Application of Titanium Dioxide Nano-particles in the Photocatalytic Decontamination of Soil.

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Introduction

Over the past 50 years, studies have shown pesticides to be extremely harmful if one is subjected to over exposure. There are numerous biological and chemical treatments potentially used for soil clean-up, although these can produce harmful by-products and are time consuming. Heterogeneous photocatalysis is an emerging technology for the decontamination of soils. Unlike non-destructive traditional methods, like volatilisation or adsorption onto a solid phase, this process has the advantage of destroying the organic compounds, in-situ, by redox reactions on the catalyst surface.

Objectives of this work

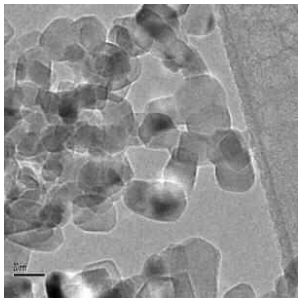
To develop a process that will prove to be a highly efficient and cost affective method of remediating a soil system that has previously incorporated the pesticide, Malathion.

Experimental

Experiments will be carried out looking at how changing certain variables can affect the photocatalytic decontamination of the pesticide. These variables include: Amount of titanium dioxide used in each situation; Light exposure times; Moisture content of the soil.; Soil pH, Activity related to soil depth. These will be performed using a soil comprised of 75% peat, 25% sand, and anatse titanium dioxide nanoparticlies as a photocatalyst. The experiments will be carried out in a fume hood fitted with a UV tube. Samples are analysed using HPLC.

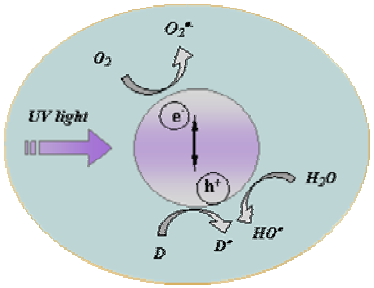
Results

The concentration of Malathion was compared at different times in differing soil systems.

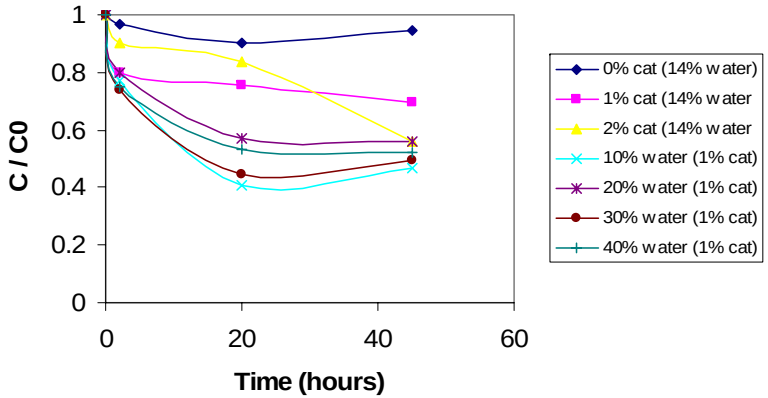


TEM photo of anatase titanium dioxide nanoparticles.

Fume hood containing experimental equipment.



The photocatalytic mechanism.



Concentration of Malathion at time x compared to time 0.

Conclusions:

The results are promising as it shows that by incorporating a small amount of catalyst, degradation of the pesticide can occur quite rapidly. As expected, the concentration of pesticide in the control decreased slowly and is due to photodegradation. It was expected that by increasing the moisture content of the soil, there would be a faster rate of degradation due to the increased availability of free radical hydroxyl ions. This is proven to some extent by the results achieved. The fact that the rate of degradation decreased after a certain time may be accounted for through the evaporation of moisture during the experimental process.