

## Silica Gel, a value added product production from Rice Husk Ash

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### Abstract

The present study deals with the production of Silica Gel from Rice Husk Ash. Different mills of Bundi district of Rajasthan were visited to know about the production and utilization of Rice Husk and Rice Husk Ash produced. Rice Husk Ash from different sources was chemically treated and the extracted amounts of Silica Gel were compared. It was found that Rice Husk Ash contains 70.90 percent to 84.50 percent Silica Gel. This suggests that Rice Husk, which is considered as waste product from the Rice Mills and sold at Rs. 300 per quintal, can be used for production of value added product such as Silica which has its commercial sale value of Rs. 200 per Kg.

### Introduction

Rice is one of the staple foods of India. In Rajasthan, rice is mainly grown under the highly rain-fed areas like Kota and Bundi districts. It is estimated that 0.23 tons of rice husk is produced from every ton of rice produced. These mills use 70 percent of the Rice husk produced as a fuel in boiler. Burning rice husk generates Rice Husk Ash. About 20 million tons of Rice Husk Ash is produced annually in India. Remaining 30 percent rice husk and rice husk ash, produced by burning of rice husk in boiler, is sold at Rs. 300 per quintal to the Poultry to be used as feed, Bricks manufacturing factory, Glass Industry or is used as a Bio-fertilizer.

On chemical analysis of rice husk ash, it was found that it contains about 80 percent Silica or most commonly known as Silica Gel. Silica Gel is considered as a value added product with commercial sale value of Rs. 200 per Kg. Silica Gel is a non-toxic, non-flammable, non-reactive material. The high surface area of Silica Gel crystals, allows it to adsorb water easily, thus making it a useful desiccant. Once saturated with water, the gel can be regenerated by heating it to 120 °C (250 °F) for two hours. Other uses of Silica Gel includes its use in Column Chromatography, insulation powder in steel mills and refrigerators, manufacturing of refractory bricks, repellents in the form of 'vinegar-tar', etc. With increasing grade quality of Silica Gel, cost also increases.

### Materials and Methods

A survey was done to find out the availability of rice mill in different districts of Rajasthan. During the study it was found that Rice husk mills are mostly situated at Bundi district in Rajasthan. Rice Husk mills that were visited at Bundi are; Makhmal Basmati Rice Mill, Tansen Balaji Industries, Jyoti Industries. These mills produce 20-25 tonns of rice husk daily and this rice husk is burned in the boiler of the mill itself. Remaining rice husk and rice husk ash are being sold at very low cost. These mills are using 70 percent of the total Rice Husk as a fuel in boiler and after burning the husk, 90 percent of ash is available to them. Remaining 30 percent Rice Husk and Rice Husk Ash are sold in Rs.300/qt to potter, Bricks manufacturing factory / industry and poultry farm. According to Makhmal Basmati Rice Industry Rice Husk Ash is sold to Glass Industry in Gujarat in Rs. 1300/per Trolley.



**Figure 1: Rice mill visited at Bundi**



Figure 2: Rice husk after separation of rice      Figure 3: Burning of rice husk in boiler of the mill



Figure 4: Disposed Rice Husk Ash in the premises of Mill

Table 1: Availability and use of rice husk and rice husk ash in different rice mills visited

Name of Rice Mill	Quantity of Rice Husk	Utilization	Quantity of Rice Husk Ash Produced	Commercial Sale @ Rs 300 / Quintal
Makhmal Rice Mill	20 to 25 Ton / Day	70% in Boiler	17.50 ton /day	-----
		30% Commercial sale	15.75 ton /day	Rs 2250 Net Gain
		90% ash out of 70% RH	7.50 ton /day	Ash Sold @ Rs 1300 /Trolley
Tansen Balaji Industry	5 to 7 Ton / Day	70% in boiler	4.9 ton /day	-----
		30% commercial sale	4.41 ton /day	630 Rs Net Gain
		90% ash out of 70% RH	2.10 ton /day	Ash Sold @ Rs 1300 /Trolley
Jyoti Rice Industry	1.2 to 1.5 Ton / Day	70% in boiler	1.05 ton /day	-----
		30% commercial sale	0.945 ton /day	135 Rs Net Gain
		90% ash out of 70% RH	0.45ton /day	Ash Sold @ Rs 1300 /Trolley

The samples of Rice Husk and Rice Husk Ash were collected from the Rice mills visited. The Silica Gel Extraction study was done at Department of Renewable Energy Engineering, C.T.A.E., Udaipur. Initially, rice

husk was burnt in muffle furnace, traditional chullah and improved cook-stoves at the department for producing rice husk ash but the combustion was not proper because the residue was not complete ash. Therefore, briquettes of rice husk were prepared and then they were burnt in improved cook-stoves at the department for rice husk ash production.

