covered form, respectively. The objective of this work was the study and preparation of polymer nanocomposites with TiO2 nanoparticles and the characterization and correlation with the photodegradation properties. A new technique was proposed and tested to obtaining TiO2 polymer nanocomposites, based on the use of the spray drying process to produce a nanocomposite with high nanoparticles content. The process consisted in the following stages: obtaining TiO2 nanoparticles, through the sol-gel process; obtaining stable mixtures of hydrosoluble polymer PVOH and TiO2; and spray drying of TiO2/PVOH aqueous suspension. Tests of incorporation the TiO2/PVOH concentrated powder obtained by spray drying were accomplished in PET, LDPE and EVA. LDPE nanocomposites films, with TiO2 rutile and anatase nanoparticles acquired, were obtained and compared with LDPE films with the concentrated powder of TiO2/PVOH, accomplishing the characterization and correlation with the photodegradation properties ((when exposed to the ultraviolet radiation UV artificial and natural) through the mechanical properties measured. The results showed that the spray drying process is an innovative way to obtain a nanocomposite with high TiO2 nanoparticles content (50%), isolated and encapsulated. The mechanical properties of the films after the photodegradation for UV radiation indicate that the films with TiO2/PVOH concentrated powder show potential to accelerate the effects of the photodegradation in the LDPE matrix, turning the technique developed quite promising for applications where the photodegradation is a requested.