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Silica Sand Potency of Bukit Pelintung as Base Material of Solar Cell

Husnul Kausarian,[a,*] Mursyidah Umar [b] and Sugeng Wiyono,[c]

[a)]*Engineering Geology, Universitas Islam Riau, Indonesia*
[b)]*Petroleum Engineering, Universitas Islam Riau, Indonesia*
[c)]*Civil Engineering, Universitas Islam Riau, Indonesia*

*Corresponding author:kausarianhusnul@yahoo.com

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ABSTRACT

Bukit Pelintung is a part of the Pematang formation exposed at the surface. Bukit Pelintung has different lithology with the area surround it, where the area surround Bukit Pelintung consists of old and young superficial deposit with peat, clay and silt lithology. Bukit Pelintung is a part of the Pelintung village, subdistrictMedangKampai, Dumai city located in the northeastern city of Dumai. The total area of Bukit Pelintung is about 36km^2. Silica sand in Bukit Pelintung associated with iron (Fe_2O_3) sand and alumina (Al_2O_3) sand and characterized by different colors of sand. Four-point location of the research area that has been conducted in Bukit Pelintung showed a high silica content. Laboratory test using the X-RF (X-Ray Fluorescence) method showed the compound silica (SiO_2) has a high percentage above 95%.

KEY WORDS: *Silica Sand; Bukit Pelintung; Percentage of SiO2; Solar Cells.*

NOMENCLATURE

SiO_2	Silica
BPel 1, 2, 3, 4	Sampling Area of Bukit Pelintung
Al_2O_3	Alumina
Fe_2O_3	Iron
X-RF	X-Ray Fluorescence

1.0 INTRODUCTION

Silica sand is one of the minerals are relatively abundant in Indonesia. This is possible due to Indonesia conditions, which is almost half as acid igneous rock forming minerals such sources. Silica sand can be found in coastal area, rivers, lakes, beaches and some of the shallow seas. This mineral plays an important role for the industry, either as the main raw material as well as follow-up material. As the main raw material, silica sand used by the manufacturing industry to produce products that can be used by consumers primarily for building materials and the main ingredient in the design of interior/exterior as well as materials for household needs. While the follow-up material, silica sand used for printed materials in the foundry, refractory materials and as filler in the mining and petroleum industry, especially when performing drilling activities.

Along with the state of the Indonesian economy, the development of silica sand in the last three years have fluctuated significantly, the production and consumption of silica sand began creeping up.

Silica sand is acidic weathering of igneous rocks such as granite, gneiss or other igneous rock containing major mineral quartz (Table 1). The quality silica sand in Indonesia is quite varied, depending on the process and the influence of mineral genesis impurities formed during sedimentation processes involved.

In Nature, silica sand found with varied grain size, from fine fraction (<0.06) is located far from source rock and (>2mm) is located not far from the source rock.

Crystalline quartz (SiO2) mostly white, with a white spout and polish glass. With imperfect parts and pieces that are not flat

(concoidal), mineral crystal has a hexagonal bipyramid prism, has a specific gravity 2.65 kg/m3 and hardness 7 (Mohs scale). Has outstanding durability in the process of abrasion/erosion. Melt at a temperature of 1,7100C. When experience rapid cooling, will provide an amorphous texture.

Table 1: Percentage of mineral content in the silica sand

Mineral	Percentage
SiO_2	55,30-99,87%
Fe_2O_3	0,01-9,14%
Al_2O_3	0,01-18,00%
TiO_2	0,01-0,49%
CaO	0,01-3,24%
MgO	0,01-0,26%
K_2O	0,01-17.00%

2.0 GEOGRAPHY

Bukit Pelintung located in the Pelintung village, MedangKampaisubdistrict city of Dumai (Figure 1). Bukit Pelintung has an area of approximately 36 km2. Bukit Pelintung boundaries are as follows:

- North: Melaka strait.
- East: Bukit Batusubdistrict, Bengkalis district.
- South: Bukit Kapursubdistrict.
- West: TelukMakmur village.

