

PRODUCTION OF SODIUM SILICATE FROM RICE HUSK ASH WITH REGULATORY SETS MAGNESIUM

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Abstract

Utilization of rice husks in Indonesia in general is still very limited. Utilization of silica contained in rice husk ash, which has been used, among others, in the manufacture of sodium silicate. Silica compounds themselves can be used in and manufacturing basic materials for electronic and ceramic equipment, glass, rubber, cosmetic products, and pharmaceuticals. The addition of Mg can increase the silica content (SiO_2) in rice husk ash. The best results show an effective Mg ratio of Mg addition to increase silica content is 1: 1. produces the highest amount of silica which is 58.12% of the rice husk ash with a size of 140 mesh.

Keywords: *rice husk, natrium silica, Magnesium.*

1. INTRODUCTION

In Indonesia, rice husks produced from milling or pounding of grain are still agricultural waste, which until now has become a problem, besides being only piled up as rubbish, burning husks also results in serious air pollution. Although there are some areas in Indonesia that use rice husk as fuel for both household and brick making and the ashes

are used as rubbing ash, the use of rice husk in general is still very limited. World rice husk production currently reaches 80 million tons by weight, this means there is a silica content of about 3.2 million tons in world rice husk (Souza et al., 2000). Previous studies on ash produced from rice husk pyrolysis showed that silica content in ash reached 94.39% (Erawati, 1994). Utilization of silica contained in rice husk ash, which has been used, among others, in the manufacture of Silicon Nitride powder, Si_3N_4 , which is the result of pyrolysis of husk ash in nitrogen flow. Silicon Tetrachloride, SiCl_4 , which is the result of chlorination of rice husk ash which has been hydrolyzed in a nitrogen atmosphere. Sodium Silicate (Na_2SiO_3) which is a compound produced by the reaction of rice husk ash with sodium hydroxide (NaOH) solution (Sitompul et al, 1999). From the various uses of rice husk ash above, it will be very potential and can be an economic advantage if the silica extracted from rice husk is a high quality product, that is if the surface area, particle size and purity factor (Souza et al., 2000). The rice husk used came from the area, Sidoarjo.

