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CHEMICAL COMPOSITION IDENTIFICATION OF COMPOUNDS IN COAL AFTER A DISBURSEMENT PROCESS

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ABSTRACT

The purpose of this study was to observe the chemical compounds composition in coal after a liquefaction process. Based on the test results, it is obtained some of the compounds contained in liquid coal. The dominant compound is Naphthalene, benzene and methyl groups. This compound is a hydrocarbon compound which allows to be used as a fuel.

Keywords: identification, chemical compounds, liquid coal.

INTRODUCTION

To reduce the increased fossil fuels exploration, it is needed a new form of energy. Coal is one of the fossil fuels which are formed from sedimentary rocks derived from organic sediment, primarily from plants which are formed through a coaling process. The main elements consist of Carbon, Hydrogen and Oxygen. Coal is also an organic rock that has physical properties and chemical complex that could be found in various forms. Coal could be classified as Anthracite coal which the highest grade coal has a shimmering metallic black colour (luster) and has a 8% moisture content and 86-98% of C, Bituminous (68-86% C, 8-10% moisture content) and Lignite or brown coal (carbon levels below 60% and moisture content 35-75% by weight). In general, coal used is Anthracite Coal ($C_{240}H_{90}O_4NS$) and Bituminous ($C_{137}H_{97}O_9NS$) containing high levels of carbon and still relatively low water levels. While Lignite utilization is still less because of a lower carbon value and have a moisture content of 35-75% [1]. The content ash in coal is about 50-70%, allowing it to be used as heat energy and fuels [2]. To determine poly-nuclear aromatic hydrocarbons derived from coal and fossil fuel is done by a high performance liquid chromatography [3].

In order to ensure the element content as well as the feasibility of brown coal as a fuel, a liquefaction process is needed which could passes through several stages. After going through the stages of the process liquid coal is then tested for the physical and chemical properties to ensure that coal can be used as fuel oil [4]. In ensuring the properties of elements contained in liquid coal to be used as the material it needs an adequate technology [5].

Some who has been doing research on the coal liquefaction is as follows:

(a) The coal liquefaction decomposition process is done by pyrolysis, solvent extraction and directly or indirectly liquefaction processes [6-7].

(b) The coal liquefaction process is by separating three fraction: Soluble pentane and soluble benzene (crude asphalt); and soluble benzene. The soluble pentene is then separated into fractions of Propane - soluble liquids (Oil), and insoluble propane liquid (Resin). The soluble benzene fraction was then separated into soluble carbon disulfide (carbena), and carbon disulfide– soluble fraction (carboid) [8].

(c) Ethanol and cicloheksanon is capable to break large number of hydrogen in coal and then open structure [9-10].

(d) The coal conversion ratio to produce liquid coal is generally estimated between 1 and 2 barrels/Coal tones with assuming 10% of world Coal could be diverted into liquid become Coal [11-12].

(e) The contact area parameter degradation time would strongly affect the hydrocarbon long chains Hydrocarbons from alkane and alcohol on the liquid coal analysis [13].

(f) Constraints faced in the tar processing, is the compound complexity, so it is necessary to facilitate an early separation processes to ease the further utilization. The common separation process used for example is by the distillation fractionation using a reactor based on the Boiling point difference components. The tar component separation which is relatively consist from many type of components from such as Hydrocarbon light fraction to heavy fraction would result an efficiency process obstacles and require a large energy for the distillation process [14].

(g) Some materials that can be used as motionless phase is aluminum and carbon [15-20].

The coal liquefaction process becomes very important because coal is affordable and available

worldwide, enabling many countries to access coal reserves in domestic and international markets, to reduce dependence on imported oil and enhance secure energy [21]. Liquid coal can be used for transport, cooking, stationary power generation and chemical industries [22]. High quality coal is a sulphur free fuel, low particulates, nitrogen oxides and low [23]. Liquid fuel from coal is a very clean processing fuel and could reduce the health risks and indoor air pollution.

EXPERIMENTAL SETUP

Material used in this study is brown coal. The reason using this brown coal is because it is a kind of coal that has low carbon content and a high water content that could not be used as solid fuel.

