The Content and Function of Electrical Energy Sources from Silisium which are contained by the Sand of Kuri Ca’di Beach in Maros Regency

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Abstract. Renewable energy, such as solar cells (solar power), wind power, biomass, etc. attract the attention of various parties, especially because the use of a variety of energy does not increase the level of carbon dioxide in the air. Biomass is a concept that looks at biota bodies quantitatively. This concept also includes animal bodies as energy resources. The term biomass also includes growing bodies, woods, grass in fields, agricultural products, and seaweed also including biomass.

This study discusses the source and electrical energy of sand on the Kuri Ca’di beach in Maros Regency. White sand will be dissolved using N-Hexan and Methanol solvents so that they can be separated between the polar and non-polar groups. Then the Sand was tested using FTIR (Fourier-transform infrared spectroscopy) intended to research a group contained in the spectrum of TMS (Tetramethylsilan) by observing the contents of CH3 which are composed in TMS.

The study results showed that the sand before extraction had been shown in wavelength between 3,000 to 3,500 to be considered a strong CH3 group instead of the sand that had been extracted.

1. Introduction
Indonesia is a country with abundant natural resource potential. These potentials include oil, gas, and mineral materials. Among minerals materials, there are materials classified as oxide materials that have the potential for high technology utilization such as ZnO, SiO2, MgO, Al2O3, TiO2, to be able to maximize the use of these materials supported by new technologies namely nanotechnology. Products from nanotechnology are in the form of nanomaterials, wherein the synthesis is developed which is very widely used in the electronics field. Biomass treatment from solid waste can use various processes, namely thermal conversion, chemical conversion, and bio-chemical conversion. Gasification is a method of thermo-chemistry. The results of the gasification process produce the main natural gas whose elements consist of H2 and CO, with trace gas (content) CH4 elements of different proportions. The gas produced from biomass gasification is cleaned and adjusted to be used as a raw material for the methanol synthesis process by utilizing catalyst reactions and high pressure conditions. The structure of the gasification reactor is simple, what needs to be considered is that the raw material needs to be crushed to a small shape and the gasification process requires high temperatures [1]. The largest silica content is found in beach sand [2]. It was observed in this study,
which is Lampung Province which has coarse grain characteristics and varying degrees of chloride (Cl) and sulfate (SO₄) salts which are not exceeding the specified limit [3].

Previous research stated that sand originated from rocks that experienced weathering and erosion, and it has many minerals, one of which is SO₄ (Sulfate). Sulfate itself is one of the main components of the constituent clay / red soil which we all know can be used as a catalyst in the gasification process of wood powder or rice husk. Therefore the SO₄ compound can be used as a reference to make a beach sand catalyst material in the rice husk gasification process. Clay can also be added to the sand content to the beach sand material. In addition, beach sand is mainly composed of silisium dioxide, so that it can be used as a raw material for silisium production. Silisium itself in the process of processing silisium dioxide into silisium or metal can be used as energy and is provided by nature, namely wind or energy from sunlight.

Silisium is a non-toxic material and has energy content such as carbon, which is the core of fossil energy. The energy in silicium is stored in chemical bonds and can be moved to another place safely. When the silisium production process is made into silicon, the liquid side product is obtained, Tetramethylsilan (TMS) has the fuel energy of gasoline from petroleum. If this TMS is burned, it will produce less energy and CO₂ than gasoline and clean sand. Thus, this can be used as an alternative fuel in the future.

2. Renewable Energy

Renewable energy is a replacing energy source to meet energy demand. At present, the increase in energy needs is dominated by fossils which are not renewable energy and have a negative impact on the environment. Fossil energy is closely related to the ecology of damage and ultimately to global warming, shifting layers of the earth, climate, water, and environmental pollution. An alternative solution to reduce the use of fuel oil (BBM) is to use fuel oil, which converts to natural gas in the transportation sector. The potential for new and renewable energy is very significant, Indonesia is endowed with a variety of energy resources. Recorded there are 75,091 MW of geothermal energy, 29,164 MW, mini / micro hydro 769.69 MW, biomass 49,810, solar power 480 kWh / m² / day, wind power 3-6 m / s, 161.5 million SBM biofuel, biogas 2, 3 million SBM, and 3,000 MW municipal waste (Director General of New and Renewable Energy and ESDM Energy Conservation). The data assumes how rich and renewable energy needs to be empowered [2].

