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Synthesis of Silica from Rice Husk Ashes with Variation of Solvent (KOH) Concentration

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Abstracts

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The purpose of this experiment is to utilize natural resources as the candidate of low cost and mass production of silica and to understand the effect of KOH concentration as solvent to the phase structure of silica. The silica was prepared by sol-gel method with rice husk ashes as the raw material from natural resources. The sample was further characterized by X-Ray Diffractometer. The grain size of samples was 490,35 nm, 700,88 nm and 490,44 nm for solvent variation of 5%, 10% and 15% respectively. Those three samples contain silica (SiO₂) and magnesium oxide (MgO) obtained from XRD data. ©2017 JNSMR UIN Walisongo. All rights reserved

Keywords: silica, rice husk dust, phase structure

1. Introduction

Supported by its tropical climate, Indonesia is one of the greatest agrarian country in the world. Moreover, Indonesia place the third greatest rice producer in the world. The rice husk is a light yellow shell covering the rice. It is generally utilized as growing media in farming and agriculture. The burned rice husk produce a rice husk ashes or rice husk dust. It is traditionally employed as a kitchen set washers and traditional fuel in bricks production.

Quran Al-An'am (95) and Al-Qaaf (9) mention toward grains plant including rice.

إِنَّ اللَّهَ فَالِقُ الْحَبِّ وَالنَّوَى يُخْرِجُ الْحَيَّ مِنَ الْمَيِّتِ وَمُخْرِجُ الْمَيِّتِ مِنَ الْحَيِّ ذَلِكُمْ اللَّهُ فَأَلَيْ تُوْفِكُونَ

"Indeed, Allah is the cleaver of grain and date seeds. He brings the living out of the dead and brings the dead out of the living. That is Allah ; so how are you deluded?"

وَنَزَّلْنَا مِنَ السَّمَاءِ مَاءً مُبْرَكًا فَأَنْبَتْنَا بِهِ جَنَّاتٍ وَحَبَّ الْحَصِيدِ

"And We have sent down blessed rain from the sky and made grow thereby gardens and grain from the harvest"

Chandra et al synthesized and characterized silica from rice husk dust. The dependence of solvent concentration to the phase structure of silica prepared from rice husk dust will be further discussed.

2. Experiments Procedure

Rice husk was first cleaned from dusts with deionized water and dried. It was burned and further heated at 700 °C for 4 hours. The 60 ml of KOH solution with concentration variation of 5%, 10% and 15% was added to 10 gram of rice husk and stirred at 85 °C for 60 minutes. The solution was further filtered, rinsed and heated at 85°C for 60 minutes.

The HCl 1 M solution was gradually dropped to the sample until it reaches pH 7 and forms gel-solution. It was further dried at 85°C for 80 minutes in the oven. The sample was then ejected from the oven. After it reaches room temperature, the sample was further grinded to the ashes.

3. Result and Discussion

Silica have been synthesized by sol-gel method with variation of solvent concentration and further characterized by X-Ray Diffraction (XRD) to identify grain size and phase structure.

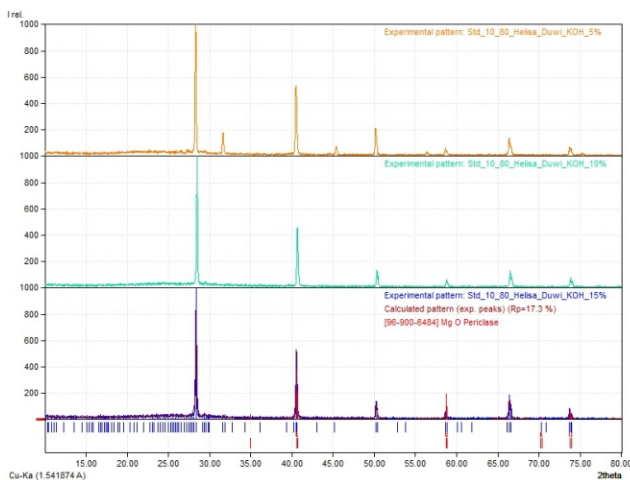


Figure 1. XRD Data of silica with various solvent concentration of 5% (yellow), 10% (green), 15% (blue).

The phase formed was quartz as identified in Figure 1. The Cu-Kα wavelength used is

1.54Å. The grain size was measured using the following equation.

$$t = \frac{0,9 \lambda}{\beta \cos \theta} \quad (1)$$

with “t” is the calculated grain size, λ is the Cu-Kα wavelength source, β is FWHM (Full Width at Half Maxima) and θ is the diffraction angle. The grain size values are showed by the following table.

Table 1. The grain size value of silica with various solvent concentration

Sample	Silica			t (nm)
	Solvent Concentration	2θ	FWHM	
1	5 %	28,2	0,0029	490,35
2	10 %	28,4	0,0020	700,88
3	15 %	28,3	0,0029	490,44

The grain size enhances with the 10% concentration of KOH due to the solvent's reducing properties. The grain size diminishes with the 15 % of solvent concentration due to the broken oxygen functional group and silicon bond. The supporting microstructure and elemental analysis is required to further analysis.

4. Conclusion

The low cost and easy handle silica has been successfully synthesized from natural source, rice husk ashes, with variation of solvent (KOH) concentration. The phase of silica is quartz analyzed from XRD data result. The highest grain size has been achieved at convenient concentration of solvent, i.e 15% due to the reducing property of the solvent.

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References

- [1] Buckley, A. M., & Greenblatt, M. J. 1994. Sol-Gel Preparation of Silica Gels. Vol. 71(7), hal. 599.

- [2] Chandra, Andy, dkk. 2012. Isolasi dan Karakterisasi Silika dari Sekam Padi. *Perjanjian*, No: III/LPPM/2012-09/80-P, hal. 7-9.
- [3] Kusuma, Hamdan Hadi. 2015. X-Ray Diffraction and Density Distribution Measurements on the Al₂O₃ Crystals Grown by Czochralski Method with Different Pull Rate. *Jurnal of Natural Sciences and Mathematics Research*.
- [4] M., Galang Fajar Agung, dkk. 2013. Ekstraksi Silika dari Abu Sekam Padi dengan Pelarut KOH. *Konversi*, Vol. 2 (1), hal. 29-30.
- [5] Rio, B.F. 2011. Sintesis Nanopartikel SiO₂ Menggunakan Metode Sol-Gel dan Aplikasinya Terhadap Aktifitas Sitotoksik. *Jurnal Nanoteknologi*, UNAND, Padang.
- [6] Suka, I. G., dkk. 2008. Karakteristik Silika Sekam Padi dari Provinsi Lampung yang Diperoleh dengan Metode Ekstraksi. *MIPA*. Vol. 37 (1), hal. 47-52.
- [7] Wibowo, Aji. 2015. Sintesis Nanosilika dari Abu Ketel Menggunakan Metode Hidrothermal dengan Variasi Waktu dan Suhu Proses. Skripsi. Bogor: Institut Pertanian Bogor.