The research method is to processing of coal liquefaction. The material used in the liquefaction process consists of Lignite (brown coal), solvent and catalyst. Coal liquefaction stages in the process include the selection of the coal that will be disbursed, the process of coal destruction to produce powder up to 200 mesh size. Powder, catalyst and solvent was added to the 500 ml capacity autoclave, this process takes place at a temperature of 400 °C and a pressure of 20 bar, to produce tar. A distillation process to separate the liquid and waste coal is done by using a distillation process. The liquid produced from the distillation process is heavy oil while the residue produced is in a slag form.

LIQUID COAL PROCESSING

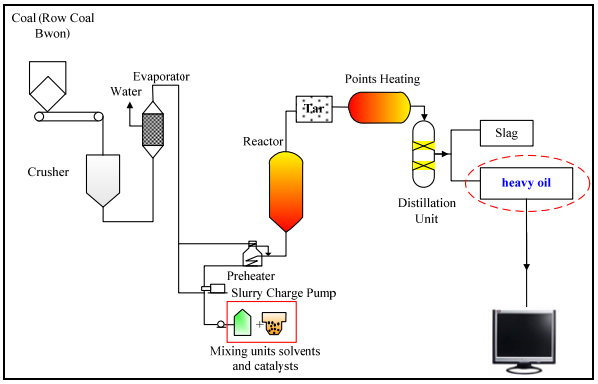


Figure-1. Research installation.

The testing process using a Gas Chromatographic-Mass spectrometric (GC-MS) is for validating the potential use of liquid coal as a new fuel.

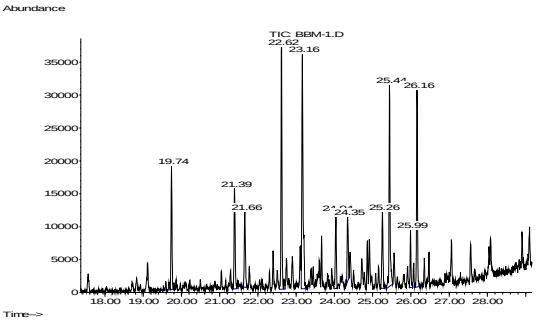
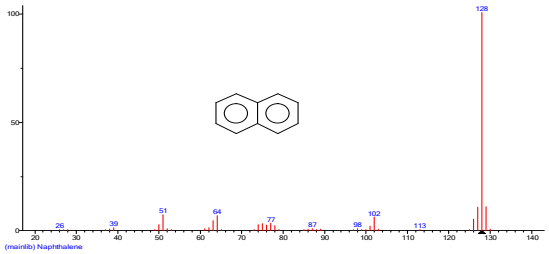
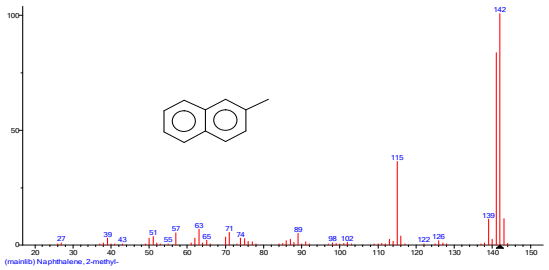


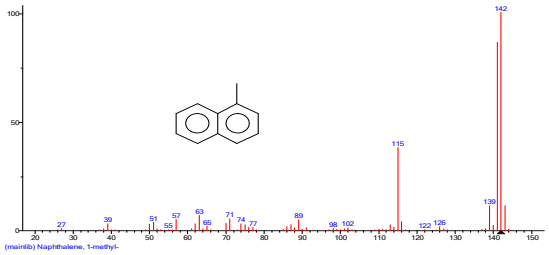
Figure-2. GC-MS test result.



