OPTIMIZATION OF SILICA EXTRACTION OF RICE HUSK (*Oryza sativa L.*) TO INCREASE ABSORPTION PLANT NUTRIENTS

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ABSTRACT

Extraction of silica has now been developed as one of the additional nutrients in the soil. This silica extraction technology from materials that are no longer used as an example of rice husks. As result of the extraction of rice husk silica is used to nourish the rice plants themselves. The addition of plant nutrients can be optimized by using an encapsulation system. The process of nutritional encapsulation is expected to optimize the absorption of nutrients in the soil in slow reaction. This inhibitory process can also be supported by the use of nutrient remobilization. So the purpose of this research is to obtain the optimum result of silica extract from rice husk and to know the characteristics of capsulation result of silica extract produced. As for this research using the addition of KOH so that this research method using Randomized Block Design (RBD) with KOH 2.5%, 5%, and 7.5%. The analyst has performed mass equilibrium analysis, water content of the material, and SEM analysis for physical analysis. In this study showed that with the addition of 5% KOH treatment to be the best treatment in this study that produced as many as 4.5 grams. Furthermore, the sample was treated with liquid nitrogen as an encapsulation medium. The result of the research showed that the silica value contained in the extract yield on KOH 5% by 19.4% while in addition KOH 7.5% silica content of 21.8%. This shows the highest value of yield that is in the addition of KOH of 5% but the silk content of the most that is in the addition of KOH of 7.5%.

Keywords : *Adsorbtion., Oryza sativa L., Nutrition., Silica., Rice Husk.*

1. INTRODUCTION

Nutrient encapsulation technology in plants is widely developed to improve soil ability in plant growth. Nitrogen encapsulation. Nitrogen encapsulation is one technique that can be used to maintain the nutrients in the soil especially on rice crops in the fields.

Application of this method is closely related to the method of slow adsorption (slow adsorption) nutrients on the soil. With the application of this method is expected at the time of soil maintenance, especially plants still obtain nutrients needed. For example, the soil requires urea, nitrogen, potassium, or phosphorus periodically. It is also capable of streamlining the required energy in the framework of the cultivation of rice crops.

The first step in this research is the manufacture of nitrogen encapsulation with various combinations of treatment, then is the determination of the concentration and dose of nutrient dosage required. The next step tested it was applied to rice plants with various observation variables.

The rice husk is the outermost ulit bag or the hard coat of cariopsis wrap (rice grain), composed of two interlocking lemma and palea halves. The leaf or coating is peeled off and separated during the milling process and generates about 20% of the rice husk as waste product or waste material [10]

In the first year of the study is an assessment related to the nutrient value required by rice crops. So after the nutritional value has been known modeling is done by using the design drawing tool accompanied by the material to be used. The purpose of this study is to form nitrogen encapsulation so as to bind and maintain nutrients especially in rice plants. So the research titled Nitrogen encapsulation to increase nutrient adsorption in rice plants (Oryza sativa L.) Can be carried out with the expected goal.

2. METHOD

The research was conducted at Agricultural Mechatronics Laboratory and Agricultural Machinery Department of Agricultural Engineering Faculty of Agriculture Universitas Brawijaya, while for

the test result was conducted at Soil Laboratory of Faculty of Agriculture Universitas Brawijaya on June 2017 - Oktober 2017.

2.1. Material

The materials used in this research include rice husk, HCL 25%, KOH 2.5%, 5%, and 7%, soil, and aquades.

2.2. Tool

The tool used is 60 - 100 mesh sieve, capsulator, container place, mixer, pH meter and digital 0.01 gram.

2.3. Research Procedure

Silica extraction using alkaline method. This method based on the large amorphous silica solubility in the alkaline solution and the deposition of dissolved silica in bases and acids (Sembiring and Simanjuntak, 2015). The silica on rice husk is obtained in amorphous form by using 5% KOH solution at optimum pH 7 or neutral. Then it is precipitated in 10% HCl solution with a high enough purity result. Here is the process of silica extraction from rice husk :