Figure 1: Location of Bukit Pelintung (Modified from Google Earth).

3.0 GEOLOGICAL CONDITION

Bukit Pelintung area (Figure 2) is located at northeast of Dumai city. Geological construction around Bukit Pelintung consists of alluvium (Figure 3) derived from quarter age to recent age that stretches up to straits of Melaka, especially over the muddy swampy areas along the north coast.

The types of alluvium are found mainly in areas along the coast until the mid-land as the young land and not mountainous, and even some parts composed of muddy marshy ground. The bedrock of Dumai city is soft soil deposit/peat which has so many high compressibility values encountered alluvium is characterized by the presence of a Young Superficial Deposit (Qh) consisting of clay, silt, gravel slippery, remains of plants and peat bogs and Old Superficial Deposit (Qp) consisting of clay, silt, clay, gravel and remains of plants.While the area the Bukit Pelintung is part of Pematang formation which is exposured to the surface (Figure 4) and consists of barik purple-orange mud stone, breccian conglomerates (Figure 5) and brown carbonaceous shale.

Figure 2: Bukit Pelintung Outcrop.

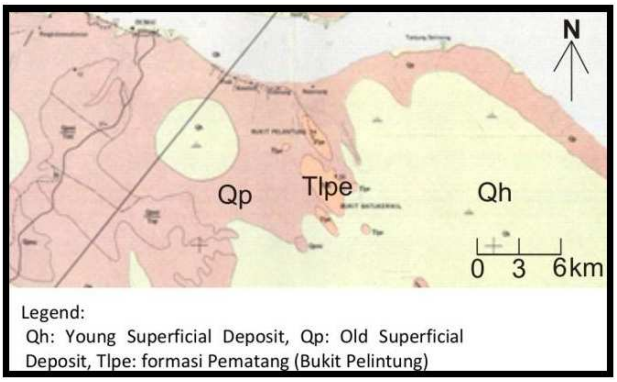

Figure 3: Geological Map of Bukit Pelintung (Modified from Pusat Penelitian dan Pengembangan Geologi).

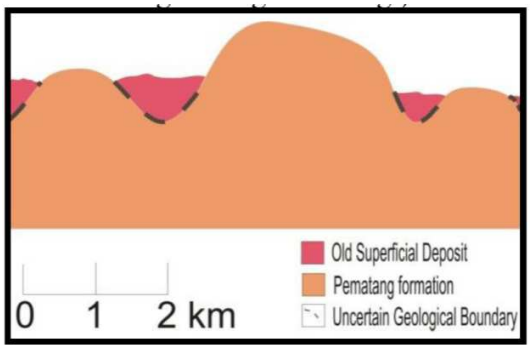

Figure 4: A Model of Pematang Formation Exposure Known as Bukit Pelintung.

Figure 5: Breccian Conglomerates of Bukit Pelintung.

4.0 OBJECTIVE

Silica sand hands an important role for the industry especially in base materials for solar cells, either as a primary or auxiliary raw materials. As the main raw material, silica sand used by the cement industry, glass, bottles and glassware, email (enamel). While the auxiliary raw materials used in metal casting, and other industries.

The survey results from the Study and Technology Development Research Center of Mineral in the same period, the production of silica sand increased by about 28.30% per year. The increase in production is due to be supported by silica sand resources are very abundant.

The purpose of this study was to conduct an inventory and determine the potential (characterization and utilization) of silica sand resources in the Bukit Pelintung, city of Dumai, Riau province.

5.0 METHODS

The activities carried out in this survey covering the plotting of observation points, the observation of rock outcrops and rock sampling (sand sampling) and the testing of samples in the laboratory. Field observation is necessary to know the exact distribution and the precipitated area of silica sand.

