



DEVELOPMENT OF TEACHING MATERIALS OF BASIC CHEMISTRY COURSE IN SUBJECT THERMOCHEMICAL WITH TOPICS BIO-COAL BRIKET FORM

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Abstract

Basic Chemistry course is a compulsory course for students of the Department of Mathematics and Science Education. In the syllabus there is Thermochemical subject. It discussed the changes in thermal energy that occurs from a chemical reaction system. Energy changes that occur in exothermic or endothermic reactions. In exothermic reaction, it used the explanations and examples from textbooks, which is a common example that did not pay attention to the natural resources that existed in that place. Basic chemistry course with the subject thermochemical which discussed South Sumatera's potential – oil, gas, and coal that need to be developed so that learning became more useful. Those resources are abundant fuel in South Sumatra. Researcher has been conducted research about potential areas of southern Sumatra, which is about Coal. The results of this study used by the researcher to develop teaching materials Basic Chemistry Course with the subject Thermochemical with Bio-Coal Briquette South Sumatra. Coal is a fuel source that is abundant in South Sumatra. Almost all districts in South Sumatra has reserves coal, although only a few districts that have been exploiting coal; Muara Enim, Lahat, OKU, MURA and Banyuasin. South Sumatra coal quality is generally low, the type of lignite to subbitumitas (5000-6500 kcal/kg). The main use of coal is as PLTU fuel. With the depletion of oil reserves, Indonesian government eliminated household kerosene subsidies, and transfers to other fuel substitute for oil, which is a gas. Gas fuel prices are relatively more expensive, so we need to find an alternative. As an alternative to kerosene besides gas is coal briquettes. Briquette is a block of material that can be burned. Briquettes Coal briquettes are made from coal fuel. Coal Briquette is a fuel that is cheaper than gas, easier to use, and available in South Sumatra, because there is a briquette factory in the same city where coal mining. Coal briquettes is still less than the wider use of gas. This is due to coal briquettes is more difficult than the gas ignited. Researcher has conducted research that coal briquettes easily ignited. The research conducted is doing blending coal with durian peel fiber as a stimulant ignition. Coal briquettes produced bio-coal briquettes called, because of added fiber of durian leather (a bio/plant) in the manufacture of coal briquettes. Has studied various forms of bio-coal briquettes, coal composition -fiber of durian leathers, fiber position and coal briquettes. The results of the research funding schemes BOPTN leading research universities in 2013 showed that the best is to form cylindrical briquettes, coal composition : fiber : adhesive : lime : silica is 100 : 17.5 : 10 : 1 : 1 with the position of the fiber portion with most coal in coal briquettes. Determination of bio-coal briquettes is by measuring the heat generated by each briquette

Key words: Teaching materials of Thermochemical, Bio-coal briquet, fiber of durian leathers

INTRODUCTION

Basic Chemistry course is a course that must be followed by students study program under the auspices of the Department of Mathematics and Science Education ; ie student of Mathematics Education, Biology Education, Physical Education, especially students of Chemical Education. Although as a compulsory subject, weighting the Chemical Basis courses between different study programs. In

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mathematics education curriculum, physical education and biology education is 2 credits; whereas in the education department of Chemistry, 8 credits. The differences are rational, given the function and contribution of core subjects to study each study program is not the same.

In Basic Chemistry course syllabus outlined a variety of subjects. The purpose of the discussion of the main points of discussion in the basic chemistry, aims for students to know and understand the basics of science in chemistry. One of the subjects given in the Basic Chemicals is subject Thermochemistry. Highlights Thermochemical discuss sub-topics that relate to the change in thermal energy (temperature system) that occurs in a system that undergoes a chemical reaction.

Heat energy changes that occur in a reaction consisting of two groups of changes. Changes in energy expenditure of energy can be heat (exothermic) or taking heat energy from the environment (endothermic).

In the discussion of exothermic reaction, this time using explanations and examples of the reactions listed in the basic chemistry books, which of course is a common example, which do not pay attention to the natural resources that exist in the local area. For learning basic chemistry becomes more useful, especially in identifying potential areas of South Sumatra, it is necessary teaching materials developed basic chemistry course subject to the topics Thermochemical reviewing potential areas of southern Sumatra, such as coal.

Chemical Education Study Program Curriculum

Curriculum in Program of Chemistry Education consists 149 credits. According Kepmendiknas no. 232/U/2000 guidelines for the Higher Education Curriculum and Assessment of student learning outcomes, higher education curriculum is a set of plans and arrangements regarding the content and study materials and lessons as well as the submission and assessment is used to guide the implementation of learning-teaching in college.

Chemistry Education Curriculum S1 FKIP Sriwijaya University, in Handbook of academic FKIP Sriwijaya University in 2013, declared consists of 5 groups of subjects, namely: Group personality development courses (MPK), Group of scientific subjects and skills (MKK), group work skills course (MKB), subject group work behavior (MPB) and subject group lifestyle society (MBB).

Personality development courses Group (MPK) is a group of study materials and lessons for developing the Indonesian people are faithful and devoted to God Almighty and noble character, steady personality, and independent and have a sense of civic responsibility and nationality. Subject knowledge and skills group (MKK) is a group of study materials and lessons are intended primarily to provide a foundation of knowledge and mastery of certain skills. Group work skills courses (MKB) is a group of study materials and lessons with the aim of producing skilled workmanship based on the basic knowledge and skills are mastered. Subject group work behavior (MPB) is a group of study materials and lessons that aim to shape the attitudes and behaviors needed someone to work according to skill level based on the basic knowledge and skills mastered. Lifestyle course community groups (MBB) is a group of study materials and lessons necessary for someone to be able to understand the rules of the society in accordance with the choice lifestyle expertise in the work.



