# Urban Air Purification Using Semi-Active Photocatalysis

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## Abstract

Photocatalysis has received considerable attention in recent years with a huge potential in air purification applications. This work focusses on the semi-passive use of photocatalytic surfaces in streets as an innovative method for removing anthropogenic pollutants (especially volatile organic compounds or VOC's) from urban air. The proposed method is based on lamellae, coated with a photocatalyst (TiO2), lightened with UV light and arranged horizontally at the walls of street canyons to purify air upon contact. To test the feasibility of the method, COMSOL Multiphysics® simulations were performed, considering different options. A constant VOC background concentration was considered, as well as a continuous source of VOC's emitted from street traffic. In a first approach, fans were used to force polluted air over the TiO2 coated lamellae. Secondly, we investigated the possibility to increase the air flow over the lamellae by heating the surfaces of the lamellae, thus creating natural convection. The physics modeled included laminar or turbulent air flow, mass transfer and heterogeneous surface reactions (adsorption, desorption and photocatalytic reactions). Acetaldehyde was considered as a model VOC and adsorption, desorption and photocatalytic reaction rate constants of acetaldehyde were derived by correlating experiments and COMSOL® results (as shown in other work). Significant improvements of local air quality were obtained according to the model results. In future work, some designs will be tested in the reality.

## Figures used in the abstract

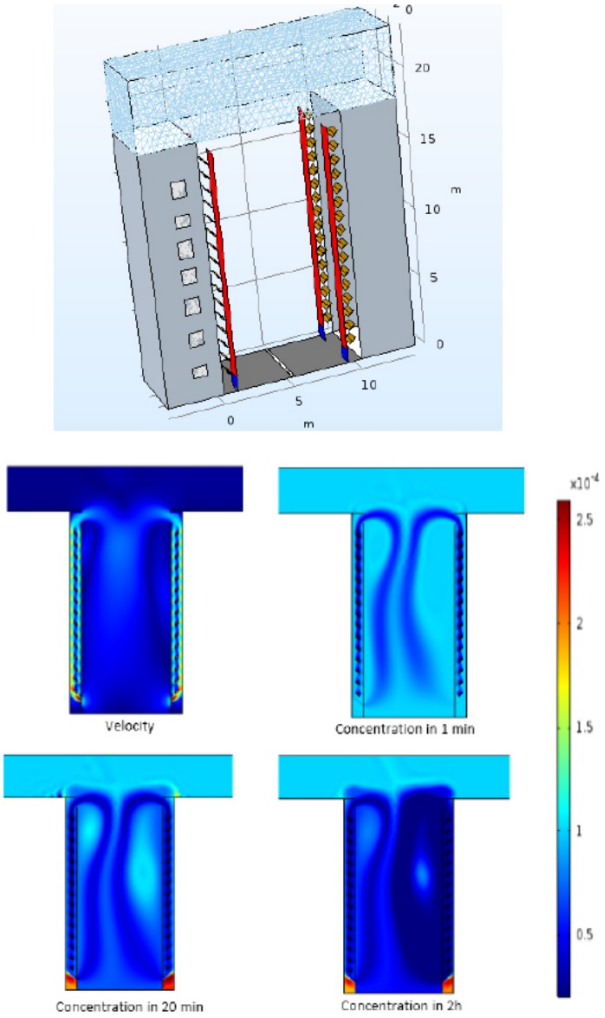


**Figure 1**: Photocatalytic lamellae in a street canyon (top) and some results for forced convection (bottom).