**Treatment of wastewaters and municipal effluents by solar advanced oxidation processes: technology and applications**

**S. Malato**

Plataforma Solar de Almería – CIEMAT, 04200 Tabernas, Almería, Spain

*Sixto.malato@psa.es*

Advanced Oxidation Processes (AOPs) are efficient technologies for water treatment in terms of degradation of pollutants and inactivation of pathogens. In AOPs, the generation of highly reactive radicals allows attaining the oxidation of a great variety of pollutants. A wide range of advanced treatment methods have been investigated including consolidated and not intensively implemented AOPs. The presentation will evaluate their efficiency in the removal of contaminants, advantages and drawbacks, possible obstacles to the application and technological limitations with mid to long terms perspectives. It will also explore the state of the art and latest progress in photoreactors for solar AOPs for water treatment including decontamination of conventional biorecalcitrant wastewaters and elimination of contaminants of emerging concern. The overview will also show how to focus specific wastewaters and discriminate between different AOPs to avoid inefficient applications.

Pilot-scale test results for the complete removal of a plethora of contaminants and microcontaminants have been quite satisfactory. Results reinforce the idea that treatment of extremely low concentrations of contaminants (as contaminants of emerging concern), requires different operating concepts from the application of photocatalysis to high-organic-load industrial wastewaters. The key matter is the design and operation of photoreactors accordingly to the wastewater to be treated. Despite the limitations of the process, the efficiency of the technology for the treatment of wastewater has prompted its investigation at pilot-scale in combination with other technologies as biotreatment and membrane processes. Also, different solar photoreactors have been proposed for applying photocatalysis, trying to take into account the specific needs of the process. In this sense, Raceway Pond Reactors, have arisen as an interesting and feasible scaling-up option for treating municipal effluents, being well-known solar photoreactors based on compound parabolic collectors, more suitable for the treatment of bio-recalcitrant industrial wastewaters with high organic load.

The interest in renewable H2 production sources, with H2 as an energy carrier, is growing. It would be also commented the first approaches to another application of solar photocatalysis, the potential combination of H2 generation with simultaneous water decontamination, as a proof-of-principle study of the potential application of solar photocatalysis as a single technological solution for the water-energy nexus. With this technology, clean hydrogen fuel is produced at the same time as wastewater is treated in anoxic conditions, eliminating highly recalcitrant contaminants and disinfecting it for reuse.