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Photoelectrochemical Degradation of Cinnamic Acids

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Despite the fact that the photocatalytic oxidation on semiconductors is a relatively recent technique for the demolition of polluting impurities in water, the large body of research in this field is an evidence of the good perspectives of the method for application purposes[1,2].

In the present work we report on the photocatalytic degradation of trans-3,4-dihydroxy-cinnamic acid (DHCA), a toxic compound present in olive oil waste waters, on TiO_2 thin films supported on glass or titanium. The compound We show that the chemisorption of the acid is an important factor in the overall reaction mechanism. In turn, adsorption and the reaction kinetics depend on pH and on the origin of the titanium dioxide employed. Concerning the last point, we have conducted experiments both with a commercial oxide (Degussa, P-25) and with nanocrystalline TiO_2 prepared by the sol-gel method[3] . Samples prepared from TiO_2 P-25 showed a higher degree of adsorption and a higher efficiency for the degradation of DHCA. Since it was established that the true surface area was only slightly higher for films prepared from nanocrystalline TiO_2 as compared with those from P-25 and, therefore, this in not an influent parameter for the explanation of the experimental results.

UV-visible diffuse reflectance measurements showed that the interaction of DHCA with the surface is different for the two different TiO_2 samples. FTIR measurements confirmed the strong chemisorption and showed, in addition, that irradiation leads to the formation of intermediates that can be identified as quinones, originating from the oxidation of the phenolic groups.

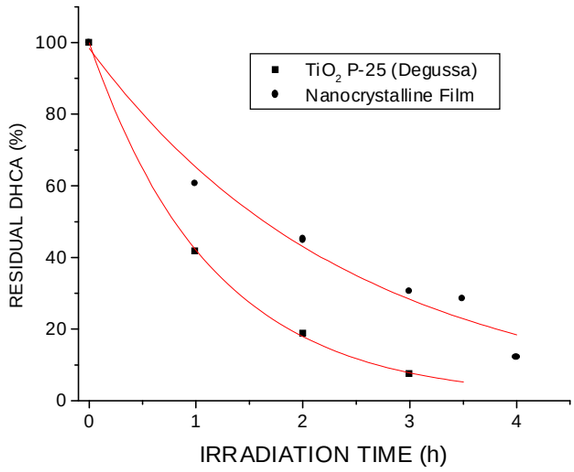

Figure 1 – Photocatalytic degradation of trans-3,4-dihydroxy-cinnamic acid on films of TiO_2 : effect of the origin (preparation) of the oxide. Irradiation wavelength > 360 nm. The geometric area was 1.8 cm^2 , in both cases. The initial concentration of the hydroxy-acid was 5 x 10^{-4}M.

References

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