TITLE OF RESEARCH TOPIC: Development of multicomponent photo-Fenton-like catalysts for water purification under visible light

Summary:

Contaminants of emerging concern (CEC) are one of the most important groups of organic pollutants in water. Advanced oxidation processes (AOPs) can generate highly reactive hydroxyl radicals that degrade organic pollutants to inorganic compounds such as H_2O, CO_2, and inorganic salts. Iron-based Fenton AOP as a homogeneous catalytic oxidation system is one of the most commonly used AOPs for water purification. However, it has some environmental drawbacks such as the presence of iron ions in the effluents and the operation of the system under acidic conditions (pH=3). We have designed a manganese-based Fenton-like AOP as a heterogeneous catalytic system that operates at neutral pH (*Advanced Functional Materials, 2012, 22, 820-826*). The doctoral program is focused on the development of a manganese-based photo-Fenton-like catalyst as a heterogeneous catalytic system that operates efficiently at neutral pH and under visible-light illumination.

Research techniques used:

Solvothermal synthesis and different impregnation methods will be used to develop multicomponent manganese-based photo-Fenton-like catalysts (e.g. multi-component Mn-Cu or Mn-Fe functionalized mesoporous silica etc.). Basic (XRD, SEM, nitrogen physisorption, TEM, etc.) and advanced (HR TEM, *in-situ* EPR, XAS performed at a synchrotron, etc.) techniques will be used for catalyst characterization. Catalyst will be tested with selected model CECs (e.g. bisphenol A and analogs, etc.). The most efficient catalysts will be tested in a pilot unit at SOLAR TREATMENT OF WATER UNITS at PSA in Almeria in Spain (via secondment).

The reason why the topic is innovative:

The use of sunlight to assist the photo-Fenton process is one of the most sustainable methods for water treatment. The scientific and practical goals of the topic are to **combine innovative laboratory research** (design and development of efficient photo-Fenton type catalysts working at neutral pH and solar light) **with applied research** (testing the most efficient catalyst in a pilot unit at SOLAR TREATMENT OF WATER UNITS at PSA in Almeria in Spain via secondment) **thus fulfilling industrial needs** (significant improvement of cost-efficiency of promising AOP systems and environmental impact).

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