E2-29: Application of TiO_2 for photocatalytic degradation of Chloropyrifes

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Degradation of organochlorine weedicide, 3,4, DPA and organophosphorous insecticide, methamidophos, by using TiO_2 as a photocatalyst have been reported. Addition of H_2O_2 to enhance this degradation process is also reported. TiO_2 has been used as the photocatalyst under sunlight in the literature. Present work was carried out to investigate the possibility of application of this method to degrade the insecticide chloropyrifos ($C_6H_{11}Cl_3NO_3PS$).

An aqueous solution of (200 cm^3) Chloropyrifos (350 ppm) was irradiated (λ=365-366nm) in a photochemical reactor in the presence of TiO_2 powder (100 mg) and dioxygen (45 cm^3min^{-1}). Samples were withdrawn at different time intervals and were analysed for Cl^- and PO_4^{3-}. A pyrex thimble was used to cut-off the UV region. Effects of light, flow rate of dioxygen application of TiO_2 coated polyethylene film and sunlight on degradation of chloropyrifos were studied.

When the flow rate was 45 cm^3 min^{-1}, 100% dechlorination (2h) and 50% dephosphorisation (3h) occurred during artificial illumination, in the presence of TiO_2 powder. When the flow-rate of dioxygen was 25 cm^3min^{-1}, rate of dechlorination (90% , 3h) and dephosphorisation (20%, 3h) decreased. Under artificial illumination, when TiO_2 coated polyethylene film was used (thickness of the polyethylene sheet: 0.08 mm; flow rate of dioxygen 25 cm^3min^{-1}), dechlorination (73%, 3h) and dephosphorisation (15%, 3h) decreased. Application of TiO_2 coated polyethylene film in the presence of sunlight caused 100% dechlorination (5h) and 15% dephosphorisation (7h).

Organochlorine and organophosphorous groups in chloropyrifos could be converted to Cl^- and PO_4^{3-} by using TIO_2 as a photocatalyst. Instead of artificial illumination, sunlight could also be used for this degradation process. Application of TIO_2 coated polyethylene film solves the problem of removing TiO_2 powder.

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