Ph.D. defense

Institut de Chimie Séparative de Marcoule / CEA Marcoule
(UMR 5257, CEA, CNRS, Université Montpellier, ENSCM)

BAPTISTE RUSSO

will present his Ph.D. dissertation

Porous nanocomposite materials prepared with Rice Husk from Camargue used as sorbants

The defense will take place on **Tuesday, October 27th, 2020** at **9.00 am**

in the ICSM Auditorium

Rice is the second most produced cereal worldwide and is also produced in Camargue. The rice husk, which is the protective part surrounding the rice grain during its growing, is composed of silica and organic biopolymers and represents 20 % of the total mass of the cereal immediately after the harvest. When this rice husk is thermally treated, the resulting ashes show promising properties in wastewater treatment.

During this thesis, eight different materials have been prepared with chemical and/or thermal treatments under air or argon atmosphere. The characterization of these materials has shown that an acidic pretreatment of rice husk removed its impurities. When those impurities are removed, resulting materials show a large specific surface area (several hundred of $m^2\ g^{-1}$) after thermal treatment and either consist of dense silica and silica nanoparticles or a silica/carbon mix depending to the used gas. When impurities are kept, the silica sinters which leads to a decrease of the specific surface area. In that case, the silica presents a different structure from the one obtained from the chemically pretreated rice husk. The results also show that the thermal treatment under argon allow the formation of turbostratic carbon.

It has been found that the most efficient materials for the metals extraction are those who are prepared without chemical pre-treatment. Sorption capacities of metals for these materials are 0.15 mmol g^{-1} for the siliceous ash and 0.33 mmol g^{-1} for the composite material after 24 h of contact time. To explain these results, a “reactive poral diffusion” process is proposed. Such process occurs as follow: a silicate phase sealing some pores is dissolved, the dissolved species precipitate integrating the metals and lead to an ionic exchange. This exchange occurs between the metal cations from the solution and the alkali and alkaline earth elements from the solid. The capacity for phenol was 0.16 mmol g^{-1} with the composite ash. These experiments show that rice husk ash can be used as sorbants materials for wastewater treatment, in both cases for metallic or/and organic pollution.

Keywords: rice husk ash; wastewater treatment; sorbant material; heavy metals; organics pollutants