Determining the potential of quartz sand in the Pasir Putih Village, District of Pendolo, Regency of Poso

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Abstract. This research aims to investigate the potential of quartz sand in Pasir Putih Village of Pamona Selatan District, Poso Regency. The research is conducted by using a method of geoelectrical resistivity with Schlumberger configuration. Mapping process was done at 37 points of measurement and calculated using IP2WIN software. Each measurement point is connected to 5 trajectories in order to map the potential distribution of quartz sand. The software of 3D RockWork is used to calculate the volume of white sand at the research area. The results obtained are detected white sand with a resistance value of 1000 Ωm - 140,000 Ωm to a depth of 100 meters below level ground for lanes 1 and 2 which is located adjacent to Poso Lake. The existence of white sand distribution decreases with distance away from Poso Lake (trajectory 3, trajectory 4 and trajectory 5). Calculated volume of quartz sand at this study location was 134.56 million m³ with measurement area of 2.151.498 m².

1. Introduction
One of the mainstays in the independence of the supply of raw materials for solar cell components is the mastery of advanced material technology. The Material technology for solar cells has experienced rapid progress, where initially solar cells were produced using the material of Single Crystal Silicon Wafer (c-Si) [1]; then developed at least four other types of basic ingredients, such as: (a) Amorphous silicon (a-Si) [2], (b) Polycrystalline silicon (poly-Si) [3], (c), Copper indium gallium diselenide (CIGS) alloys [4] and organic solar cells [5-7].

With the abundance of high concentration silica sand reserves in Indonesia, it provides great opportunities for the development of the national solar cell industry. Today, it is essential to address the industrial development of solar cells which is supported by studies and application of solar cell technology. Of course, the solar cell industry in question is an industry that has independence in terms of the supply of raw materials for its production, or at least production of raw materials, silicon ingots and wafers can be obtained locally [8]. The results of preliminary research on the technique of preparing and characterizing natural sandy silica for raw materials for solar cells have been carried out showing that quartz sand in the Pasir Putih Village, Pamona Selatan Sub-district has 99% purity that is eligible to be processed into solar cell raw materials [9]. For this reason, it is necessary to map the potential of quartz sand in that location and conduct a systematic analysis of the Silica sand purification technique for solar cell raw materials.
2. Experimental

2.1 Exploration of Quartz Sand
Exploration of potential of quartz sand in Pasir Putih village, Pamona Selatan sub-district, Poso district includes (1) a preliminary survey conducted to describe the geological and topographic conditions of the research area and to determine the location of measurement points. To find out the geological conditions of the study area, the geological map of Poso district was used. Whereas to determine the topography of the research area, it is used the geospatial map of Indonesia; (2) Geoelectric resistivity measurements to determine the potential of quartz sand at the study site using Wenner-Schlumberger configuration with Automatic Array Sounding (AAS); (3) Data processing and interpretation using IP2WIN software.

2.2 Purification of Quartz Sand
The purification of SiO$_2$ compounds from quartz sand was then carried out using the milling method [10]. Quartz sand was washed using water to clean and then dried it at normal air temperature and sieved it using a 60 Mesh sieve. Furthermore, separating iron sand using a magnet. After the separation of iron, the sand was ground using ball milling for 3 hours which was then purified using leaching method and then analyzed by the XRF method to see the composition in the sample.

3. Result and Discussion

3.1 Potential mapping of the quartz sand
The 2D data plot of the exploration results on the 5 stretches in the study location is shown in figure 1. Based on data processing using IP2WIN software, it was detected that resistivity of quartz sand of 1000 ohms - 140,000 ohms in this case marked with a red bar [11]. Line 1 is directed NE, quartz sand is detected on the surface to a depth of 100 m. At a distance of 0 m to 750 m, white sand is detected to have a thickness of 50 m and then up to a distance of 1200 m the thickness of white sand reaches up to a thickness of 100 m. Track 2 is directed NE, quartz sand is detected on the surface to a depth of 100 m bmt. At a distance of 0 m to 800 m white sand is detected up to a thickness of 50 m and then up to a distance of 1200 m the thickness of white sand reaches up to 100 m thickness. However, at a distance of 1050 m to 1250 m the thickness is cut only to a depth of 25 m. Track 3 is directed NE, quartz sand is detected on the surface to a depth of 100 m below ground level. At a distance of 0 m to 1200 m white sand is detected 50 m thickness and then up to a distance of 1200 m the thickness of white sand reaches up to 100 m thickness. But at a distance of 1600 m to a distance of 1800 m white sand is not detected. Whereas on Line 5 quartz sand is detected evenly only to a depth of 25 m below level ground.

