Cleaning the air we breathe: Degradation of Allergens of Pollen by Heterogeneous Photocatalysis.

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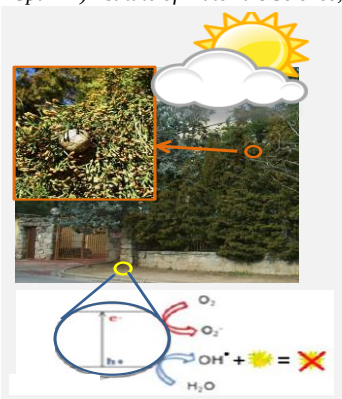

In this work, the potential for degradation of different allergens, coming from pollen of trees, grasses and plants, by heterogeneous photocatalysis has been undertaken. 7 different allergens usually employed in medical allergy tests and widely present in our cities were thoroughly characterized and submitted to degradation experiments by two different commercial catalysts for 3 different sources of radiation, illuminating with different intensities, following the evolution of the products of reaction. As a result, it has been possible to determine the rate of reaction of each allergen, in function of the source of radiation conditions and the secondary products formed, confirming the fact that heterogeneous photocatalysis is a feasible way to undertake the problem of the excess of allergens as airborne contaminants.

When pollen is suspended in the air, millions of people suffer from seasonal pollen allergies, accompanied by several symptoms such as asthma, sneezing, itchiness, runny nose, and watering eyes during different periods. According to several predictions, due to climate change, pollen counts are expected to more than double by 2040. Within this framework, reduction of the pollen in the air seems to be only possible in indoor air, mainly by using filters. Additionally, resistance of pollen is a major one of the vegetable kingdom, as their exine membrane supports the action of acids and alkalis, as well as heating up to 300 °C; they are altered only by certain microorganisms, such as fungi and Bacteria [1−4] and by some oxidizers, such a O_3, and several reactive oxygen species (ROS) [5-9].

On the other hand, application of photocatalytic technology to construction materials is being increasingly used provided the huge photocatalytic area that these materials can provide. These effects have been achieved by the incorporation of nanoparticles, mainly TiO2, in the materials. Nowadays this technology is been applied in our cities (buildings, tunnels, pavements, etc.) nowadays as pilot trials.

Making both fields to converge, very recently, the authors carried out a pioneer study of the feasibility of heterogeneous photocatalysis to diminish the counts of pollen [10]. The research was carried out at different levels, from solutions to mortar specimens with the evidence that heterogeneous photocatalysis was able to reduce the amount of pollen grains, opening the door to a whole field of research, already full of gaps and whose implications could be quite controversial.

Following this subject, in this work, the potential for degradation, by heterogeneous photocatalysis, of different allergens from pollen of trees, grasses and plants, usually employed in medical allergy tests has been undertaken. The species studied have been: Cupressus Arizonica, Ligustrum Vulgare, Olea Europaea and Platanus Acerifolia, coming from trees, Pollen III (Avena, Hordeum, Secale, Triticum), Pollen IV (Dactylis, Festuca, Lolium, Phleum, Poa) and Poa Pratensis, from pollen of grasses and from plants, the Artemisia Vulgaris. All of these species are very allergenic and widely present in our cities.

The allergens have been thoroughly characterized through different techniques (Fourier transform infrared spectroscopy (FTIR), Fluorimetry, HPLC) and have been submitted to degradation experiments using two different commercial catalysts for 3 different sources of radiation, and for each, illuminating with different intensities. The evolution of the products of reaction has been followed by analysing them at different times.

As a result, it has been possible to determine the rate of reaction of each allergen, in function of the source of radiation conditions and the secondary products formed, confirming the fact that heterogeneous photocatalysis is a feasible way to undertake the problem of the excess of allergens as airborne contaminants.

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