Abstract :

Water purification has become a worldwide problem, in particular in industrialized countries, where wastewater usually contains organic pollutants, such as dyes from the textile industry, leather tanning industry, paper production, food technology, agricultural and pharmaceutical industries. The development of an effective treatment for these effluents is the subject of considerable research. Currently, the most recent advances in wastewater treatment were carried out by advanced oxidation processes (AOPs), which appear to be the most effective techniques for biorefractory elimination of organic pollutants. This technology is based on production of non-selective reactive oxidative species that will enable the oxidation of a large number of organic pollutants. The most used oxidant is the hydroxyl radical owing to its high reactivity ($E° = 2.73$ V). On the other hand, it has been reported that photocatalysis represents one of the most promising AOPs that uses nanoscale semiconductor particles, such as TiO_2, CuO, Fe_2O_3 and WO_3. The obtained results show great efficiency for organic pollutant decomposition following the discovery of Fujichima (H_2O splitting by TiO_2) because of their wide bandgap. More importantly, nanostructures can be synthesised by low cost methods such as hydrothermal, sol–gel, hydrolysis, thermal evaporation and chemical vapour deposition. Therefore, nanotechnology has opened new opportunities and challenges in the advancement in photocatalysis. This chapter will focus on the synthesis and characterization of potential nanomaterials, in particular TiO_2 and ZnO, as well as the elimination of various dyes, including the different mechanisms involved during the process of photodegradation.