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Inactivation of faecal bacteria in wastewater by methylene blue and visible light

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ABSTRACT

The high inactivation of faecal indicators [faecal coliforms (FC), *E. coli* and faecal streptococci (FS)] using a combination of methylene blue (MB) with natural sunlight or artificial visible light determined on a small scale, was dependent mainly on the MB concentration, its application process and pH. In order to avoid primarily leaching of the compound into the environment and to further understand the MB photosensitization mechanisms, MB should be properly immobilized within resin. The FC and FS were found to be susceptible to the photodynamic action of MB fixed to the support. The mechanism of faecal bacteria inactivation by MB also seems to be a combination of Type I and Type II processes, and the relative efficiency of each of them depends notably on the experimental conditions. In parallel, the MB stability under light "photobleaching" has been studied by optical absorption spectroscopy. It has been shown that it was dependent essentially on pH, nature of the medium (distilled water and secondary wastewater effluent) and time exposure to light. Practically, all of the MB (10 μM) disappeared from effluent, exposed to sunlight, by the end of a 12 h experiment with a bleaching rate from 92 at neutral pH. Kinetic data indicate that the dye photobleaching efficiency can be approximated by pseudo-first-order reaction.

Keywords: Faecal coliforms; Mechanisms reaction; Methylene blue; Photobleaching; Photosensitization; Pseudo-first-order reaction; Wastewater

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