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INNOVATIVE SELF-CLEANING AND BACTERICIDE COATED POLYMER FILMS AND FABRICS UNDER DAYLIGHT IRRADIATION

T. Yuranova[1], J. Rengifo[2], A. Rincon[2], C. Pulgarin and J. Kiwi[1]*
[1]*Laboratory of Photonics and Interfaces, Basic Science Faculty, Institute of Chemistry*
[2]*Laboratory of Environmental Biotechnology, Swiss Federal Institute of Technology (EPFL), 1015 Lausanne, Switzerland*

ABSTRACT

During the last 5 years our group has worked on the design, synthesis and testing of self-cleaning of modified polymer films and textile presenting self cleaning and disinfection properties. The aim is to find substrates that will retain the catalytic sites added in the surface presenting 3 properties: a) the kinetics of the self-cleaning or disinfection surface reaction presents an adequate kinetics for the selected reaction, b) the film or fabric remains stable during acceptable operational periods and c) no leaching out of the active catalytic sites should proceed under the conditions of normal use.

The self-cleaning effects of inert flexible polymer films (60-100 micron) have been developed, and we have reported Nafion-TiO_2 under visible light irradiation for the discoloration of dyes and the abatement of organic compounds[1]. Flexible Nafion-loaded and less costly fiberglass-Nafion-TiO_2 surfaces also represent suitable interfaces for self-cleaning of organic compounds[2]. Polyethylene-maleic anhydride copolymer-film is able to anchor TiO_2 and was shown to be able to abate toxic and non-toxic organic compounds[3]. Successful stabilization of TiO_2 with high activity under solar daylight light was achieved with Tedlar, a widely used fluorocarbon polymer film modified with TiO_2. Self-cleaning was observed over a period of months without decay of activity[4].

Self-cleaning, deodorant and anti-VOC (volatile organic compounds) effects are possible when modifying the surface of textiles before anchoring them on TiO_2. Physical methods like RF-plasma and vacuum-UV have been used to introduce carboxylic groups in wool-polyamide[5] and cotton[6]. The TiO_2 forms a complex with the -COOH groups retaining their oxidative action under solar irradiation in the presence of water vapor and air. This leads to self-cleaning effects and to the destruction of organic compounds like wine, coffee, make up, grease etc. Chemical spacers have also been used to attach TiO_2 to fabrics, anchoring this semiconductor on one carboxyl and condensing the surface -TiOH with the second carboxyl-group[7].

Bactericide effects on synthetic fiber wound pads and cotton fabrics loaded with Ag have also been achieved recently in our laboratory[8,9]. The activation by vacuum UV introduces -COOH anchoring groups on the wound pads and subsequently the Ag-ions are fixed on this surface from an appropriate solution. Destruction of *E. Coli* in periods < 3 min was observed on these Ag-loaded fabrics confirming the efficiency of the bactericidal effect.

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