2. METHODOLOGY

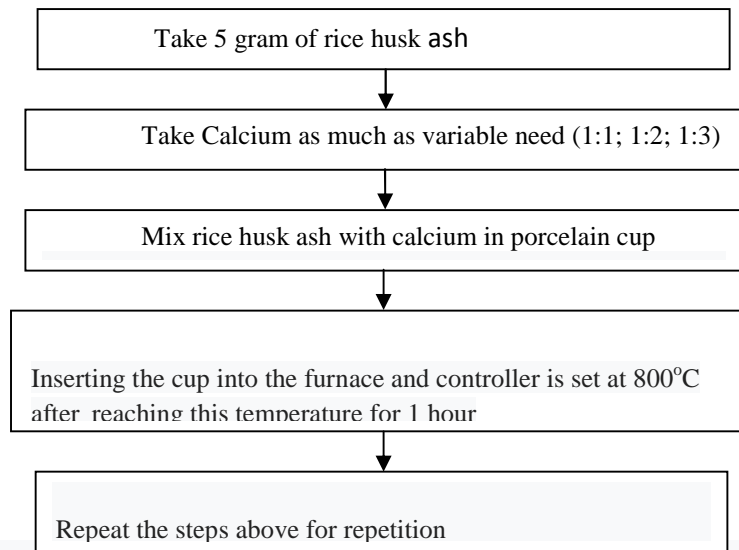


Figure 1. Schematic of the Mg treatment process

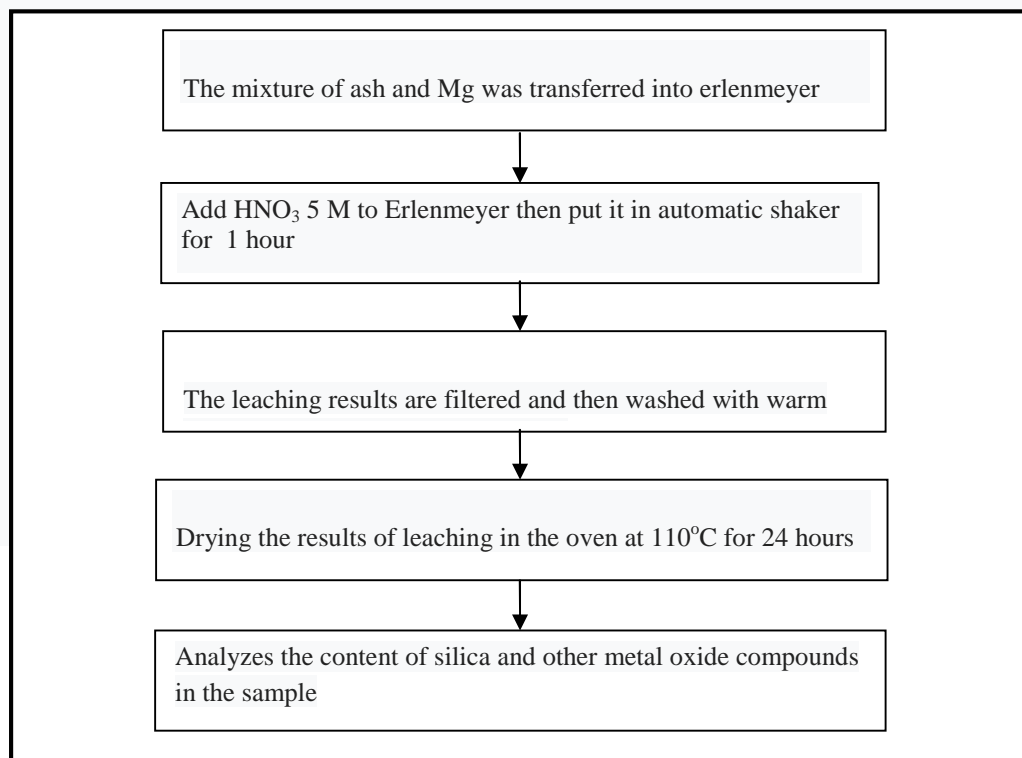


Fig 2. Acid Leaching Process

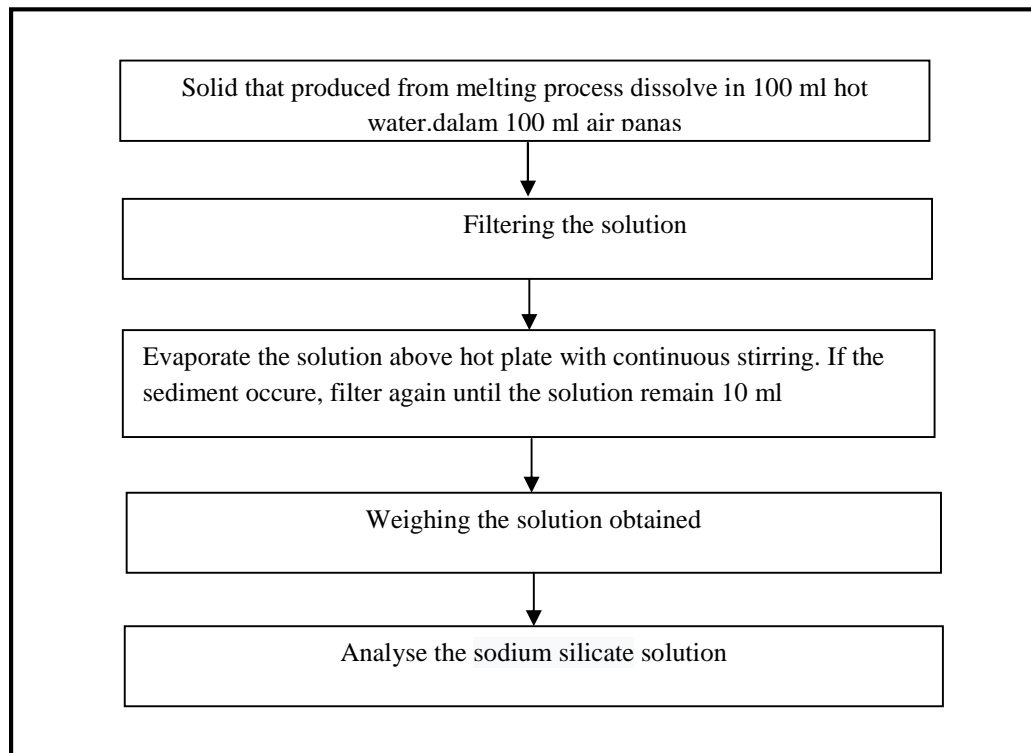


Fig 3. Acid Leaching Process Contonue

3.RESULTS AND DISCUSSION

Table 1. Rice Husk Ash Content

Indicators	% Weight
SiO ₂	47.70
MgO	11.82
CaO	13.10
Fe ₂ O ₃	2.36
MnO	1.91
Al ₂ O ₃	22.90

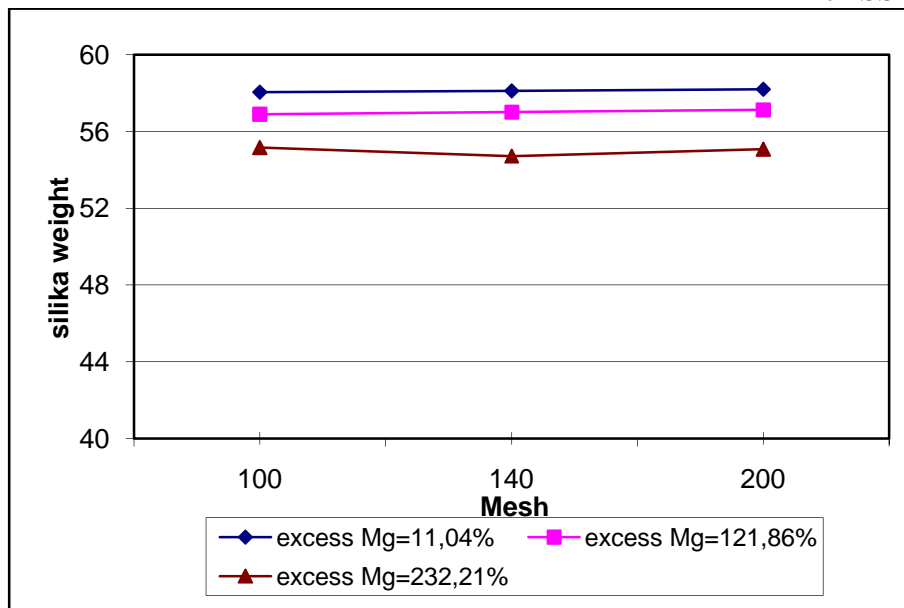


Figure 4. Effect of Magnesium addition to silica content after acid leaching

Figure 4 shown that magnesium addition influence the silica content. The silica content become maximum in ratio Mg : silica = 1 : 1. In these ratio, silica content become high and these ratio effective to reduce metal oxide as an impurities. But after the ratio increased, the silica content decreased. This matter indicate that the effective addition for calcium and magnesium to increase the silica content in rice husk ash is at the smallest ratio.

Because if the addition exceed the needed in their activity to reduce the metal oxide, they will become new impurities in the rice husk ash that will decrease the silica content. This matter caused by the addition of calcium and magnesium have very excessive, far through its equivalent point, so that there is a lot of reactan that do not react. These unreact reactan will cause a decline in silica content.

