NO-WASTE

1.4.2013-31.3.2017

Utilization of Industrial by-products in Environmental Protection

NEWSLETTER 3

HYDROTHERMAL ACTIVATION OF CARBONACEOUS MATERIAL TO PREPARATION OF CATALYST SUPPORT

World consumption of activated charcoal should exceed 10% per year, reaching an estimated amount near 1.36Mt in 2015 (ROMÁN et al., 2013). Carbonaceous Materials have been prepared from different kinds of materials such as coconut shells, wood, lignin, petroleum, turf, coke, bones, seeds, sawdust, rice shells, fertilizer residues, rubber and others. The activated charcoal prepared from natural materials has a higher amount of ashes when compared to those prepared from polymeric waste, which also has higher mechanical resistance against abrasion and compression (S.B. de Oliveira et al., 2008). Regardless the source, the carbon adsorption properties are always affected by the chemical structure of the surface. The spherical polymeric charcoal, obtained from the polymer waste is particularly attractive because regular spheres with high specific surface area and lactonics groups on the surface (Fig. 01) as well as to their textural properties are obtained. They also show high adsorption capacity and suitable mechanical properties, besides regular granulometry and resistance against abrasion. Furthermore, these solids allow an easy incorporation of metals in their surface as well as on the surface of the precursor resin (V.Z. Radkevich et al., 2008). For activation of the carbonaceous material is necessary high temperatures (above 700 °C), i.e., consumption of large amounts of energy. Other possibility is the activation of the carbonaceous materials by hydrothermal activation (HTA), where lower temperatures and high pressure are required (180 to 220 ºC, 22 to 120 bars). This process is based to already known from Bergius and Specht process (1913), who described the hydrothermal transformation of cellulose into Hydrocharcoal (HTC). Hydrothermal carbonization can be used for fabrication of carbon spheres of controllable size with large numbers of oxygen-containing functional groups on their surface using a hydrothermal treatment. HTA, however, nevertheless represents a simple and environmentally friendly technique because there is the possibility to save energy in the charcoal activation step, obtained from polymers waste to be applied as catalytic support.

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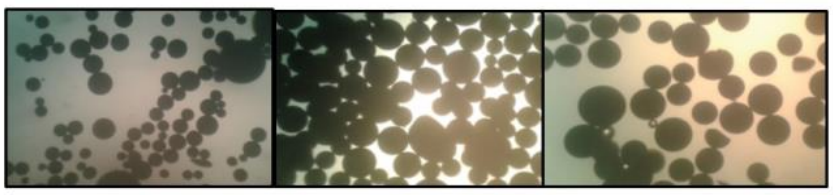
HYDROTHERMAL ACTIVATION OF MICROPARTICLES
Characterization of the Microparticles by Optical Microscopy



Analysis of the microparticles after hydrothermal activation obtained from optical microscopy demonstrated the efficiency of the method as **maintaining morphologic integrity and sphericity** of the **particles**.

HYDROTHERMAL ACTIVATION OF MICROPARTICLES
Analysis of Functional Groups Present on the Surface of the Microparticles

Samples	Functionals Groups (mmol.g-1)		
	Carboxylics	Lactonics	Phenolics
CAC-CAG	1,63	0,38	0,48
CNA-BRA	1,31	0,23	0,72
CNA- KHTC01	3,29	0,74	2,69
CNA- KHTC02	2,66	0,30	1,64
CNA- KHTC03	1,44	0,02	1,89
CAP- KHTC01	0,88	0,18	0,56
CAP- IHTC01	2,13	1,15	0,72
CAP- IHTC02	1,37	0,51	2,34

Identification- Conditions:

CAC-CAG (Commercial Activated Charcoal);
CNA-BRA (Natural Charcoal Without Activation);
CNA-KHTC01 (CAC-CAG Ativated by HTA: KOH 3,0 mol.L^{-1}, 4 h/150 ºC);
CNA-KHTC02 (CAC-CAG Ativated by HTA: KOH 2,0 mol.L^{-1}, 4 h/150 ºC);
CNA-KHTC03 (CAC-CAG Atvated by HTA: KOH 1,0 mol.L^{-1}, 4 h/150 ºC);
CAP-KHTC01 (Polymeric Charcoal Activated by HTA: KOH pH 9.0, 4 h/150 ºC);
CAP-IHTC01 (Polymeric Charcoal Heated to 400 ºC and Activated by HTA: KOH 1:1, 4 h/190 ºC);
CAP-IHTC02 (Polymeric Charcoal Heated to 450 ºC and Activated by HTA: KOH 2:1, 4 h/190 ºC.

Oliveira, S. B; Antero R. V.; Barbosa D. P., Zang, J. W., Zang, W. A., Chemical Brazilian Congress (2014)

Figure 01 - Comparation betwen functional groups of the CAC, CNA and CAP

WP 1 Hydrogen and synthesis gas production from waste
University of Poitiers

WP 2 Valorisation of wastes from olive and argan production
University of Chouaib Doukkali

WP 3 Production of valuable chemicals from CO_2 and organic gases
University of Oulu

WP 4 R&D on the HTC technology to valorize industrial by-products and wastes,
Federal University of Applied Sciences, Goiania

WP 5 Utilisation of methane originating from coal mining
Dalian Institute of Chemical Physics

WP 6 Research on the HTC process: Product design
Trier University of Applied Science

August, 2014
Newsletter by Federal University of Applied Sciences (IFG), Goiânia, Goiás, BRAZIL

NO WASTE PROJECT: ”Sustainable production is one of the key issues of the production technologies today. In addition to the modifications to the processing technologies that make production more environmentally friendly, intensive research is needed in valorisation and utilization of different by-products and wastes produced by the industry. In addition to industry, wastes are created by the communities and agriculture. The exploitation of these wastes is important, since the amount of the waste is continuously increasing and the treatment of this waste is not adequate even today. **Finding the new ways to utilize industrial, communal and agricultural waste and by-products, and transferring those to valuable products, is the goal of NO-WASTE.”**