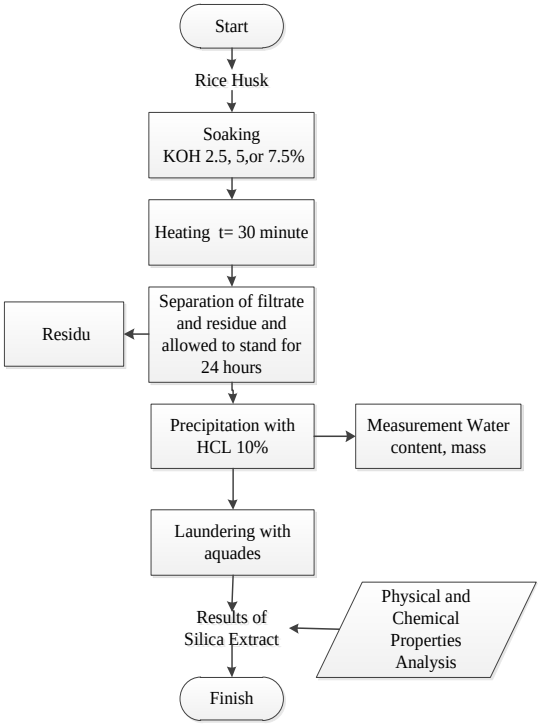


Figure 1. Flow Chart of Silica Extraction

2.4. Research analysis

Physical Properties Analysis on the yield of silica husk rice extraction using texture testing, solubility in water and in soil. While chemical analysis of silica husk rice extraction results is by using nitrogen content analysis, and nutrients by using kjeldahl method. Silica analysis includes silica using X-ray (XRF), material structure using X-Ray Powder Diffraction (XRD) and complete with Scanning Electron Microscopy (SEM), and carbon content using Fourier Transform Infra Red (FTIR).

3. RESULTS AND DISCUSSION

3.1. Yield of Silica Extract

The extraction of silica from rice husk is obtained by adding KOH as an element to optimize the silica content in rice husk, besides that potassium element which is enclosed in KOH can also be used as combination of basic fertilizer in soil ie ? Sodium Potassium and Potassium (NPK).

In this study, KOH 1.5% 500 mg into a glass beaker containing 50gr of powdered husk, then heated for 1 hour using an electric stove with 300 watts of power, after which the rice husk was given KOH idle for 24 hours with closed aluminum ? foil. After 24 hours added 10% HCL ? and then restored for 24 hours.

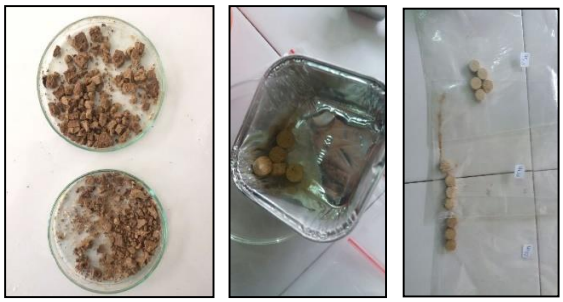
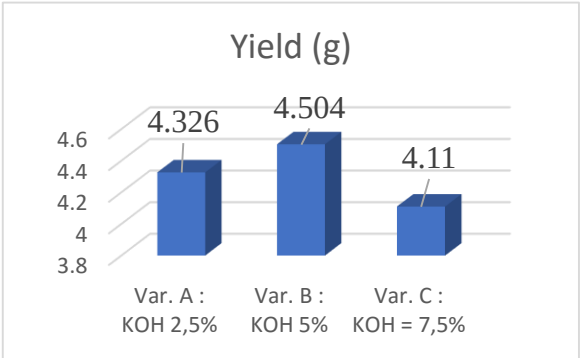


Figure 2. Capsulation process of rice husks



P-ISSN:2356-3109 E-ISSN: 2356-3117

3.2. Material structure analysis using X-Ray Powder Diffraction (XRD)

Research was continue with the optimum yield of silica rice husk was obtained, the powder diffraction analysis of the sample was used to find the crystalline and amorphous phases in silica samples. Obtained graph of XRD analysis is as follows.

The graph shows that the yield value of KOH addition of 5% is 4.32 gram or bigger when compared with the addition of KOH 2.5% that is 4.50 gram. This indicates that the increasing number of KOH influences the yield of rice husk extraction. While for the addition of KOH of 7.5% is a decrease of 4.11 grams. It can be a benchmark that the addition of KOH of 5% is the most optimized solvent addition that can be done in this study.

3.3. Scanning Electron Microscopy Analysis

Analysis of physical structure of silica extract from rice husk using Scanning electron microscopy (SEM) with 1000x and 5000x magnification can be shown with the following picture.

