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"Research in water regeneration treatments: state-of-the-art"

Industrial activity stands for 20 % of total water consumption. Moreover, the industrial discharges represent an important source of pollution to environment as only 20 % of them are treated at a global scale. There is, therefore, a need to make a transition towards the so-called "Circular Economy". Among some of the pollutants with an industrial origin are found nitro- and halophenols, heavy metals, pharmaceutical industry wastes, dump leachates, solvents (chlorinated, VOCs, etc), paper industry wastes, alpechin (liquid waste from the olives treatment) and pesticides. Some of them are biodegradable, meaning they are easy treated using biofilters or activated sludges; whereas other substances are considered non-biodegradable. At the same time, the substances can be inert to the treatment (non-toxic), or toxic, either instantaneously (acute toxicity) or in the long-term (chronic toxicity). If biodegradability is very low or negligible, it must be necessary to consider alternative treatments in all cases. Waters decontamination is carried out using different methods such as use of membranes, by Reverse Osmosis (RO) or NanoFiltration (NF), or the employment of Advanced Oxidation Processes (AOPs). The use of membranes allows contaminants be separated from water although it should be noticed they are not eliminated. Also, despite permeate is available for its re-use, it generates a reject that must be treated to reach the ultimate goal of Circular Economy. In this case, the use of AOPs may play a pivotal role to recover products and remove completely contaminants. They are methods performed at room temperature and atmospheric pressure that generate a sufficient amount of hydroxyl radicals to purify water. Typical AOPs include ozonisation (O_3 generation from O_2 using a high-voltage electric discharge), the use of UV_c light (<280 nm) in combination with an oxidant (H_2O_2 or chlorine) to generate oxidant radicals or the photo-fenton process. The latter is widely used in Plataforma Solar de Almería-CIEMAT, showing different applications for water treatment. The speaker explains each of these choices at length, which are found among the most acknowledged AOPs for the treatment of bio-recalcitrant waters. The first take-home message was that a deep assessment of every specific problem is needed in order to choose the best option to solve it. Nowadays several technologies for decontamination of polluted waters are available, allowing its safe re-use. Finally, AOPs show high efficiencies as tertiary treatment for the elimination of all contaminants types, although it must be necessary to evaluate costs and the entire life-cycle in order to select the best option in each case.