



VALORIZATION OF RICE HUSK BY CHEMICAL AND THERMAL TREATMENTS

Rosario Madrid¹, F. Margarido^{1*}, C.A. Nogueira²

¹ CVRM - Centro de Geo-Sistemas, Instituto Superior Técnico, Technical University of Lisbon (TULisbon), Av. Rovisco Pais, 1049-001 Lisboa, Portugal, fernanda.margarido@ist.utl.pt

² LNEG – Laboratório Nacional de Energia e Geologia, UPCS, Estrada do Paço do Lumiar, 1649-038 Lisboa, Portugal

* Presenting author

Rice husk is an abundant available agricultural waste material in all rice producing countries. These husks are not of commercial interest, being utilized as a fuel in some regions, and treated as waste in other countries causing pollution and disposal problems. Rice husk has many industrial applications, and due to growing environmental concern, its conversion to value-added products by thermal or chemical treatment makes it an important secondary resource material.

Rice husk contains about 13-29% inorganic matter, being composed of silica (87–97wt%) with small amounts of alkali and other trace elements. This high grade of silica opens a possibility for its valorization as raw material for the production of a series of silicon-based materials, including silicon carbide, silica, silicon nitride, silicon tetrachloride, pure silicon, and zeolite.

This paper presents a process developed for producing silica from rice husk, with amorphous properties, high purity and porosity, with potential valorization in several applications. The process involved three main operations: water washing for removal of some impurities, acid leaching with HCl or H₂SO₄ for dissolution of contaminating metals and incineration for organics decomposition.

In the washing operation some particles and dirt present in the husk were removed. The chemical analysis of the washed husk and solution allowed to conclude that the quantity of metals removed in the washing was substantial, being about 60% for potassium, 46% for iron, 56% for manganese and >80% for zinc. A partially purified husk was obtained.

The chemical treatment by leaching with HCl 0.4M and H₂SO₄ 0.2M, of samples as-received (natural) and washed husk, allowed obtaining high metals removal efficiency, namely >99% for potassium, 85-90% for iron, >96% for manganese and >80% for zinc. The final composition of the leached husk was 0.003-0.005% K, 0.016-0.021% Fe, <0.001% Mn and <0.0007% Zn. No significant effect was found for the leaching conditions tested.

The incineration of the rice husk after previous purification was performed at 540°C, by using samples obtained in the several chemical treatment conditions, and using thermal treatments with different heating and cooling slopes. The weight loss attained in the incineration was about 80%, resulting a white coloured final husk ash. The analysis by XRD confirmed the quasi-amorphous characteristics of the silica formed.

Acknowledgement: Rice ask samples were kindly supplied by Prof^a Paulina Figueiredo from Instituto Politécnico de Setúbal, to whom the authors wish to acknowledge.

Keywords: Rice husk, Leaching, Incineration, Valorization.