The observation location plots on the base map/topography map. Based on observations in the field, eventually determined observation points in total amounted to four observation location in the Bukit Pelintung (Figure 6) which are BPel 1, BPel 2, BPel 3 and BPel 4.

Figure 6: The Observation Location at Bukit Pelintung.

6.0 RESULT AND DISCUSSION

6.1 Silica Sand Sampling

Furthermore, sampling of rock appropriate weighing as needed, where half for laboratory testing and the rest for the inventory. Rock sampling was conducted using geological hammer or other tools. Figure 7 shown of Bukit Pelintung sample.

Figure 7: Sample of Bukit Pelintung.

All samples were taken from the observation location showing the properties of sand almost as white or homogeneous by direct observation in the field. This is giving suggest that the silica sand contained in this region has almost the same silica content.

6.2 Distribution of Silica Sand at Bukit Pelintung

Thorough observations on the Bukit Pelintung shows the distribution of silica sand in this hill is not located along the entire of the hill's body, but it spreads and associated with iron sand (Fe_2O_3), alumina sand (Al_2O_3) and the other minerals.

6.3 The Origin of Silica Sand on the Bukit Pelintung

Bukit Pelintung is a unique phenomenon in the city of Dumai, this is because the city of Dumai bedrock consists of young alluvium, while Bukit Pelintung composed by sandy rock derived from Pematang formation which is exposured to the surface. Therefore the source of silica sand contained in this area comes from Pematang formation and not from the bedrock made up the city of Dumai.

Apart from the host rock of Dumai city that is unlikely to produce silica sand, silica sand resource estimate is also proved by the results of microscopic photography showing the granular form of silica sand particles is not rounded. This suggests that the source/origin of silica sand come from the near source. Microscopic Photography represents the study area in Bukit Pelintung which are BPel 1 (Figure 8), BPel 2 (Figure 9), BPel 3 (Figure 10) and BPel (Figure 11).

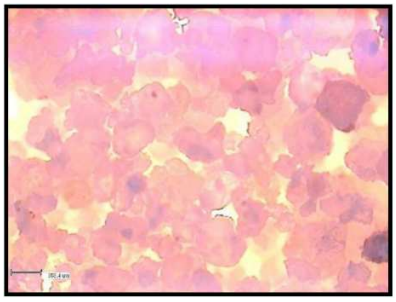

Figure 8: BPel 1 Microscopic PhotographSilica Sand Sample.

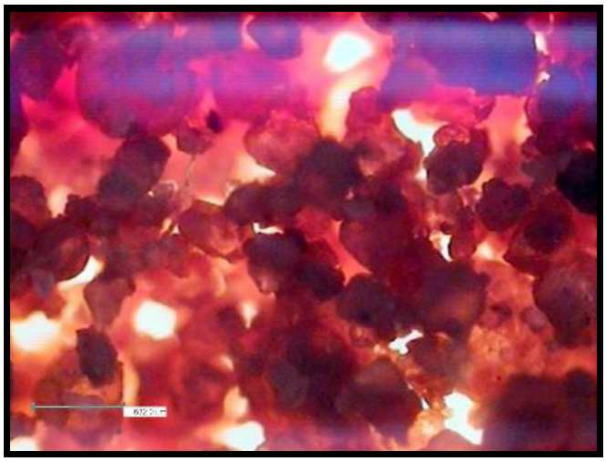

Figure 9: BPel 2 Microscopic Photograph Silica Sand Sample.