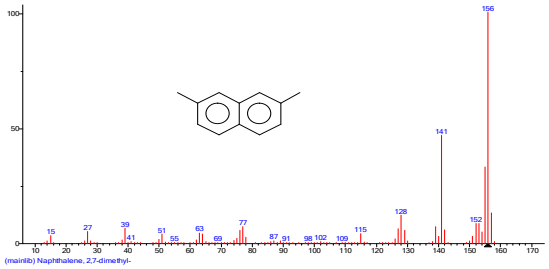
(a) Napthale



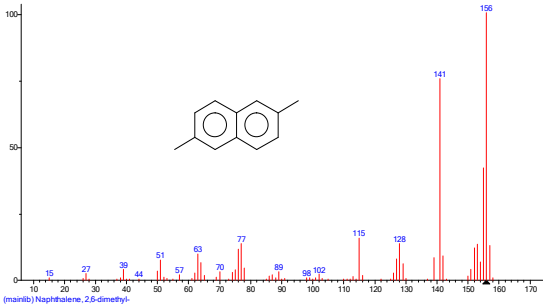
(b) Napthalene, 2 methil



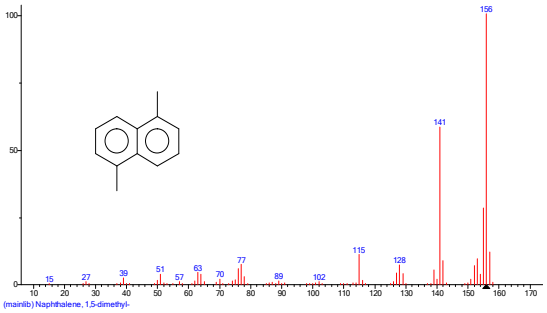
(c) Naphthalene, 1-methyl-



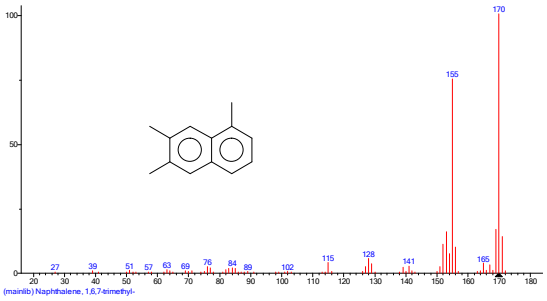
(d) Benzene, 1-(2-butenyl)-2,3-dimethyl-



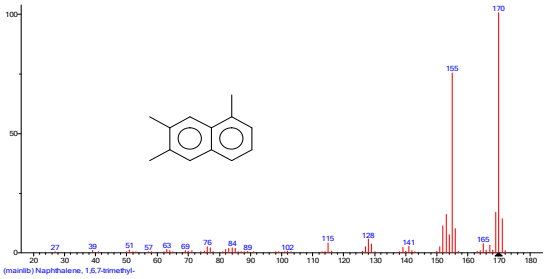
(e) Naphthalene, 2, 7-dimethyl-



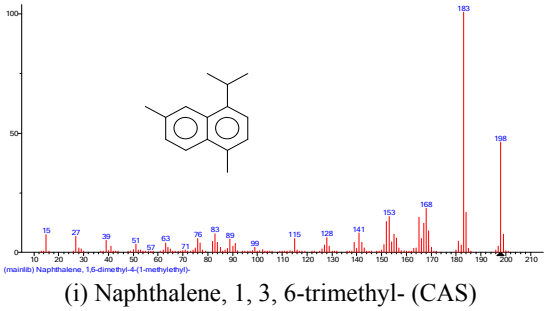
(f) Naphthalene, 2, 6-dimethyl-



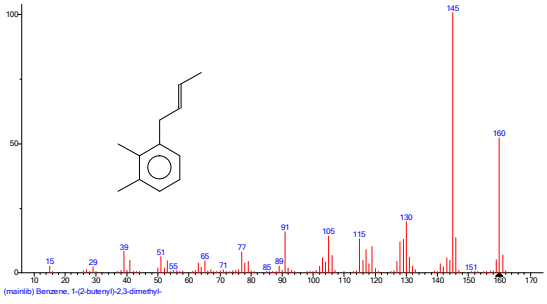
(g) Naphthalene, 1, 5-dimethyl-



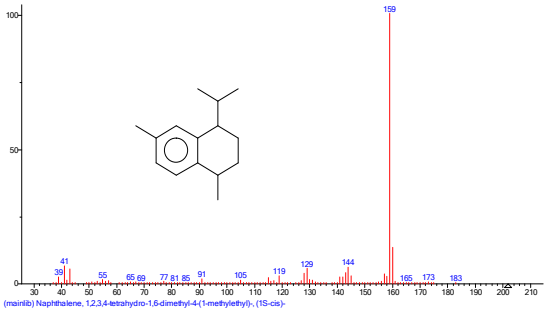
(h) Naphthalene, 1, 2, 3, 4-tetrahydro-1,6-dimethyl-4-(1-ethylethyl)-, (1S-cis)-