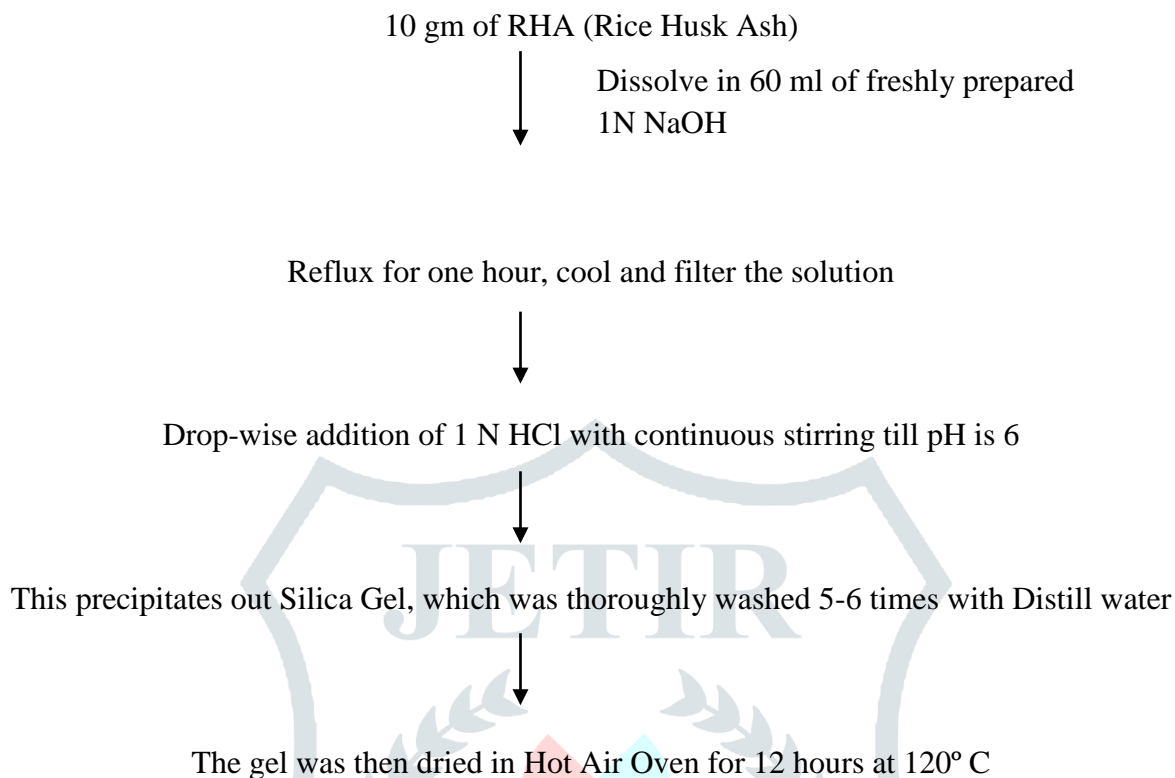


**Figure 5: Rice husk Briquettes**



**Figure 6: Burning of Rice husk Briquettes in Improved Cook-stove**

The ash produced from burning of rice husk briquettes and the rice husk ash samples collected from mills were then used for Silica Gel Extraction. The department lab was used for extraction using the following chemical method. Freshly prepared 60 ml of 1N NaOH and 10 gm of ash were mixed to form a solution. This solution was then refluxed for 1 hour, cooled and filtered. 1 N HCl was then added drop-wise to this solution with constant stirring. This makes the Silica Gel precipitates out. The precipitate was then collected and washed thoroughly with distill water 5-6 times and then the gel was dried in Hot Air Oven for 12 hours at 120<sup>0</sup> C. Thus, Silica Gel was extracted from Rice Husk Ash. Flow chart of the method adopted is shown as follow:



**Figure 7: Precipitated Silica Gel**



**Figure 8: Dried Silica Gel**

### Results and Discussion

Different rice mills of Bundi district, Rajasthan were visited. Rice husk and Ash samples from different Rice mills were collected and chemical analysis was done for Silica Gel extraction from Rice Husk Ash. On comparing the Rice Husk Ash samples from different mills and ash produced at department, it was found that 67.90 percent to 84.50 percent silica gel is present in the samples taken.

**Table 2: Percentage of Silica Gel extracted from Rice Husk Ash**

Sr. No.	Sample	Weight of Rice Husk Ash	Gel in (gm)	Gel %
1	Makhmal Basmati Rice Mills RHA	10 gm	7.84	78.40
2	Tansen Balaji Industries RHA	10 gm	8.45	84.50
3	Jyoti Mills RHA	10 gm	7.09	70.90
4	Husk burnt at DREE	10 gm	6.79	67.90

Maximum amount of Silica Gel was obtained from Rice Husk Ash sample of Tansen Balaji Industries i.e. 84.50 percent of Silica Gel. This proves that Rice Husk and Ash, which are considered as waste products from the Rice Mills and sold at Rs. 300 per quintal or thrown as such, can be used for production Silica which has its commercial sale value of Rs. 200 per Kg. The Ash produced in the department didn't showed good results, as the silica content was just 67.90 percent. This may be due to incomplete combustion of Rice Husk in the improved cook-stoves.

### Conclusion

Rice Husk, which is considered as a waste product of Rice Mill was chemically analysed for value added product production. Silica Gel, a value added product, was extracted from Rice Husk Ash. Industries of Bundi district, Rajasthan were visited and Rice Husk and Ash samples were collected from them. On chemical analysis of the rice husk ash samples, it was found that the samples contain 67.90 percent to 84.50 percent Silica Gel. This strongly suggests that Rice Husk Ash can be used for Silica Gel production. The yield may be increased by burning the residual or waste Rice Husk in Thermox boiler by complete combusting the sample and yielding higher percentage of Silica Gel.

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