

# **Towards holistic wastewater treatment using activated carbon/zeolite coupled atmospheric plasma system**

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Conventional wastewater (WW) treatment systems are predominantly designed to target organic and ammonia removal, leaving micropollutants largely unaddressed [1]. Conversely, advanced oxidation processes (AOPs), while effective against most micropollutants, face limitations due to required optimized conditions like pH adjustment, hindering their use for holistic WW treatment. Moreover, the use of added chemicals in AOPs increases treatment costs and raises environmental concerns about potential residue in the treated effluent [2]. In this regard atmospheric pressure plasma-based systems can efficiently degrade organic pollutants without added chemicals or heat. The potential utilization of renewable energy further enhances plasma-based WW treatment's appeal as a standalone green technology [3].

In this study, a dual plasma discharge system was developed and systematically investigated for organics and ammonia removal in the first stage, while disinfection and targeted micropollutants removal will be investigated in the later stage of the study. This abstract includes the results from the first stage of the study where integration of atmospheric plasma with activated carbon and zeolite has achieved comprehensive removal of organics and ammonia from the system. Furthermore, the study explores the regeneration of adsorbents within the system and compares its energy efficiency with conventional biological treatment methods. The findings underscore the potential of the dual plasma discharge system as a standalone solution for holistic WW treatment.

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[3] G. Tomei, M. Saleem, E. Ceriani, A. Pinton, E. Marotta, C. Paradisi, *Chemistry - A European Journal*. 90021-5 (2023).