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The Study of Specific Surface Area from Carbonat Rock Using Micro Computed Tomography (μ-CT)

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Abstract. *Habibi M R, Niyartama T F. 2017. The Study of Specific Surface Area from Carbonat Rock Using Micro Computed Tomography (μ-CT). Proc Internat Conf Sci Engin 1: 111-113.* Carbonate rocks have been scanned and reconstructed in order to get the value of specific surface area. We get it from the reservoir at a depth of 1000 metres in South Sumatra. Skyscan Micro-CT 1173 is used for throwing and thresholding images using Global Otshu to characterize rocks. Our calculation result shows that the value of specific surface area of carbonate rocks show results 10^0 to 10^{-2} using the programming Algorithm Fuzzy C-Mean. The difference in values far enough that it can be assumed that the carbonate rocks have a heterogeneous surface area. In addition, histogram model shows the similarity of the sample. The macro sample has the same characteristics as the micro sample.

Keywords: Carbonat rock, Micro-CT scan, specific surface area

INTRODUCTION

Specific surface area is a property of the material which is the ratio of an area of with a total volume of sample or bulk volume of the material (Tiab et all, 2011). Specific surface area can be calculated with the following equation:

$$S_A = \frac{S}{V_{bulk}} \quad (1)$$

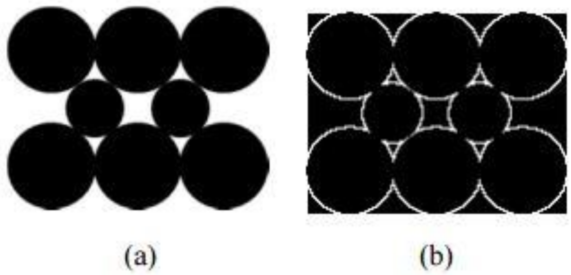

Figure 1. Perimeter illustration with detection of edge (Irayani, 2014).

The perimeter is the circumference of an object. In 2D, the perimeter can be viewed as a long curve enclosing object, and in 3D, the perimeter is the area enclosing the object. Perimeter quantity can be calculated with the method of detection of edges, i.e. counting pixels enclosing the object. Illustration of the Image shown on the perimeter of 2.4, in part (a) shows the various objects and images (b) are colored white is perimeter (Irayani, 2014)

Programming language Fuzzy C-Mean Algorithm php used to manipulate the image in the measurement of the specific surface area. The first specified are the spatial resolution, determine the unit of pixels from each dataset scenario. After that each image dataset scenario opened one by one and processed using the programming Algorithm Fuzzy C-Mean to calculate the perimeter or circumference of each grain. After obtained data round the entire perimeter of the data aggregated and divided by the volume of bulk using Ms Excel to get the value of specific surface area from each dataset scenario.

MATERIALS AND METHODS

Material

The carbonate rock from the reservoar was used in this research. Carbonate rocks will be made into plug cores with smaller size. The creation of this sample aims to get an increasingly smaller sample size to generate a small resolution image anyway so the image quality is obtained from a sample of the most good. The macro sample has the same characteristics as the micro sample. This research was done on March-May, 2016. This research was conducted in laboratory of Zoology Faculty of Science and Technology UIN Sunan Kalijaga Yogyakarta.

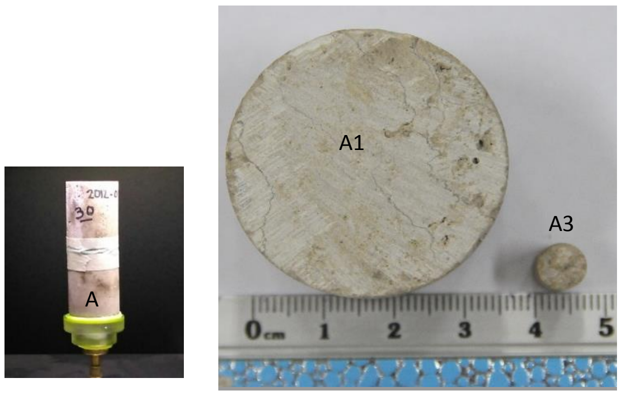

Figure 2. Sampel Plug Core Reservoar Carbonate.

The samples have been analyzed in the laboratory petrofisika. The results of the analysis into a reference in accordance with table 1.

Table 1. The results of the calculation Laboratory Petrophysics (Lemigas).

Code Sampel	PorV (cc)	GD (Gr/cc)	Por (%)	K abs (mD)	Lithology Description
C37	7,849	2,746	13,987	1,845	LS (PS):gry, hrd, sli vuggy, dru calc, calc, om, sli stylotite.

