CHARACTERIZATION OF SILICA SAND AS RAW MATERIAL FOR SOLAR PANEL BASED ON GEOCHEMICAL ANALYSIS IN TELUK RENDAH VILLAGE, JAMBI

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Abstract

Pengunaan panel surya untuk menghasilkan listrik dapat mengurangi ketergantungan akan bahan bakar fosil. Hal ini sesuai dengan salah satu tujuan dari The Sustainable Development Goals (SDGs 2030) yaitu memastikan akses untuk energi yang terjangkau, dapat di andalkan, berkelanjutan dan modern. Indonesia memiliki potensi bahan galian pasir silika yang besar dengan sumberdaya sekitar 25 miliar ton dan cadangan mencapai 330 juta ton. Indonesia sebagai negara tropis dan berada tepat di garis katulistiwa menjadikan Indonesia sebagai negara yang mendapatkan penyinaran matahari yang lama dan konsisten setiap harinya. Oleh sebab itu potensi pemanfaatan panel surya di Indoensia juga cukup besar, disamping bahan bakunya juga tersedia di Indonesia. Pasir silika memiliki sumberdaya yang berlimpah, stabil digunakan sebagai penyimpan panas, dan memerlukan biaya yang rendah sebagai penyimpan panas dengan temperatur hingga 1.2000C. Penelitian ini menggunakan metode kuantitatif, yaitu dengan cara melakukan pengujian dan pengukuran secara geokimia pada sampel pasir silika yang ada di Desa Teluk Rendah, Jambi. Sampel diuji menggunakan motede Atomic Absorption Spectrometry (AAS) untuk mengetahui dan melakukan analisis terhadap karakterisasi sampel pasir silika yang telah di ambil. Pemanfaatan dan penggunaan pasir silika dapat dioptimalkan sesuai karakteristik dan sebaran unsur yang ada di dalamnya. Kualitas pasir silika sebagai bahan baku panel surya sebaiknya mengandung kadar unsur Silicon Dioxide lebih dari 99,7%, Iron Oxide kurang dari 85ppm, Titanium Dioxide kurang dari 140ppm, Aluminium Oxide kurang dari 500ppm. Dari hasilm pengujian didapatkan kualitas pasir silika di daerah penelitian memiliki kadar Silicon Dioxide sebesar 95,78%, Iron Oxide 17.200ppm, Titanium Dioxide 13.700ppm, dan Aluminium Oxide 8.900ppm.

Keywords: Pasir silica, Panel Surya, AAS, Kadar, Desa Teluk Rendah,

Abstract

[CHARACTERIZATION OF SILICA SAND AS RAW MATERIAL FOR SOLAR PANEL BASED ON GEOCHEMICAL ANALYSIS IN TELUK RENDAH VILLAGE, JAMBI] *The use of solar panels to generate electricity can reduce dependence on fossil fuels. This is in accordance with one of the goals of The Sustainable Development Goals (SDGs 2030), namely ensuring access to affordable, reliable, sustainable and modern energy. Indonesia has a large potential for silica sand mining materials with resources of around 25 billion tons and reserves reaching 330 million tons. Indonesia as a tropical country and located right on the equator makes Indonesia a country that gets long and consistent sunlight every day. Therefore, the potential for the use of solar panels in Indonesia is also quite large, besides the raw materials are also available in Indonesia. Silica sand has abundant resources, is stable for use as a heat storage, and requires low costs as a heat storage with temperatures up to 1,2000C. This study uses a quantitative method, namely by conducting geochemical tests and measurements on silica sand samples in Teluk Rendah Village, Jambi. The samples were tested using the Atomic Absorption Spectrometry (AAS) method to determine and analyze the characterization of the silica sand samples that had been taken. The utilization and use of silica sand can be optimized according to the characteristics and distribution of the elements contained therein. The quality of silica sand as a raw material for solar panels should contain grade of Silicon Dioxide content of more than 99.7%, Iron Oxide less than 85ppm, Titanium Dioxide less than 140ppm, Aluminum Oxide less than 500ppm. From the test results, the quality of silica sand in the research area has a Silicon Dioxide content of 95.78%, Iron Oxide 17,200ppm, Titanium Dioxide 13,700ppm, and Aluminum Oxide 8,900ppm..*

Keywords: Silica Sand, Solar Panels, AAS, Grade, Teluk Rendah Village

INTRODUCTION

Solar panels can convert solar energy into electrical energy. The use of solar panels to generate electricity can reduce dependence on fossil fuels. This is in accordance with one of the goals of The Sustainable Development Goals (SDGs 2030), namely ensuring access to affordable, reliable, sustainable and modern energy.

