Advanced Photocatalytic Heterostructered Materials for the Controlled Release of Active Compounds upon Solar Activation

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This work focus on the study of nitrogen-doped TiO_2 nanoparticles successfully synthesized using a hydrothermal treatment at lower temperature [1-2] and its application as photocatalysts for the controlled release of active compounds with repellent properties from within polymeric microcapsules upon solar activation. The controlled release process is promoted upon solar radiation absorption by the action of reactive oxygen and hydroxyl species produced during both reduction and oxidative processes, as a result from the light-activated electronic transitions from the photocatalyst valence band to the conduction band. The polymeric microcapsules were synthesized via interfacial polymerization from the condensation reaction of an isocyanate and a polyol to form a polymer film at the interface of these monomers [3]. The resulting microcapsules have sizes ranging from 20-200 µm. A mosquito repellent oil was used as the core and also as the volatile agent to be released. The qualitative and quantitative analysis of the released active compound has been performed by gas chromatography coupled with mass spectrometry and high-performance liquid chromatography.

In vitro assays were carried out in insectaries at the Portuguese Institute of Hygiene and Tropical Medicine (IHMT), to test the efficiency and robustness of this novel photocatalytic microcapsule system to the prevention of mosquito-transmitted diseases.

The effect of pH on the synthesis of nitrogen-doped TiO_2 nanoparticles was investigated in order to study the influence on the optical properties, crystallinity, domain size and surface area of nanoparticles.

References

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[2] C.J. Tavares, F.J.S. Pina, International Patent, WO 2011/012935 A2, International Patent (PTC), World Intellectual Property Organization, PCT/IB2009/055716, publishing date: February 2, 2011.

[3] N. Tsuda, T. Ohtsubo, M. Fuji, *Advanced Powder Technology* 23 (2012) 724-730.

Figures

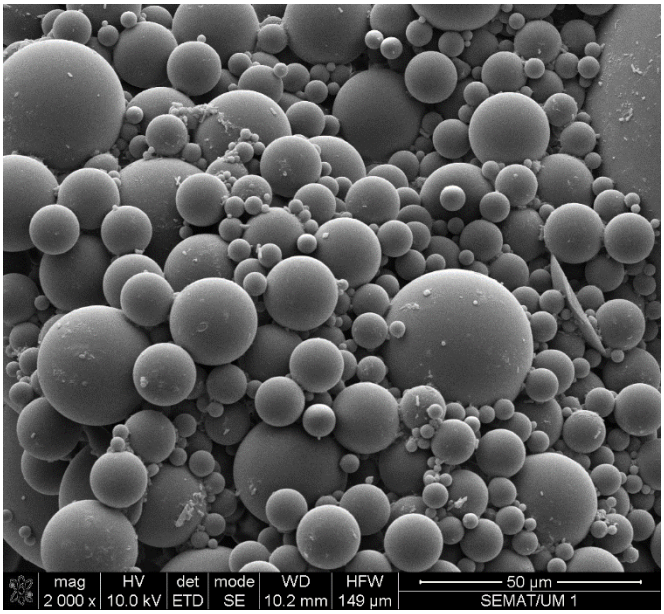

Figure 1 - Scanning electron microscopy micrographs of polymeric microcapsules loaded with a mosquito repellent oil functionalized with TiO_2 nanoparticles onto its surface.

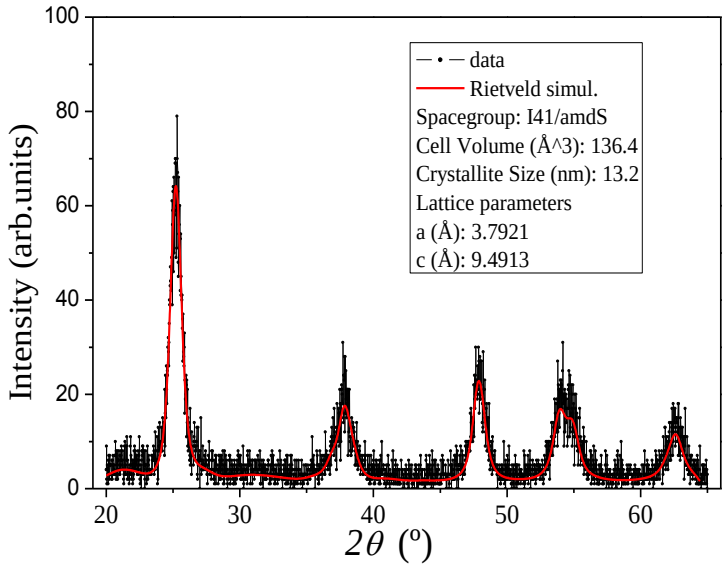

Figure 2 – X-Ray diffraction patterns of nitrogen-doped TiO_2 nanoparticles synthesized by a modified sol-gel method using a low temperature hydrothermal treatment.