3. Fuel

Initially, the fuel we use comes from oil sources that will run out, for example, fossils. Over time with the development of renewable energy campaigns due to environmental problems caused by the disposal of fossil fuels, various new innovations that are more environmentally friendly, the biomass material emerged. In addition, data from ZREU in 2000 stated that Indonesia produces 146.7 million tons or equivalent to 470 GigaJoule (GJ) of biomass per year, which is the main source of agricultural residues which is 150 GJ per year and 120 GJ of wood rubber per year. As an illustration of fossil fuel reserves namely our petroleum. Currently, there are only 4.3 billion barrels, with a population of around 240 million, so our oil reserves are only about 18 barrels per capita. Thus it can be estimated that the petroleum reserves will be exhausted in about 25 years. Therefore the development of alternative fuels instead of fossil fuels is an effort that must be immediately implemented so that Indonesia does not become a larger net importer country in the future [4].

4. Experimental Setup

This research was conducted at the Chemistry Department Laboratory of FMIPA Unhas. The test consists of 2 (two) stages, which are:

1. Separation of sand particles into residues.
   At this stage, the sand will be residual using N.Hexan and Methanol solvents to separate polar and non-polar compounds inside. The tools used are:
The testing process carried out is as follows:

a. The Sand is weighed as much as 250 gr on a balance coated using HVS paper.
b. Before pouring into a separating funnel all the tools will be washed using Aquades to maintain the neutrality of the compounds contained in the tool.
c. The sand is weighed as much as 250 gr then inserted into a separating funnel consisting of 3 types of separating funnels to be tested.
d. N.hexan will be poured into a 250ml graduated cylinder and then put into a separating funnel that has been mixed with sand.
e. The separating funnel will be shaken so that N.hexan mixes with the sand, leaving it to stand for 3 days.
f. After 3 days the sand stored in the separating funnel will be poured into Erlenmeyer.
g. Then the results of the residue will be washed using methanol for 3 days so that the polar and nonpolar compounds are separate on the Kuri Ca'di Sand.

2. Extraction of sand residues and FTIR testing

In this test, the beach sand was tested using FTIR (Fourier-transform infrared spectroscopy) tool aimed to examine the groups contained in the TMS (Tetramethylsilan) spectrum by observing CH3 compounds arranged in TSM. The tools and materials used in this test are:

A. Materials:
   1. White Sand before Extraction
   2. White Sand after Extraction

B. Tools:
   1. Filter Paper no. 42
   2. FTIR (Fourier-transform infrared spectroscopy)
   3. Mashers (Mortal and pestle)
   4. Filter (sieve)
   5. Compressor tool
   6. Glass funnel
   7. Oven

The testing process carried out is as follows:

a. Cover the glass funnel with filter paper, then pour the sand extraction results into the Erlenmeyer sediment. Wait until the water is completely gone from the sand residue.
b. The residue will be dried and then oven for 10 minutes and will be tested using FTIR tools.
c. There are 2 types of samples to be tested, which are sand before extraction and after extraction. So, sand that hasn't been extracted will be filtered using a sieve and mashed up first using a masher.
d. After that, the sample will be inserted into the mold plate on the compressor tool which is useful for removing the remnants of water contained. The pressure used in 70 KN.
e. After a circular plate is formed, it will be tested through an FTIR tool to determine the content of the sand chemical group.
5. Experimental Result

In stage 1, which is the separation of sand particles into residues, the sand is extracted with N.Hexan 3 times 24 hours then extracted with methanol 3 times 24 hours. At the beginning of the testing process, the sand must be washed with N.Hexan, which is used to remove or remove non-polar material (if any) in the sand. Then washed with Methanol to remove TMS (Tetramethylsilan) because TMS is one of polar group (TMS dissolves in methanol). The following is a picture of the TMS (Tetramethylsilan) group,

![TMS Group](image)

Figure 1. Tetramethylsilan (TMS)

The results of these residues are examined using the FTIR (Fourier-transform infrared spectroscopy) tool to be entitled to TMS (Tetramethylsilan) whether or not it can actually produce fuel. Basically, the FTIR (Fourier Transform Infra Red) spectrophotometer is the same as the IR dispersion spectrophotometer, which distinguishes it from the development of the optical system before the infrared ray is diverted to the sample. The rationale of the FTIR Spectrophotometer comes from wave equations formulated by Jean Baptiste Joseph Fourier (1768-1830) a mathematician from France. Fourier suggested the following electronic waves:

\[ f(t) = a_0 + a_1 \cos \omega_0 t + a_2 \cos 2 \omega_0 t + \ldots + b_1 \cos \omega_0 t + b_2 \cos 2 \omega_0 t \] (1)

which in:
- both of a and b are constant
- t is time
- \( \omega \) is angular frequency (radian per second)
- (\( \omega = \) both of 2 \( \Pi \) f and f are frequency in Hertz)