Silica sand is needed in the solar panel industry as a cheap and efficient primary raw material. Based on data from the Ministry of Energy and Mineral Resources in 2021, Indonesia has a large potential for silica sand mining materials with resources of around 25 billion tons and reserves reaching 330 million tons. Quoted from CNN data, the amount of silica sand resources and reserves has attracted the attention of the Chinese company, Xinyi Group, to invest up to 381 trillion rupiah to establish a glass and solar panel factory in the Riau Islands. Despite the problems faced by Indonesia in implementing this investment, the interest of foreign companies to invest in Indonesia shows the great potential of silica sand here as a raw material for solar panels. If managed properly, silica sand can become an export competitor and improve people's welfare.

Research on the characteristics of silica sand as a raw material for thermal energy storage (TES) has been intensively carried out. From the results of the research that has been carried out, it is known that silica sand has abundant resources, is stable for use as heat storage, and requires low costs as heat storage with temperatures up to 1,2000C. Research on the characterization of silica sand on Bangka Island using geochemical analysis has been carried out to by Syafrizal, et al (2022) to determine its potential as a raw material for solar panels using geochemical analysis. Geochemical analysis is considered capable of determining the distribution of elements contained in silica sand samples.

METHOD

This study uses a quantitative method, namely by conducting geochemical tests and measurements on silica sand samples in Teluk Rendah Village, Jambi. The test was carried out with the intention of knowing and analyzing the characterization of the silica sand samples that had been taken. Geochemical analysis can be used to determine the proportion of metal and non-metal elements in a sample.

The research sample was taken using the grab sampling method using a shovel, then put into a 2kg ziplock plastic, then the sample was coded according to the applicable naming provisions. Before testing and analysis in the laboratory, samples need to be prepared in order to reduce and sort some of the samples. This aims to find representative samples and the most representative of the research area for further testing.

Sample testing is carried out using atomic absorption spectrometry (AAS) method. The AAS method is a type of spectrophotometric analysis where the basis of measurement is the measurement of the absorption of a light by an atom, the light that is not absorbed, is forwarded and converted into a measurable electrical signal. AAS will analyze the presence of metal and metalloid elements based on the absorption of radiation by free atoms of the element.

RESULTS AND DISCUSSION

Silica taken from silica sand with very high purity can be used as a raw material for solar panels because it has high energy conversion efficiency, relatively low production costs compared to using other elements, abundant in nature, environmentally friendly, and shows long-term stability. The specifications of silica sand as a raw material for solar panels can be seen in the following table 1.

Table 1. standard grade of solar panel raw materials

No	Unsur	Kadar
1	Silicon Dioxide	≥ 99.7%
2	Iron Oxide	≤ 85 ppm
3	Titanium Dioxide	≤ 140 ppm
4	Aluminium Oxide	≤ 500 ppm
Ukuran Partikel: 109-700 mikron (24-140 mesh)		

From sample testing using geochemical analysis with the AAS method, the quality of quartz sand in the Teluk Bawah area that was sampled was as follows.

Table 2. Elements grade in research sample

No	Unsur	Kadar	
		%	ppm
1	SiO_2	95,78	957.800
2	Al_2O_3	0,89	8.900
3	Fe_2O_3	1,72	17.200
4	K_2O	0,087	870
5	Na_2O	0,084	840
6	CaO	0,035	350
7	MgO	0,060	600
8	TiO_2	1,37	13.700
9	LOI	0,38	3.800
10	MnO	0,025	250

From the test results using AAS, it was found that the Silica Dioxide content of quartz sand in the research area was quite high at around 95.78%, but this content did not meet the requirements as a

raw material for solar panels with a minimum content of 99.7%. The research sample also contained a fairly high level of Titanium Dioxide of 13,700ppm, while the Titanium Dioxide content in silica sand recommended as a raw material for solar panels was no more than 140ppm. Likewise, the Aluminum Dioxide value had a higher content than the threshold for raw materials for solar panels with a content of 8,900ppm in the sample, while the recommended content was no more than 500ppm. The Iron Oxide content in the sample of 17,200 ppm far exceeded the recommended content of no more than 85ppm. However, if seen from the fairly high amount of silica in the research sample, silica sand in the research area still allows it to be used as a raw material for solar panels with further purification so that it meets the desired threshold content standard. Therefore, it is necessary to further study the appropriate purification process and the purification costs required as a consideration of the potential of silica sand in Teluk Rendah village as a raw material for solar panels.

CONCLUSION AND SUGGESTIONS

The silica content in the sample with a Silicon Dioxide content of 95.78% does not meet the minimum content limit for solar panel raw materials with a recommended Silicon Dioxide content of 99.7%. The threshold for other elements is also higher than the provisions, including Titanium Dioxide which is quite high at 13,700ppm while the requirement is not more than 140ppm, the Aluminum Dioxide content in the sample is 8,900ppm while the requirement is not more than 500ppm, and the Iron Dioxide content is 17,200ppm with a requirement of not more than 85ppm. However, if seen from the fairly high silica content of 95.78% in the sample, the possibility of using silica sand in the research area needs to be further studied. The right purification process can be used to increase the silica content, reduce the levels of Titanium Dioxide, Aluminum Dioxide, and Iron Dioxide so that they meet the raw material standards for solar panels.

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