Photocatalytic treatment of cow-farm wastewaters

S. Georgopoulos, M.I. Papadaki

Department of Environmental & Natural Resources Management, University of Patras, Agrinio, Seferi 2, 30100, Greece

Keywords: photo-treatment, catalyst, degradation

Presenting author email: sgeorgop@upatras.gr

Rejection of cow-farm wastewaters without control creates serious environmental problems. Frequent complaints rise, because these wastewaters create environmental pollution at least in surface waters. In an effort to solve the environmental problems induced by these wastewaters, the scientific community is conducting research to establish treatment methods; one of these is photocatalysis.

Photocatalysis, in an environmentally friendly application. In this process oxidant moieties are produced (especially $^{\bullet}OH$) from an aqueous solution, with the presence of a solid (heterogeneous) catalyst and a specific wavelength of light. The oxidative activity of these molecules on organic and inorganic compounds and on living organisms is defined as a photocatalytic degradation process (Serpone & Emeline, 2002, Parsons, 2004).

Cow-farm wastewaters were photocatalytically treated under natural sunlight in a photocatalytic (TiO_2) reactor which was installed in Agrinio in the Prefecture of Aetoloacarnania in West Greece.

The photocatalytic system consisted of parabolic collectors (CPC' s) with a slope of 67° and south direction. Parabolic collectors intended to the greatest possible concentration of sunlight around the reactor glass-tubes were made of polyvinyl chloride (PVC) covered with aluminium sheets. Three glass tubes 500 mm in length, of internal diameter 7,5 mm were used. The thickness of the glass wall of the tubes was 2 mm; the volume of each tube was 86 mL.

The solution that was treated contained 2g L^{-1} Titanium dioxide (TiO_2, type: AEROXIDE P25 - Degussa® , AG, D-60297). Before the experiment started, the cow-farm wastewater was filtered with a screen of 1 mm holesize. The aqueous solution was stirred for an hour in the dark (in order to reach equilibrium of the adsorption of the substance on the surface of the photocatalyst) (Bizani et al., 2006).The duration of the experiment was 5 days (27 of May until 1 of June to 2013).

During the experiment samples were extracted and the UV absorbance of each sample was measured. The UV absorbance was measured by Hitachi U-2000 UV Spectrophotometer 1212301-10 with cuvettes made of quartz of 3.5 ml capacity. The UV absorbance was measured in the range of 190-1100 nm. The absorbance value at 204, 289 and 374 nm was used for the comparisons which are reported in this work.

The UV absorption at the 204 nm at the beginning of the experiment was **1.12 AU** and at the end of the experiment 1.80 AU i.e an approximate 40% increase of absorption based on the initial concentration (zero day).

Thus, the aforementioned method appears promising in the effective and economical removal of cow-farm wastewaters. However, further studies are required in order to develop an integrated method which will practically enable complete removal or degradation of organic compounds from waters or soil.

References

Bizani E., Fytianos K., Poulios I., Tsiridis V., 2006. Photocatalytic decolorization and degradation of dye solutions and wastewaters in the presence of titanium dioxide. Journal of Hazardous Materials, **136**, 85 – 94.

Parsons S., 2004. Advanced oxidation processes for water and wastewater treatment, IWA Publishing, UK.

Mills A., Le Hunte S., 1997. An overview of semiconductor photocatalysis. Journal of Photochemistry and Photobiology A: Chemistry, **108**, 1-35.

Acknowledgements

The author Stavros Georgopoulos would like to thank the Alexander S. Onassis Public Benefit Foundation for providing the funds for this research by means of a scholarship for a doctoral degree.