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Can TiO_2-based photocatalytic textiles be used to improve the urban air quality?

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Despite current legislation and efforts made to improve urban air quality, significant negative effects still persist. That is the case of traffic, which impact on air pollution is a growing problem. For this reason, depollution measures are necessary to reach safer air quality levels. Recently, the use of titanium dioxide (TiO_2) based photocatalytic self-cleaning and de-polluting materials has been considered to remove air pollutants, especially NO_x. TiO_2 can be found in the market under different formats for environmental purposes, and its effectiveness depends not only on the support (concrete, paints, etc) but also on the impregnation method (layer, embedded, etc).

By combining laboratory and field campaigns, the LIFE PHOTOCITYTEX project was conceived to demonstrate the effectiveness of using TiO_2-based photocatalytic nanomaterials in textiles as a way of alleviating the air pollution in urban areas. Within the project, which is already within its last year, two one-year extensive passive dosimetric campaigns have already been completed to assess their impact on the selected urban sites, measuring before and after the installation of the photocatalytic textile prototypes, respectively. Also, intensive active measurement campaigns (using active dosimetry, monitors and instrumentation for physical parameters) have been conducted to account for winter and summer conditions. Besides, lab-tests have been concluded to determine optimal photocatalytic formulations on textiles, and these have been tested at the EUPHORE simulation chambers under typical environmental conditions of various European cities. Besides the effect on NO_x, which has been the main focus of the study, VOCs formation and abatement has been assessed, yielding in a better overall understanding of the whole process and its implications.

Very promising results on the deep reduction of NO_x have been observed at EUPHORE. From the calculation of the uptake coefficient, a mathematical model tool foresees an averaged NO_x reduction of 2.5% under gentle wind conditions in the whole volume of the tunnel location. Furthermore, in the urban campaigns, NO_x and NO_2 reductions above 20% have been found in the vicinity of the textile (10cm from the textile).

An overview of the campaigns deployment will be given together with the results obtained, with emphasis on the observed seasonal and temporal variability. Implications, impact and possibilities of the use photocatalytic textiles as a remediation technique to improve the air quality will be discussed.

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