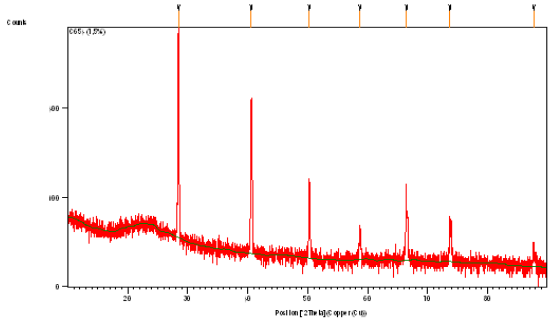


Figure 3. X-Ray Powder Diffraction Analysis (XRD) on the KOH 7.5%

In the graphic it is known that the peak value obtained from the 7.5% KOH additive sample preparation has a maximum peak value of 28.44 and 87.13 with an Å of 3.13 and β of 1.11. This suggests that the addition of KOH is 7.5% less optimum for the fraction of the powder due to the material in capsule form

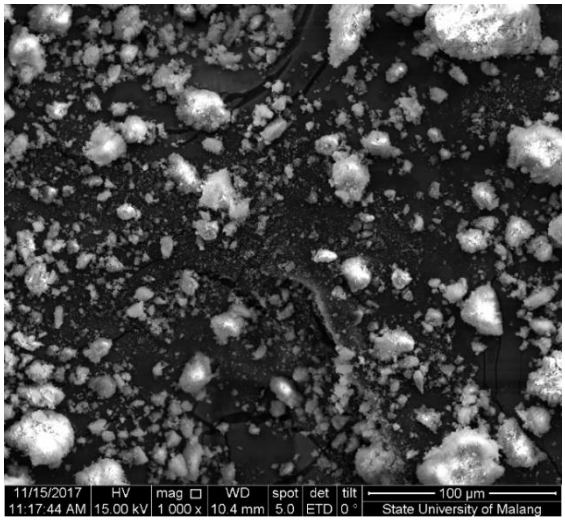


Figure 4. Physical Analysis in 1000x magnification

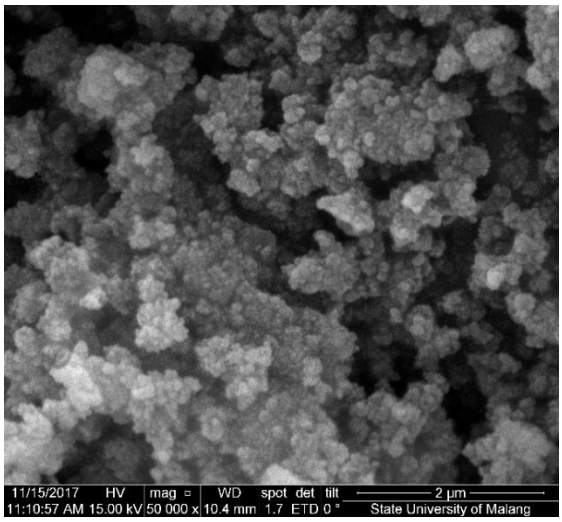


Figure 5. Physical Analysis in 5000x magnification

In the figure shows the presence of organic material and non-organic material in the extracted samples of rice husks. Some characteristics also indicate a non-diversity in particles. This indicates an optimism during the extraction process.

3.4. X-Ray Fluorosence (XRF) Spectroscopy analysis

In the graph shows the value of silica concentration produced on rice husk extraction

using KOH 7.5% by 21.8%. While the other content is potassium (K) of 44.3%. this shows the magnitude of the effect of concentration K in the resulting extract results. So that the content of silica and potassium contained in the extract of rice husks can be utilized as fertilizer for plant nutrition.

The conclusion is the value of yield of extract of silica obtained in KOH addition of 5% that is 4.5 gram. Material structure analysis using X-Ray Powder Diffraction (XRD) is in addition of KOH 7.5% of 28.44 and 87.13 with an Å of 3.13 and β of 1.11. This shows that the addition of KOH addition of 7.5% less optimum powder fraction due to the material in capsule form.

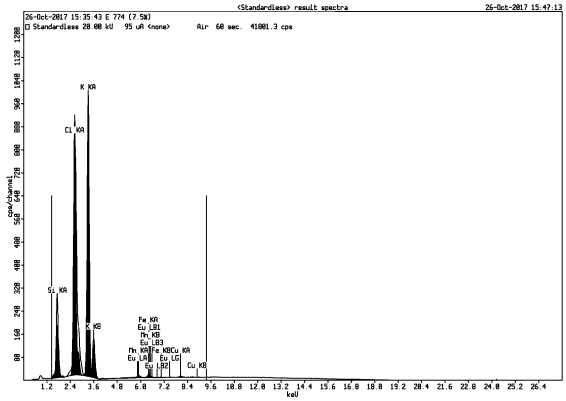


Figure 6. X-Ray Fluorosence (XRF) Spectroscopy analysis of Rice Husk Extract with KOH 7.5%

4. ACKNOWLEDGMENTS

The authors acknowledge to the Directorate General of Higher Education (DGHE) Indonesia who has funded this research through the Grant Program and to all parties who have helped the implementation of this research.

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 P-ISSN:2356-3109 E-ISSN: 2356-3117

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