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WASTEWATER TREATMENT USING TiO2 PHOTOCATALYST

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Abstract: In this study, we present the capacity of TiO_2 photocatalyst for water treatment. TiO_2 is considered the most investigated semiconductor due to photocatalytic activity, thermal stability and nontoxicity. It is considered the most promising for the photocatalytic destruction of organic pollutants. By using several parameters such as phase composition, aggregation degree, electronics structure, adsorption of gas molecules, nature of the solvent can determine photocatalytic activity of TiO_2.
Keywords: photocatalysis, wastewater treatment, TiO_2

1. INTRODUCTION – SHORT REVIEW

Most countries face a water scarcity, especially in developing areas because the available water quantities cannot meet consumer requirements. Scientific advances following rapid industrial development, environmental pollution, water residues, global warming, causing abnormal dramatic changes, leading to significant water scarcity (Shavisi Y. et. al. 2014). The standard of living has improved significantly through technology development, but this factor threatens human health and the environment. Drinking water is essential for human health. Over 80% of diseases are due to bacterial contamination of drinking water (Shavisi Y., et. al. 2014).

Along with national development, industry crunching, wastewater is becoming more and more contaminated, which leads to a debilitating process. Oily wastewater from various industries has enormous potential for environmental degradation, especially soil and water (Diallo, M.S., et. al. 2005)

The number of poles varies both in quantity and in quality due to the number of people and industrial plants. Due to the widespread diversification of water pollution and non–biodegradable problems, a number of problems have arisen that cannot be addressed through the natural cleaning cycle (Adán C.et. al. 2016).

In the past few years, the authorities in the field have imposed stricter rules, limiting the pollution caused by these wastewaters, ensuring a more efficient treatment. New sewage treatment techniques have been introduced to ensure better cleaning, significantly reducing costs (Luan J., et. al. 2009).

Worldwide there is a significant increase in pollution with toxic pesticides, organic compounds and manure emissions. Water treatment technologies that include non–biodegradable organic compounds have a great difficulty in eliminating pollutants through existing biological treatment including coagulation, precipitation and oxidation technology (Yi S.L., et. al. 2013).

Coagulation and precipitation techniques employ a method that precipitates solids in suspension forming flocs after adding a polymer coagulant or anorganicide coagulants to the coagulation of pollutants to be moved by adding a series of water–soluble metals and adjusting the Ph. These methods of healing or high efficiency of treatment, but the use of chemicals leads to the creation of new environmental problems.

Another efficient method for wastewater treatment is photocatalytic. This method uses semiconductor particles that effectively degrade a large number of pollutants.

Following studies for several semiconductor photocatalysts, TiO_2 has been proven to be the most efficient for both practical applications and fundamental research.

Titanium dioxide (TiO_2) is a highly studied material for various applications: electrodes used in photo–electro–chemical cells, electric capacitors, solar cells, in medicine for inactivating cancer cells, photodegradation of organic compounds in water or air treatment processes. The use of this semiconductor was in the form of a suspension of nanopowders (very high surface area) and in immobilized form of thin layers deposited on a rigid substrate (Nair, A.S. et al 2004).

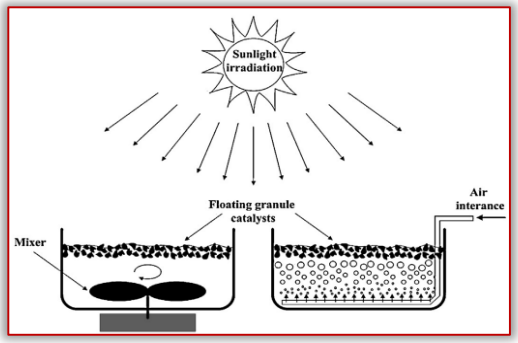

Figure 1 –Experimental set–up for photocatalytic activity reduction of ammonia

Till now has been reported the test of TiO_2 nanomaterial for photocatalytic degradation of ammonia (Shavisi et al., 2014) in the installation from Figure 1. The photodegradation of ammonia using TiO_2 show that the photochemical reaction treats the ammonia into harmless N_2 and H_2 gases (Shavisi et al., 2014).

One of the most widely used forms of TiO_2, both at the research and industrial level, is the commercial grade Degussa P25. This is a mixture of anatase: rutile in a ratio of about 3:1. Due to availability on the market, very good chemical stability,

reproducibility of experimental results and photocatalytic activity, Degussa P25 has been suggested by several research groups as reference in photodegradation processes. The properties of titanium dioxide that make it widely available are:

- High capacity for the production of hydroxylic alcohols in aqueous medium under UV irradiation,
- Potential to modify the prohibited band to use solar radiation,
- Inertial chemical, including in extreme conditions,
- Commercial availability at a relatively low price,
- Different and low complexity methods for laboratory preparation, both in powder and thin layers.

The TiO_2 photocatalyst is nontoxic, inexpensive, chemically and biologically inert, being an important photoreactive. The detailed mechanism of photocatalysis varies from poult to pollutant, but a common point has been reached, namely: responses responsible for the photocatalytic effect are redox reactions. By measuring the quantum yield of products, the photocatalytic yield can be evaluated. Oxidation treatment technology decomposes organic material because it generates radicals (OH) by way of a reaction of hydrogen peroxide and iron salts.

The technologies that use the catalytic activity of metal oxide semiconductors have been the focus of TiO_2, which is a photocatalytic technology (Marugan J, et. al. 2006). Advanced technologies use TiO_2 photocatalyst to attract higher attentiation by generating OH–semipermanent, using only non–chemical photo–energy. The operating cost can be significantly reduced when using solar energy. An obstacle in using the practical energy of this water treatment technology is due to the low light efficiency of TiO_2 (Marugan J, et. al. 2006).

The development of photocatalytic research is related to the use of solar energy. The basis of this technology is to convert solar energy into chemical energy. Conversion refers to the synthesis of chemical energy to induce a chemical reagent

2. CONCLUSIONS

TiO_2 photocatalyst will increasingly be used under UV light or solar irradiation due to low cost, safety, and advanced technology oxiers for the water treatment industry. Although there is sufficient knowledge in the field to allow the application of this method, many things remain unknown. The reactivity of a catalyst depends on organic degradation.

The use of solar energy is limited by the photo–ineffectiveness of the TiO_2 catalyst. For the photocatalysis water treatment technology, it is necessary to develop a TiO_2 innovative photocatalyst.

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