NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY "POLITEHNICA" BUCHAREST

DOCTORAL SCHOOL OF CHEMICAL ENGINEERING AND BIOTECHNOLOGIES

FACULTY OF CHEMICAL ENGINEERING AND BIOTECHNOLOGIES

DEPARTMENT OF BIORESOURCES AND POLYMER SCIENCE

DOCTORAL THESIS - ABSTRACT

Active photocatalysts based on TiO_2 in paint

PhD student: Monica Nicoleta IONIȚĂ

PhD supervisor: Prof.Dr.Ing. Ioan CĂLINESCU

For the first topic addressed in order to write the doctoral thesis, Synthesis of pigments based on TiO_2 decorated with metal oxides, to achieve this goal, two syntheses were carried out starting from industrial TiO2 and two composite models were obtained: (1) A TiO_2 composite decorated only with copper oxide, showing a strong photocatalytic activity in the visible range that generates a strong antibacterial effect. It is known industrially under the ALINNA® brand and was used in the manufacture of that paint; (2) A TiO_2 composite decorated with calcium and copper oxides, known under the trade name Q-field® and currently used in the manufacture of antibacterial paints. This composite exhibits photocatalytic activity in visible light, which makes it recommendable for decorative applications with an antibacterial effect in the medical area

In the framework of the second theme addressed in order to write the doctoral thesis, the physico-chemical characterization of TiO_2 pigments decorated with metal oxides with the help of the following techniques: (1) DFT computational density functional theory studies, (2) UV spectrum-VIS (3) X-ray diffraction (XRD), (4) Scanning electron microscopy (SEM) (5) X-ray photoelectron spectroscopy (XPS), (6) Specific heavy metal migration tests.

Within the third theme addressed in order to write the doctoral thesis, Antibacterial paint - Preparation and testing methods, the photocatalytic activity of paints containing TiO_2 composite pigment decorated with metal oxides (ALINNA® sample and Q sample) was determined -field®) complying with the standard DIN 52980:2008-10 "Photocatalytic activity of surfaces - Determination of photocatalytic activity by degradation of methylene blue", respectively ISO 10678 - 2010 "The determination of photocatalytic activity of surfaces in an aqueous medium by degradation of methylene blue ".

For the last topic addressed in order to write the doctoral thesis, the microbiological characterization of the compounds and the evaluation of the mechanism that generates the antibacterial effect, (1) antimicrobial efficiency tests (2) membrane permeability and (3) toxicity

studies on aquatic invertebrate organisms and vertebrates, proving that it exhibits good antibacterial activity generated by ROS species and is a good candidate for protective compositions in the medical area.

The aim of the research carried out was to create a new composite based on TiO_2 embedded in the paint, with antimicrobial activity created as an alternative to replace the current biocide agents, without inducing their negative effects and whose photocatalytic activity is activated by the field visible compared to the existing alternatives. The TiO2-based composite does not sublime from the compositions and does not release heavy metal ions into the environment.