10th Central European Symposium on Plasma Chemistry
21st International Conference on Plasma Physics and Applications

Bucharest, Romania, 1-5 September 2025

Book of Abstracts

Edited by: Daniela Dobrin, Monica Magureanu, Bogdana Mitu, Veronica Satulu

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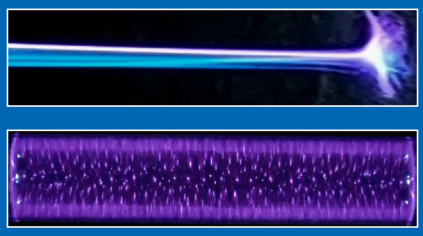

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Large scale air decontamination system using dielectric barrier discharge combined with UV activated TiO_2

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Indoor air can be polluted by many different harmful contaminants, such as chemicals, viruses or bacteria, aerosols or fine particles from smoke, among others [1]. The recent global pandemic is the perfect example showing how contaminants such as viruses are dealt with. Instead of destroying or inactivating them, physical barriers, *i.e.* filters, were mostly used. On the same way, current decontamination systems mostly rely on filters (HEPA, mechanical, electrostatic), whatever the pollutant. Such non-destructive methods work but they induce lots of maintenance costs for changing filters, which "store" the pollutants and produce potentially harmful wastes if not handled carefully.

For these reasons, alternative destructive methods have been developed. Among Advanced Oxidation Processes, the combination of cold atmospheric pressure plasma with UV activated photocatalysts is very promising [2]. The plasma generated electrons, ions, reactive oxygen and nitrogen species, combined with the photocatalyst-generated radicals (OH, O2•−) allow for the oxidation or decomposition of most chemical pollutants, as well as the inactivation of bio contaminants [3]. The synergetic effect of both technologies also helps to overcome their drawbacks, e.g. the photocatalytic effect dissociates ozone generated by the discharge.

This contribution focuses on a large-scale air decontamination system, which combines a volume dielectric barrier discharge, with a UV activated TiO_2 coated textile as a photocatalyst. The latter is activated using either UV-C lamps or UV-A LEDs. An important feature of the setup is that it can treat large volumes of air (several hundred l/min) in a single pass, making it closer to real applications than typical lab reactors treating just few l/min. The efficiency of the system against VOC contaminants is assessed using FTIR measurements of the outlet gas. Several model pollutants are tested, *i.e.*, formaldehyde, acetaldehyde and acetone. The production of ozone is also monitored using UV absorption spectroscopy. To better understand the process, the effect of the different elements (DBD, UV, photocatalyst) are also studied separately. Finally, the inactivation of fine and ultrafine particulate matter is also investigated.

Keywords: Indoor air decontamination; Plasma photocatalysis; FTIR.
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