Aliphatic Biomaker Coal of Seram Island, Maluku Province

Jein Jelsi Lamia[1], Perry Burhan[1]

Abstract* – *Characteristic of organic geochemistry (biomarker) gives information about environment of coal. Coal was extracted by dichloromethane:methanol (93:7) for 72 h. Extract was obtained then fractionated by its polarity using column chromatography McCharty method. Subsequently, it was extracted to obtain neutral, acid and polar fractions. Neutral fraction was separated by KLTP methode and the extract were fractionated into hydrocarbon component which consist of Aliphatic and Aromatic compounds. The obtaining compounds were characterized by GCMS. Result of GCMS analyzed in Aliphatic fraction shown presence of n-alkane and derivate of terpen.These compounds are considered as important derivatives from natural products of higher plants and some compounds were expected formed by bacteria.

Index Terms* – *Biomarker, Maluku, Coal, GCMS, Organic geochemistry.

INTRODUCTION

Coal is one of the world's energy resources. Coal is an extremely complex mixture of organic chemicals containing carbon, hydrogen and oxygen as the main element, as well as sulfur and nitrogen as an additional element. The quality of coal is determined by several factors, including the presence of a basin, age and the amount of contamination. Chemical properties and the physics of a coal is determined by the mechanism of its formation (Killops and Killops, 1993)

The energy crisis prompted Indonesia to give attention to the utilization of alternative energy resources, such as coal. Maluku province has a basin that holds the potential of coal reserves in Seram Island. Geographical position of Seram island is 3 ° 13'06.2 "LS 129 ° 32'11.8" E). The discovery of coal comes from District Tehoru, Seram Island, Maluku Province. Toheru area fairly close to the District Bula is currently being explored their ground oil. This area is located in a complex tectonic zone because it is the confluence of three tectonic plates, namely: Australian Plate, Pacific Plate and the Philippines, and the Eurasian Plate. Geological activity of Seram Island affect the formation of coal in this area (Martini et all, 2003). Physically, coal sample were found in Seram is a little brown and brittle. Current data for Maluku coal reserves are estimated at 2.13 million tons (Arif, 2014)

Thermal evolution of the source rock, during diagenesis, catagenesis and metagenesis. changes many physical or chemical properties of the organic matter. These properties may be considered as indicators for maturation. Characteristics of coal Triassic period were found on the island of Seram, based on its physical properties the type of coal is immature. Formations of Seram Island are formed during the Triassic periode. Therefore, this study intend to investigate the characteristic of biomarker of coal from Seram Island. The information about the components of the building blocks of coal, source of organic material, the deposition conditions and also the time of formation of coal is expected to be clear.

[1]Jein Jelsi Lamia and Perry Burhan are with Department of Chemistry, Faculty of Mathematics and Science, Institut Teknologi Sepuluh Nopember, Surabaya. Email: jeanjelsilamia@gmail.com; pburhan@gmail.com

EXPERIMENTAL

A. *Method*

The Triasic coal was collected from Seram Island, Maluku Province. Sample was crushed into fine powder (120 mesh). Bitumen extraction was performed on 200 g of the powdered sample using Soxhlet apparatus with azeotropic mixture of dichloromethane (DCM) and methanol (CH_3OH) (93:7) for 72 h. Extracts Organic matters (EOM) was separated by column liquid chromatography into neutral fraction using diethyl ether (McCarthy and A.H.Duthie, 1962)

Neutral fraction was separated by Thin Layer Chromatography (TLC) with DCM into Alcohol, Ketone and Hidrocarbon fractions. Furthermore Hidrocarbon fraction was separated by Thin Layer Chromatography (TLC) with Hexane into Alifatic and Aromatic fractions.

B. *Characterizations*

Alifatic fractions have been analyzed by gas chromatography – mass spectrometry (GC-MS) agilent 122-5561 equipped with DB-5 fused capillary silica column (60 m×0.25 mm), using helium as carrier gas. The oven temperature program were 40°C (2 min hold), 40°C-100°C at 10°C/min, then 100-290°C at 4°C/min and 290°C (30 min hold). Mass spectrometry was operated 70 eV ionization voltage and 230°C interface temperature.

RESULT AND DISCUSSION

A. *Composition of hydrocarbon compounds of alifatic*

The result of GC-MS from hydrocarbon compounds of aliphatic fraction was showed at Picture 1.Fig.1.

