CATALYTIC ASSISTED NON THERMAL PLASMA PROCESS FOR WATER DEPOLLUTION

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Pollution damages our health and the environment around us. It is the leading environmental cause of numerous mental and physical illnesses and premature deaths, particularly among children, the elderly and people with certain diseases. In addition to affecting human health; pollution is a major cause of biodiversity loss. It reduces the ability of ecosystems to perform useful functions such as carbon sequestration and decontamination.

In recent decades, attention has grown a lot towards chemical pollution of surface, coastal and marine waters underground. A phenomenon that represents a threat to the aquatic environment and that involves effects such as acute and chronic toxicity in aquatic organisms is the accumulation of pollutants in ecosystems and the loss of habitat and biodiversity. Of concern are the effects on human health that can derive from the prolonged presence in aquatic environments of multiple substances. The contamination of water caused by heavy metals, industrial chemicals (including dyes), drugs for human and animal use, herbicides, insecticides up to body care or sun creams therefore represent an environmental problem "Emerging". Various physico-chemical techniques like adsorption, membranes, and advanced oxidation processes (AOPs) like photocatalysis, UV / ozone, ultrasonication have been tested for the removal of water bound pollutants.

Among these, the non-thermal plasma is very promising and interesting. It is an ionized gas generated by a high voltage electric discharge, capable of generating highly reactive oxidative species (eg OH •, O, HO2 •, H2O2, O2−, etc.) and reductive species (eg free electrons , aqueous electrons eaq, H, etc.). Both play an important role in the degradation of reactive and oxidizing organic compounds in water.

Even if very effective, this process has some advantages which are not negligible, in particular the high energy consumption and the probable presence of the reaction by-products. To try to overcome these drawbacks, there are several proposals in the literature to combine NTP with a catalyst. The use of a heterogeneous catalyst can be foreseen both inside the reactor where the electric discharge takes place, and outside the reactor. The presence of a catalyst promotes the formation of reactive species, increases the half-life and allows better results to be obtained, in less time and by exploiting lower energy values.

The objective of this work is to make a comparison between the catalytic active species most proposed by the literature to improve the performance of NTP for water treatment, to evaluate its efficiency in terms of any developed by-products and required energy consumption. Furthermore, the authors want to examine the recyclability of the proposed catalysts and identify a combination of process parameters that allow to develop an effective treatment for different classes of organic substances dangerous for the aquatic environment.