PFCsByPlasCat - Perfluorinated Organic Compounds (PFCs) Degradation using Non-Thermal Plasma Enhanced by Boron Doped Graphene Oxide as Catalyst

Perfluorinated compounds are a group of toxic chemicals that persist in the environment for long periods. These man-made chemicals have been detected in drinking water and groundwater, raising serious concerns about human health. So far, advanced oxidation processes, including Fenton reagents, ozone oxidants, ultraviolet light or catalysts, have shown limited success in reducing and removing these chemicals. The EU-funded PFCsByPlasCat project will test an alternative treatment option known as non-thermal plasmas that produces several reactive species at a time. Various nanocatalysts will be tested, including boron-doped graphene oxide, to maximise the efficiency of the novel hybrid plasma–catalyst process. Real samples of contaminated groundwater will be tested to validate the process.

The extensive use of perfluorinated compounds (PFCs) in many industrial/commercial applications, as surfactants, emulsifiers, etc., and their high chemical stability are responsible for their ubiquitous presence in the environment. Specifically, the contamination of groundwater and drinking water supplies by perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS) is raising great concern as more data on PFCs toxicity in humans and wildlife is becoming available. Thus, a parallel surge in monitoring campaigns and in the search for innovative water treatment technologies for PFCs is required. Since PFCs are highly resistant to degradation by standard chemical and biological processes, advanced oxidation processes (AOPs) are being considered and, including Fenton, ozone and UV irradiation with catalysts, applied so far with limited success. Among innovative AOPs, air non-thermal plasmas (NTP), which produce several reactive species at a time, have been recently tested for the treatment of PFOA/PFOS yielding promising results. The proposed research aims to advance the state of art by developing an innovative treatment process for PFCs in which NTP is applied in combination with novel boron-doped graphene oxide (B-GO) nano photocatalysts. The catalysts synthesized and characterized by the Researcher will be tested on prepared solutions of PFOA and PFOS using various NTP reactors which are available in the beneficiary laboratory. The best catalyst-reactor combination will thus be identified; conditions and parameters will be optimized to maximize the synergy between plasma and catalyst and the efficiency of the novel hybrid plas-cat process. Real samples of contaminated groundwater will be tested to verify the process applicability to complex matrices. For excellence of research, basic guidelines will be drawn and disseminated for implementing an efficient hybrid plas-cat process in view of auspicable scaling-up and technology transfer to stakeholders.

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