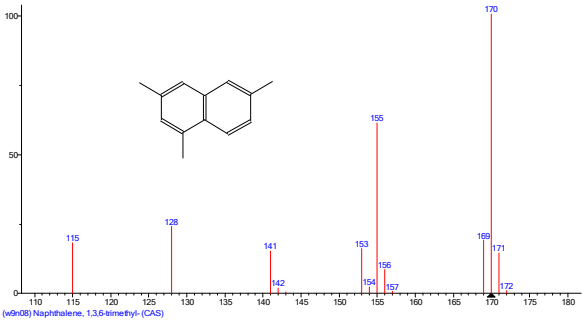
(i) Naphthalene, 1, 3, 6-trimethyl- (CAS)



(j) Naphthalene, 1, 6, 7-trimethyl-



(k) Benzene, [1-(2, 4-cyclopentadien-1-ylidene) ethyl]-



(l) Naphthalene, 1, 6-dimethyl-4-(1-methylethyl)-

Figure-3. Molecules structure forming the liquid coal fuel.

Table-1. Forming compounds in the coal liquid fuel formula.

No.	Compound	Formula
1	Naphthalene	$C_{10}H_8$
2	Naphthalene, 2-methyl-	$C_{11}H_{10}$
3	Naphthalene, 1-methyl-	$C_{11}H_{10}$
4	Benzene, 1-(2-butenyl)-2,3-dimethyl-	$C_{12}H_{16}$
5	Naphthalene, 2,7-dimethyl-	$C_{12}H_{12}$
6	Naphthalene, 2,6-dimethyl-	$C_{12}H_{12}$
7	Naphthalene, 1,5-dimethyl-	$C_{12}H_{12}$
8	Naphthalene, 1,2,3,4-tetrahydro-1,6-dimethyl-4-(1-ethylethyl)-, (1S-cis)-	$C_{15}H_{22}$
9	Naphthalene, 1,3,6-trimethyl- (CAS)	$C_{13}H_{14}$
10	Naphthalene, 1,6,7-trimethyl-	$C_{13}H_{14}$
11	Benzene, [1-(2,4-cyclopentadien-1-ylidene)ethyl]-	$C_{13}H_{12}$
12	Naphthalene, 1,6-dimethyl-4-(1-methylethyl)-	$C_{15}H_{18}$

Based on the results of GC-MS testing, the liquid coal derived compounds comprising elements of Naphthalene compounds, benzene and methyl groups.

Naphthalene is an aromatic hydrocarbon crystalline formed as white solid and form of two benzene rings bundled. These compounds are volatile, volatile even in solid form. The vapour produce is flammable. The hydrocarbon compound is the main substance of the fuel oil. Naphthalene will provide an optimum power. Methyl is a compound element close to gasoline. While benzene has a double bond carbons which are not localized to a particular carbon, but could be moved. This phenomenon is called resonance. The existence of resonances in this benzene causes the benzene bond to be stable so that the double bonds could not be addition reacted by water.

The physical properties of benzene is (a) a colourless liquid (b) have a distinctive odor (c) volatile (d) are not soluble in polar solvents such as water, but soluble in the solvent that is less polar or non-polar such as Ether, (e) a melting point of 5.5 degrees Celsius, (f) the boiling point is 80,1derajat Celsius. The chemical properties of benzene is (a) carcinogenic (poison), (b) a non-polar compounds, (c) not so reactive, but combustible and (d) are more susceptible to substitution reactions then the addition reaction.

CONCLUSIONS

Based on the test results it is found some of the compounds contained in liquid coal. Naphthalene and Methyl is the dominant compound. This compound is a hydrocarbon compound which allows to be created as a fuel.

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