

REMOVAL OF THE NON-BIODEGRADABLE DYE ORANGE II BY H₂O₂ OXIDATION ASSISTED BY A Fe(II)/SAPONITE SUPPORTED CATALYST

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Waste streams of textile industry use to be contaminated by non-biodegradable dyes, and removal of such compounds must be done before the streams are returned to the environment. Such removal may be done by oxidation, with or without complete mineralisation, being particularly important the decolourisation achieved. Among several advanced oxidation processes proposed in the literature, the use of the Fenton reagent has proved to be particularly efficient. In this case, the oxidation is carried out with hydrogen peroxide, in the presence of a Fe(II) catalyst. The biggest disadvantage of the homogeneous Fenton process is the formation of sludge containing iron ions, which removal at the end of the wastewater treatment increases the overall costs, besides catalyst loss. To eliminate this drawback, some efforts have been directed to the development of heterogeneous oxidation processes, using supported catalysts.

Supported catalysts are an excellent alternative to bulk catalysts. In them, the active phase is dispersed on the surface of a support, which usually shows large specific surface area, porosity, thermal resistance, etc. Carbons, zeolites, silicas and aluminas are among the most used supports, clays being a good alternative for the preparation of several catalysts.

In the present communication, we report preliminary results on the use of a Fe-clay supported catalyst for the oxidation of Orange II, a non-biodegradable dye. The catalyst was prepared by impregnation of a saponite (Yuncillos deposit, Spain) with Fe(II) acetylacetonate. Previously, the natural saponite had been purified by a conventional dispersion-decantation method, extracting the < 2 µm fraction. Fe(II) acetylacetonate was dissolved in the minimum amount of acetone, and this solution was contacted with the clay, using the "incipient wetness" impregnation method. The precursor amount was that needed for a Fe content in the final catalyst of 5.6%. The solid was then dried at room temperature and submitted to catalytic tests, which were performed

in a stirred jacketed batch reactor, being the temperature controlled through a thermostatic bath. The absorbance and the pH were continuously monitored, using a Philips PU8625 UV-VIS spectrophotometer and a pH-meter from EDT instruments RE 357 TX, respectively. For on-line absorbance measurements (at $\lambda_{\max} = 486$ nm), a continuous flow-through cell was used, within recirculation of the solution with the help of a peristaltic pump.

A 0.2 mM solution of Orange II was considered, being treated with H₂O₂ in presence of the catalyst under different conditions. Temperature (30, 50 and 70°C), initial H₂O₂ concentration (6, 9, 12 and 18 mM) and initial Fe concentration (0.128, 0.18, 0.256 and 0.54 mM), were varied in the different tests (the last two variables allow to control the H₂O₂-Fe ratio), being the pH kept constant at 3.0. The colour of the solution was analysed and it was found that this catalyst is active for removal of Orange II. When increasing the reaction temperature, the time required to achieve colour removal is shorter. The reaction rate also increases with both H₂O₂ and catalyst concentration.

In the best conditions tested, the overall colour removal was above 99% after 280 minutes, but in the first 20 minutes it was already very significant. As changes in colour do not imply necessarily complete oxidation of Orange II, total organic carbon in solution was also analysed. Mineralisation performance seems also to be noteworthy, reaching values above 70%.

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