Thematic Section: Research into New Technologies. **Full Paper**
Subsection: Silicate Technology.
The Reference Object Identifier – ROI: jbc-01/19-57-3-155
The Digital Object Identifier – DOI: 10.37952/ROI-jbc-01/19-57-3-155
Submitted on March 11, 2019.

Use of burn rice residues for production of nanosilica

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Keywords: rice straw, rice husk, hydrochloric acid, sulfuric acid, silica, oxygen, nanosilica.

Abstract

The current uilization of rice straw and husk as a solid fuel or burning out in the open air creates a large amount of ash, which is still inefficiently used and causes environmental problems in countries that grow rice. Meanwhile, valuable organic silica dioxide can be obtained from these wastes for wide applications. Recently, the production of organic silica dioxide from various sources has attracted much attention in the world. This article presents the results of a study on the preparation of nanosilica from rice straw and rice husk of Vietnamese by a two-stage process. In the first stage, burn rice straw or rice husks with ash content of 92.4% and 92.2% respectively, were treated by sodium hydroxide solution and then filtered to obtain a dissolved sodium silicate. In the second stage, the silica gel was precipitated from a solution by hydrochloric acid or sulfuric acid, the precipitate was washed, dried and burned at 575 °C to obtain the nanosilica powder. It was found that the treatment with 25% NaOH at room temperature for 72 hours was optimal for extraction the maximum possible amount of silica from both types of silica sources. The highest yield of SiO_2 is observed when 12% HCl and 30% H_2SO_4 were used, however, the maximum yield of SiO_2 was achieved with using 12% HCl. The characterization of the nanosilica was carried out by SEM, EDS and XRD, which indicated the amorphous structure of obtained silica, which had particle diameter rang to 50 nanometers. The silica content of rice husk nanosilica powder was 54.8%, it was 60.2% for rice straw nanosilica.

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