How to read FTIR spectra are as follows:

a. Determined the X axis and Y-axis of the spectrum. The X-axis of the IR spectrum is labeled as "wave number" and the number ranges from 400 on the far right to 4,000 on the far left. X-axis provides absorption number. The Y axis is labeled as "Percent transmittance" and the amount ranges from 0 at the bottom and 100 above.

b. Determined peak characteristics in the IR spectrum. All infrared spectra contain many peaks. Next look at the functional cluster area data needed to read the spectrum. c. Specified area of spectrum in which characteristic peaks exist. IR spectrum can be separated into four regions. The range of the first region is from 4,000 to 2,500. The second region ranges from 2,500 to 2,000. All three regions range from 2,000 to 1,500. The fourth area ranges from 1,500 to 400.

c. Functional groups were determined to be absorbed in the first region. If the spectrum has peak characteristics in the range of 4,000 to 2,500, the peak corresponds to the absorption caused by NH, CH and the OH bonds alone.

d. Functional groups were determined to be absorbed in the second region. If the spectrum has peak characteristics in the range 2,500 to 2,000, the peaks correspond to absorption caused by triplicate bonds.
e. Functional groups were determined to be absorbed in the third region. If the spectrum has peak characteristics in the range of 2,000 to 1,500, the peaks correspond to absorption caused by double bonds such as C = O, C = N and C = C.

f. Compared to peaks in the fourth region to the peak in the fourth region of the other IR spectrum. The fourth is known as the fingerprint region of the IR spectrum and contains a large number of absorption peaks which account for various types of single bonds. If all the peaks in the IR spectrum, including those in the fourth region, are identical to the other spectrum peaks, you can be sure that the two compounds are identical. The regional functional group table in IR is shown in the table below.

| Bond   | Compound Types                      | Regional Frequency | Intensity |
|--------|-------------------------------------|--------------------|-----------|
| C – H  | Alkanes (Alkana)                    | 2850 - 2970        | Strong    |
|        |                                     | 1340 - 1470        | Strong    |
| C – H  | Alkenes (Alkena)                    | 3010 – 3095        | Medium    |
|        |                                     | 675 - 995          | Strong    |
| C – H  | Alkyne (Alkuna)                     | 3300               | Strong    |
| C – H  | Aromatic Ring                       | 3010 – 3100        | Medium    |
|        |                                     | 690 – 900          | Strong    |
| O – H  | Phenol, Monomer Alcohol,            | 3590 – 3650        | Fluctuate |
|        | Alcohol Hydrogen Bond, Phenol       | 3200 – 3600        | Fluctuate |
|        | Monomer Carboxylic Acid,            | 3500 – 3650        | Sometimes it widen |
|        | Hydrogen Bond Acid, Carboxylic      | 2500 - 2700        | Medium    |
| N – H  | Amine, Amide                        | 3300 – 3500        | Medium    |
| C == = = C| Alkenes                             | 1610 – 1680        | Fluctuate |
| C == = = C| Aromatic Ring                       | 1500 – 1600        | Fluctuate |
| C == = = C| Alkyne                              | 2100 – 2260        | Fluctuate |
| C – N  | Amine, Amide                        | 1180 – 1360        | Strong    |
| C == = N| Nitrile                             | 2210 – 2280        | Strong    |
| C – O  | Alcohol, Ether, Carboxylic Acid,    | 1050 – 1300        | Strong    |
|        | Ester                               |                    |           |
| C == = = O| Aldehydes, Ketone, Carboxylic      | 1690 - 1760        | Strong    |
|        | Acid, Ester                          | 1300 – 1370        | Strong    |

The results of FTIR testing on sand before extraction are shown in the following picture,
FTIR Test Results on Beach Sand before extraction

If seen in Figure FTIR testing on beach sand before extraction seen at 3000 to 3500 wavelength there is a strong CH$_3$ group from the sand diagram that has been determined using the FTIR tool. This shows that the beach sand before extraction has a high TMS content to be used as fuel.

While the results of FTIR testing on sand after extraction are shown in the following picture,

FTIR Test Results on Beach Sand after extraction

In the FTIR test results after the beach sand is extracted, it can be seen that the beach sand contains a lot of hydrogen and sodium hydroxide, the TMS content will dissolve in hydrogen because it has been extracted with methanol and N.Hexan. So that the beach sand after extraction cannot be used as fuel because of its low TMS content.
6. Conclusion

Based on the results of testing using FTIR shows that:

1. Kuri Ca'di Beach Sand has a strong CH₃ group that has a high TMS (tetramethyilsilan) content to be used as fuel.
2. The more TMS (tetramethyilsilan) content is found in beach sand which has been extracted.

7. References

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