The sequence of tracks from line 1 to line 5 is from the edge of Lake Poso away from the edge of the lake. It can be seen that the farther from the edge of the lake the white sand content is also decreasing. This is because the energy needed in the sedimentation process farther from the lake decreases [12][13]. The potential of quartz sand was determined with a software of 3D RockWork in a measurement area of 2,151,498 m$^2$ is 134,560,000 m$^3$ (figure 2).

3.2 Quartz Sand Purification Results
The XRF sample characterization results at each extraction point are shown in table 1. These results indicate that quartz sand from the Pasir Putih Village of South Pamona Sub-district qualifies as a raw material for solar cells [13].

4. Conclusion
Maps of Potential of quartz sand in Pasir Putih Village, Pamona Selatan Sub-district, Poso Regency have been obtained with a volume of 134,560,000 m$^3$. The sand samples that have been investigated at
each point show that the overall results have a purity of more than 99%. These results meet the requirements for subsequent processing in the following year for pure silicone pellets.

Figure 1. 2D plot of the potential of quartz sand for 5 trajectories in the study location.
Figure 2. The potential of quartz sand using software of 3D RockWork

Table 1. The XRF sample characterization results at each extraction point

| SAMPLES | COMPOUND OF SiO2 (%) | Before Purification | After Purification |
|---------|-----------------------|---------------------|--------------------|
| P1      | 99.47                 | 99.72               |
| P2      | 99.20                 | 99.34               |
| P3      | 99.22                 | 99.52               |
| P4      | 99.45                 | 99.91               |
| P5      | 99.26                 | 99.29               |
| P6      | 99.53                 | 99.57               |
| P7      | 99.30                 | 99.79               |
| P8      | 99.50                 | 99.94               |
| P9      | 99.45                 | 99.69               |
| P10     | 99.61                 | 99.71               |

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References
[1] Garnett E and Yang P 2010 *Nano Letters* **10** 1082-1087.
[2] Chen Xi, Jia B, Saha J K, Cai B, Stokes N, Qiao Qi, Wang Y, Shi Z and Gu Min 2012 *Nano Letters* **12** 2187-2192.
[3] Becker C, Amkreutz D, Sontheimer T, Freidel V, Lockau D, Haschke J, Jogschies L, Klimm C, Merkel J J, Plocica P, Steffens S and Rech B 2013 *J. Solar Energy Materials and Solar Cells*, **119** 112-123.
[4] Liu C P and Chuang C L 2012 *J. Solar Energy* **86** 2795-2801.
[5] Darwis D, Elkington D, Sesa E, Cooling N, Bryant G, Zhou X, Warwick B and Dastoor P 2011 *AIP Conference Proceedings (Denpasar)* The 4th Nanoscience and Nanotechnology Symposium (NNS2011) **1415** 120-123.
[6] Darwis D, Holmes N, Elkington D, Kilcoyne A L D, Bryant G, Zhou X, Dastoor P and Belcher W 2014 *J. Solar Energy Materials and Solar Cells* **121** 99-107.
[7] Vaughan B, Stapleton A, Sesa E, Holmes N P, Zhou X, Dastoor P C and Belcher W J 2016 J. Organic Electronics 32 250-257.
[8] Masmui and Suhendra N 2012 Proc. Seminar Insinas I Bandung ed Karmiadji D W et al
[9] Darwis D, Syamsu, Ukhtiani I, Metungku N, Iqbal, Kasim S, Khaerani R and Sesa E 2017 Proc. 2nd International Conference on Education, Science, and Technology (ICEST 2017) Atlantis Press.
[10] Darwis D, Khaerani R, Iqbal I 2017 Journal of Natural Science and Technology 6.
[11] Telford W M, Geldart L P and Sheriff R E 1990 Applied Geophysics Vol. 1 (London: Cambridge University Press.)
[12] Dearing J A 1997 Journal of Paleolimnology 18 1-14.
[13] Douglas R W and Rippey B 2000 J. Limnology and Oceanography 45 686-694.