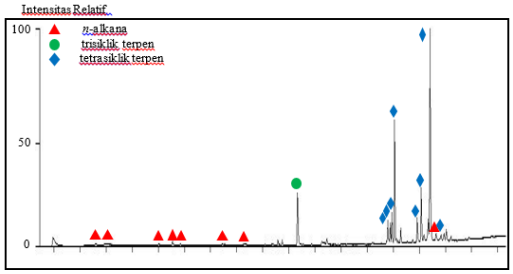

Figure 1. Chromatogram of aliphatic fraction hydrocarbon compounds of liquid coal of Seram Island, Maluku

B. n-alkane Compounds

The existence of n-alkane compounds in aliphatic fraction were identified by 57 m/z fragmentogram which was basic peak of alkane compounds. It was identified due to releasing of $(C_4H_9)^+$ groups. The fragmentogram of 57 m/z of aliphatic hydrocarbon fraction from Seram Island coal was showed at Fig. 2.

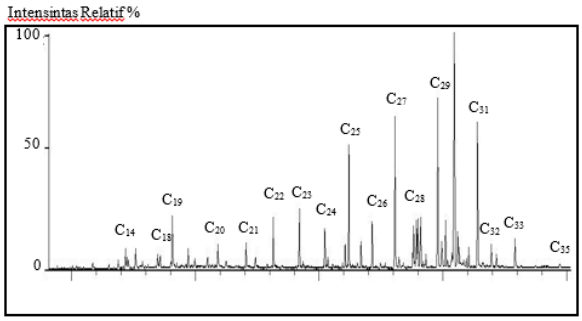

Figure 2. The fragmentogram m/z 57 of aliphatic fraction n-alkane hydrocarbon compounds of liquid coal of Seram Island, Maluku

This spectrum shows peak with characteristic pattern which linierly decreased from 57 m/z peak as base peak, furthermore the decrease peak was linierly obtained to 71; 85; 99 and etc m/z with 14 addition (as releasing methylene, $-CH_2-$) (Herod, et al., 1995).

The pattern distribution of n-alkane start from C_{14} to C_{33}, in this sample the distribution of carbon C_{14} to C_{20} less than C_{20} to C_{32}. Dominated high molecule of *n*-alkane ($>C_{20}$) gives information that the origin organic compound of sediment is from terrestrial higher plant (Erik dan Sancar, 2010). Distribution with n-alkane dominated by members in the C_{23} to C_{35} range with odd number of carbon atoms, it means that this coal still immature and reflecting a significant contributions from higher plant waxes (Killops and Killops, 1993).

C. Tricyclic and Tetracyclic Diterpenoid compounds

The partial m/z 109 and 123 fragmentograms from the aliphatic fraction of Seram Island, Maluku coal reveal the presence of tricyclic and tetracyclic terpenoid hydrocarbon. Diterpenoids can be an important source of the saturated and aromatic hydrocarbon remaining at the end of diagenesis. Trycyclic diterpenoid products can be particulary abundant where there has been a significant contribution from higher plant resins, commonly found in brown coal.

D. Hopanoids

In addition, this coal contain of 8,14-Secohopane (m/z 123 as base peak) can be formed from higher plant and other triterpenoid, the reaction appearing to be favoured by the presence of an oxygenated functional group at C-3 in the precursor. Others hopanes is 25-desmethylated hopane (m/z 177 as base peak), the presence of relatively large amounts from hopane signifying the importance of bacterial reworking, and their source beds often contain large amounts of amorphous kerogen which may derive from bacterial remains (Killops and Killops, 1993).

CONCLUSION

The aliphatic fraction of Seram Island, Maluku was identified. Among these compounds, several have been classically considered to be higher plant derived and there is bacterial activity.

REFERENCES

[1] Martini, R., Zaninneti, L., Lathuilliere, B., Cirilic, S., Cornee, J. dan Villeneuve, M. (2003), "Upper Triasic Carbonate Deposit of Seram (Indonesia): Palaeogeographic and Geodynamic Implications", *Palaeo*, Vol. 206, hal. 75-102.

[2] S.D Killops and V.JKillops "An Introduction to Organik Geochemistry". *Longman Scientific & Technical, New York*. 1993

[3] Arif. "Batubara Indonesia". Jakarta. PT. Gramedia Pustaka Utama. 2014.

[4] R.D McCarthy and A.H.Duthie. "A Rapid Quantitative Method for The Separation of Free FattyA from Other Lipids", *Journal Lipid Research, 3*. 1962.

[5] Herod, A. A., Hellenbrand, R., Xu, B., Zhang, S., & Kandiyoti, R. (1995). Alkanes and solvent dimers in successive extract fractions released from coal during liquefaction in a flowing-solvent reactor. *Fuel*, *74*(12), 1739-1752.