Procedures

The procedure of this research is as follows:

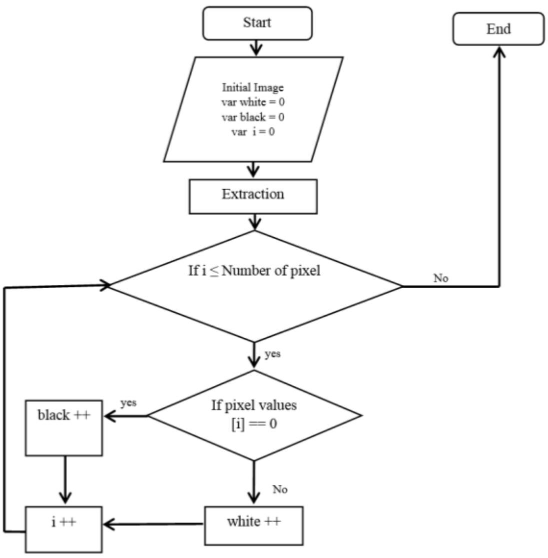

Figure 3. Flowchart specific surface area calculations per image using Fuzzy C-Mean Algorithm php (Bimantoro, 2017).

Data analysis

The calculation of the sub samples using widely 830 x 830 pixels to sample A, A1 and A3, obtained the following results (figure 4 and figure 5):

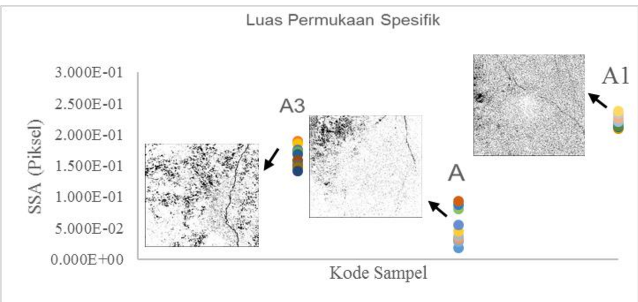

Figure 4. Specific surface area.

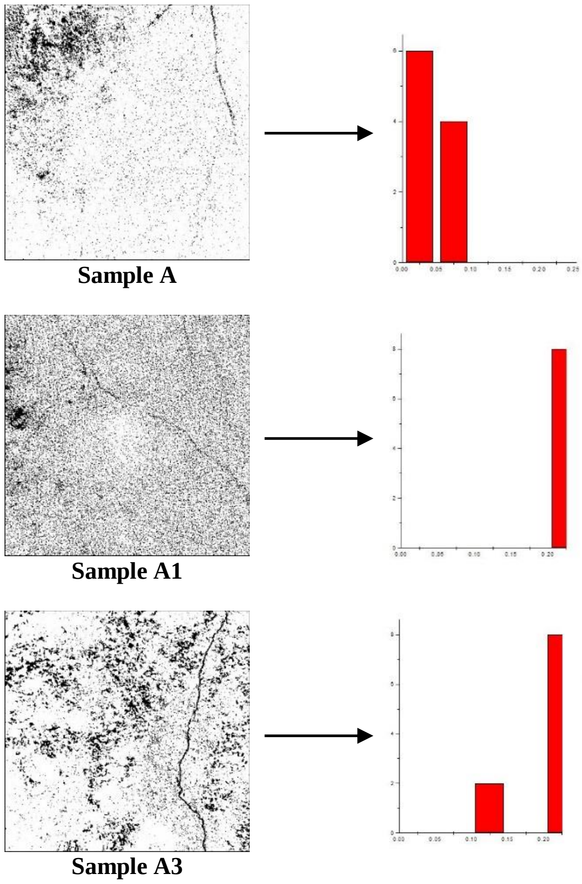

Figure 5. SSA Sample Reservoar Carbonate and Histogram Graphics.

RESULTS AND DISCUSSION

Figure 5 shows the surface area from sample A, A1, and A3. The histogram graph from the sample of A and A3 shows the same trend, whereas the A1 samples showed the difference of histogram graph when compared to samples of A1 and A3. The difference is due to the sample condition A1 which has not been in a dry state, compare with sample A and A3 that is already in a dry state when the scanning process performed on samples, thus affecting the image value of specific surface area although using the same model and characterization.

Image reconstruction of a sample A1 has a surface area of more than reconstruction image sample countless A3 and contrasts with the image of A reconstruction that has the same resolution (Figure 4.10). Although the sample A3 has a higher resolution, the result of spesific surface area calculations lower than A1 sample because A1 illumination sample not in normal distribution so the specific surface area calculations was not representative.

If we compared all the sample, spesific surface area calculations showed differeces with the order of 10^0 to 10^{-2}. The difference of specific surface area showed the sample heterogenity. Determaining the value of spesific surface can be improve in teh next study.

CONCLUSIONS

Our calculation result shows that the value of specific surface area of carbonate rocks show results 100 to 10-2 using the programming Algorithm Fuzzy C-Mean. The difference in values far enough that it can be assumed that the carbonate rocks have a heterogeneous surface area. In addition, histogram model shows the similarity of the sample. The macro sample has the same characteristics as the micro sample.

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