Table 2. Yield of water glass for rice husk ash with Mg treatment

Mesh	Rasio Mg:SiO ₂	Rasio Na ₂ CO ₃ : SiO ₂	SiO ₂ /Na ₂ O	Yield
100	1 : 1	1 : 1	1.0174	1.4855
		2 : 1	1.0234	1.1324
		4 : 1	1.0129	0.7698
	2 : 1	1 : 1	1.0078	1.5999
		2 : 1	1.0043	1.1313
		4 : 1	1.0042	0.7298
	3 : 1	1 : 1	1.0042	1.7850
		2 : 1	1.0042	1.3557
		4 : 1	1.0070	0.8080
		1 : 1	1.0063	1.5064
		2 : 1	1.0049	1.2032
		4 : 1	1.0021	0.7325
140	1 : 1	1 : 1	1.0056	1.6584
		2 : 1	1.0056	1.1172
		4 : 1	1.0028	0.7333
	2 : 1	1 : 1	1.0028	1.6711
		2 : 1	1.0055	1.3015
		4 : 1	1.0056	0.8713
	3 : 1	1 : 1	1.0084	1.4297
		2 : 1	1.0077	1.0870
		4 : 1	1.0049	0.7070
		1 : 1	1.0098	1.5773
		2 : 1	1.0042	1.1149
		4 : 1	1.0056	0.7401
200	1 : 1	1 : 1	1.0084	1.6419
		2 : 1	1.0084	1.2762
		4 : 1	1.0063	0.8095

Table 2 shown that particle size influence the increase of silica content in rice husk ash. Silica content will increase as much as the increase in their mesh. Increase in mesh means that decrease in particle size. But in the particle size 200 mesh there is decrease in silica content. This matter caused by losses in acid leaching and filtering process. In particle size 100 mesh, the silica content lower than particle size 140 mesh because in particle size 100 mesh the particle is big enough so in acid leaching process the surface contact is not maximum and the effectiveness of acid leaching is less perfect. So, the particle size 140 mesh give the maximum silica content.

Ratio sodium carbonate to silica also give big influence in water glass yield as shown in table 2. In melting process, silica in rice husk ash will react with sodium carbonate. Silica as limiting reactan and sodium carbonate as excess reactan, this is the condition to make

the reaction goes perfectly. In ratio sodium carbonate to silica in rice husk ash 1 : 1, found that sodium carbonate still become a limiting reactan and silica become excess reactan. This means that the reaction doesn't goes completely so the water glass yield not maximum. In ratio sodium carbonate to silica in rice husk ash 2 : 1, found that sodium carbonate has become an excess reactan 13,33%. Also in ratio sodium carbonate to silica in rice husk ash 4 : 1, found that sodium carbonate has become an excess reactan 69,82%. Sodium carbonate that become excess reactan give chance to silica in rice husk ash to react completely (100%) so the water glass yield become maximum too.

As a standard, the difference between the neutral water glass and alkali water glass is in their Na₂O to SiO₂ ratio where in neutral water glass Na₂O to SiO₂ ratio is 1 : 2,1 and alkali water glass Na₂O to SiO₂ ratio is 1 : 1,33. In

this experiment, as shown in table 2 and 3, Na₂O to SiO₂ ratio give various ratio ±1. This shown that the water glass in this experiment is alkali water glass.

CONCLUSIONS

1. Rice husk ash can be used as an alternative material to make water glass because of its high silica content.

2. Magnesium addition can increase silica content in rice husk ash. The mole ratio that effective to increase Ratio Mg : SiO₂ = 1 : 1 gives the highest silica content 58,20%
3. Particle size of rice husk ash also influence the silica content. Rice husk hush with 120-140 mesh (0,124 mm) gives the highest silica content. The silica content up to 58,12% weight in addition ratio Mg : Silika 1 : 1.

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