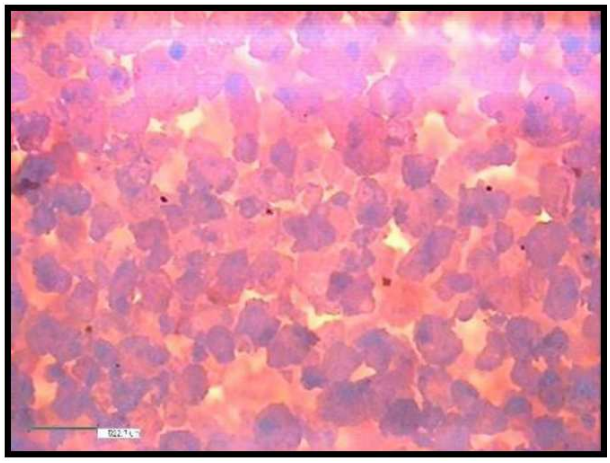

Figure 10: BPel 3 Microscopic Photograph Silica Sand Sample.

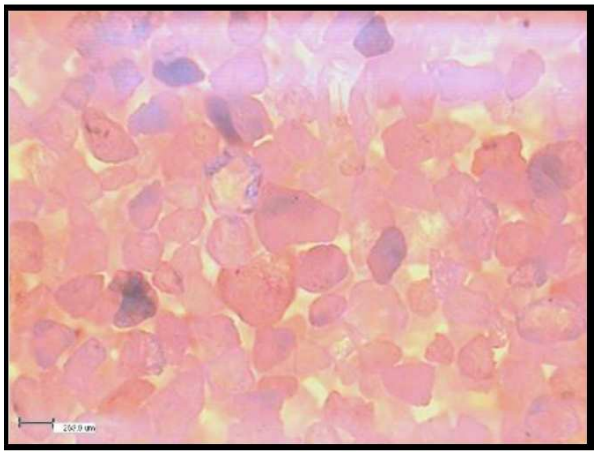

Figure 11: BPel 4 Microscopic Photograph Silica Sand Sample.

6.4 Silica Percentage in the Silica Sand of Bukit Pelintung

To determine the content of silica percentage in the silica sand samples, laboratory tests need to be done. Laboratory testing is the test of samples or rock samples obtained from the field survey activities. This work was done in the studio or lab after completing all the work field (preliminary survey) to determine the physical and chemical properties. The results of the laboratory test is needed to determine the results of the chemical analysis of silica sand samples to determine the types of elements, physical properties, the percentage content of the elements as well as the usefulness of the silica sand.

Laboratory tests used are X-RF testing (X-Ray Fluorescence). From the results of laboratory testing of unknown samples arrived at the site has an abundance of compounds such as SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5. The test results showed that the compounds of silica (SiO_2) has a high percentage amount is very large and above 95%. Based on laboratory tests, the percentage content of compounds/minerals that are found in samples of silica sand in the Bukit Pelintung is

characterized by Table 2 for location of observation (BPel 1, BPel 2, BPel 3, BPel 4).

Table 2: Silica Percentage of Bukit Pelintung.

Compound/ Mineral	Percentage (%)			
	BPel 1	BPel 2	BPel 3	BPel 4
SiO_2	96.82	88.15	96.39	94.11
TiO_2	0.13	0.34	0.14	0.15
Al_2O_3	2.00	6.13	1.62	3.22
Fe_2O_3	0.36	1.50	0.34	0.50
MnO	bdl*	bdl*	bdl*	bdl*
MgO	0.15	0.15	0.12	0.14
CaO	0.22	0.19	0.20	0.20
Na_2O	0.07	0.13	0.05	0.30
K_2O	0.40	0.11	0.36	0.54
P_2O_5	0.02	0.03	0.02	0.02
L.O.I**	0.60	2.98	0.12	1.02

7.0 CONCLUSION

After doing research on the potential distribution of silica sand in the Bukit Pelintung, though the results obtained from laboratory tests on the samples which have a high silica content above 95%.

This high content of silica (above 95%) can be utilized for the use of industrial raw materials especially for base materials of solar cells. From the results obtained, the points can be determined as the potential for silica sand mining activities.

Calculation to perform activities of these industries are very important, especially to know the amount, volume and distribution of silica sand, detailed geological mapping such as seismic mapping is needed.

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