# ABSTRACT

The presence of organic pollutants in the environment has been a growing problem in recent decades. As part of advanced oxidation processes, photocatalysis represents an attractive alternative to existing treatment techniques. In this thesis we investigated the synthesis and use of zinc oxide as a photocatalyst for the degradation of organic pollutants. Zinc oxide nanoparticles were prepared using an ethanolic extract of Japanese knotweed. We observed that the synthesis with the plant extract allowed for a finer control over the final nanoparticle size compared to the classical solvothermal synthesis. Pure zinc oxide was also decorated with nickel-oxo clusters, using microwave-assisted synthesis, leading to an improvement in some of the photocatalysts properties. We also tested the effect of the decoration on the stability and longevity of the catalyst and noticed a small advantage compared to zinc oxide prepared by the established process. The stability of zinc oxide during degradation of pharmaceuticals was also investigated in more detail by carrying out up to 15 consecutive degradations of the pharmaceutical with the same photocatalyst used several times. In addition to the model experiment, a few more experiments were carried out in which individual factors were varied (addition of hydrogen peroxide, addition of humic acid, swap of the pharmaceutical and swap of the catalyst with the decorated one) in order to investigate their influence on the catalyst deactivation process. We carried out an experiment with the addition of an oxidant during degradation, with the addition of humic acid as a representative of naturally occurring organic compounds in effluents, with a different pharmaceutical and with the replacement of the catalyst by zinc oxide decorated with nickel-oxo clusters. At the end of the degradations, the photocatalyst used was characterised by different analytical techniques (XRD, XPS, FTIR, TGA, BET) and an attempt was made to determine the degree of deactivation of the catalyst and its cause. The influence of factors on catalyst poisoning or deactivation was also compared. In addition to using the photocatalyst in a batch reactor, it was also immobilized on glass beads to create a flow-through reactor. The flow-through reactor was used in a more long-term experiment where the long-term stability of the photocatalyst (≈300 h) was investigated by monitoring the degradation rate of the antibiotic as it flowed through the reactor. The effect of the flow rate on the stability or deactivation of the catalyst was also verified.