The application of \( \text{H}_2\text{O}_2/\text{UV} \), photo-Fenton and heterogeneous photocatalysis (\( \text{TiO}_2/\text{H}_2\text{O}_2/\text{UV} \)) processes for the treatment of a highly polluted coloured wastewater was analysed. The experiments were carried out with different \( \text{H}_2\text{O}_2 \) concentrations (0.25, 0.5, 1, 2 and 5 g/L). The toxic properties of different \( \text{H}_2\text{O}_2 \) concentrations in textile wastewater were tested by the use of a Microtox bioassay with \emph{Vibrio fischeri}. The efficiency of the process was checked by assessing the physicochemical parameters, total organic carbon (TOC) and colour. The use of \( \text{TiO}_2 \) as a catalyst with UV photolysis was the most effective method to remove toxins, organic material and colour using the five concentrations of \( \text{H}_2\text{O}_2 \) tested. By using 5 g/L of \( \text{H}_2\text{O}_2 \), 94% TOC removal was achieved. In relation to colour removal, this was greater than 99% with 5 g/L of \( \text{H}_2\text{O}_2 \) in all three processes. The use of a catalyst allowed us to reduce the hydraulic retention time of the process to 30 min with \( \text{Fe}^{2+} \) and 45 min with \( \text{TiO}_2 \). Controlling the amount of \( \text{H}_2\text{O}_2 \) used as the oxidant in an advanced oxidation process (AOP) is important since it was found to increase the toxicity of the influent with the addition of \( \text{H}_2\text{O}_2 \) by 4.99 ± 1.48%, 27.4 ± 3.24%, 39.16 ± 5.64%, 53.40 ± 4.15% and 59.39 ± 4.67% with 0.25, 0.5, 1, 2 and 5 g/L \( \text{H}_2\text{O}_2 \), respectively. Therefore, under the studied conditions, an \( \text{H}_2\text{O}_2 \) concentration greater than 1 g/L is not recommended for an AOP in order to avoid an excess of \( \text{H}_2\text{O}_2 \) in the effluent.

**Keywords:** AOP; Catalyst; Toxicity; Colouring