In the group of science courses and skills courses are Basic Chemicals. In the Basic Chemistry lecture covered basic fundamentals of chemistry. Which covers the basic fundamentals of Stoichiometry, Chemical Bonding, Thermochemistry, Organic Chemistry, Inorganic Chemistry, and others.

Based on the analysis of lesson plans Basic Chemistry course, as long as the author of Basic Chemistry administer course, always using examples of common problems found in textbook. Reason being used is because it is available in textbook. No exception to the subject of the thermochemical; in explaining / applying concepts for thermochemical author uses examples about exothermic reaction or an endothermic reaction which is already available in textbook.

For learning basic chemistry becomes more useful, especially in identifying potential areas of South Sumatra, it is necessary teaching materials developed courses Basic Chemistry Thermochemistry subject with teaching materials that examines potential areas of southern Sumatra, such as oil, gas, and coal. The third material is an abundant fuel in South Sumatra . Researchers have been conducting research about potential areas of southern Sumatra, which is about Coal. Based on these results, it is deemed appropriate to make the results of research into thermochemical course teaching materials.

Research Development Of Coal Briquet

Writer in 2013 who then has conducted research on energy topics, sub topics coal, with the purpose of promotion of the use of coal for household and small industries (Sanjaya 2013). Coal made into bio -coal briquettes with biomass is used as a stimulant durian skin fiber ignition. Outcomes are the results of the research seminar papers, and articles submitted to the journal.

In addition to these two outcomes, there is another option that is as teaching materials. The results of the study made teaching materials from the course of teaching researchers. This is what underlies the authors compile teaching materials of the course of teaching, namely Basic Chemistry course, appropriate to the subject that is the subject of Thermochemistry.

Coal is a fuel source that is very abundant in South Sumatra. Almost all districts in South Sumatra has reserves of coal, although only a few districts that have been exploiting coal; such as Muara Enim Regency, Lahat, OKU, MURA and Banyuasin. South Sumatra coal quality is generally low, the type of lignite to subbituminas (5000-6500 kcal / kg). The main use of coal as a power plant fuel.

BOPTN research funding schemes with leading research universities in 2013, which has been done is to find a particular form of coal, so coal easily ignited by considering coal as an energy source. In determining the results of the research, calculated the speed of burning coal, long burning and calorific value of coal.

Subject in accordance with the results of these studies are subject to the sub-topic Thermochemical exothermic reaction. Thus when discussing the subject sub exothermic reaction, the material used and the results of the study as an example of the discussion, which is an example of an exothermic reaction, using coal in South Sumatra .

According to Hughes (1921), coal has a calorific value varies, depending on the type of coal. Consists of lignite coal type, bitumin, steam coal, cannel coal, and anthracite. Coal which has the lowest calorific value of lignite that is, while the anthracite has the highest calorific value.

Based on the above research results developed teaching materials Basic Chemistry course subject



Thermochemical sub subject of an exothermic reaction. The teaching materials entitled Bio -Coal Briquette South Sumatra.

Briquet Bio -Coal South Sumatra

Subjects Subjects Subject Thermochemical Sub exothermic reaction that Come from Research Results Teaching materials consist of: (1) Definition of exothermic reaction, (2) The material can be an exothermic reaction, (3) the potential of coal, (4) quality and calorific value coal, (5) use of coal, (6) Coal Briquettes, (7) Bio -Coal Briquette.

(1) DEFINITIONS OF EXOTHERMIC REACTION

Exothermic reaction is a reaction / change of a material with another material, especially (oxygen gas), into another material and heat energy. Examples of exothermic reaction is the burning of coal in power plant boilers Tanjung Enim.

(2) EXOTHERMIC MATERIAL

The material can be an exothermic reaction is material if it turns into another material, taking out heat energy. Examples of such materials are coal, wood, premium, diesel, natural gas (LNG), LPG, and paper.





(3) POTENTIAL OF COAL

Coal is a fuel source that is very abundant in South Sumatra. Almost all districts in South Sumatra has coal reserves. Potential Coal South Sumatra are known to reach about 85 % of the total reserves contained in Sumatra earth, which is about 22.24 billion tonnes. Lahat district, PALI, Muaraenim, Musibanyuasin, Banyuasin, OKU, and Musirawas potential as a producer of coal. The magnitude of the potential coal into a rational basis why South Sumatra launched a program as a national energy barns.

Although South Sumatra coal potential, only a few districts that have been exploiting coal; such as Muara Enim Regency, Lahat, OKU, MURA and Banyuasin. PT Bukit Asam Tbk (PTBA), a major coal mining companies in the district of Muara Enim and Lahat, targets to sell as much as 24.7 million tons of coal in 2014. Years 2013 and sold 17.76 million tons of coal. PTBA addition, there are many coal miners in the above districts, such as PT. Banjarsari Pribumi, PT. Golden Great Borneo, PT. Bumi Gema Gempita, PT. Bukit Asam (Persero) MTBU, PT. Bukit Asam (Persero) A. Laya, at Kecamatan Merapi Timur; PT. Mustika Indah Permai and PT. Bukit Tunjuk, at Kecamatan Merapi Timur and Merapi Barat; PT. Batubara Lahat, PT. Muara Alam Sejahtera, PT. Duta Alam Sumatera, PT. Priamanaya Energi, PT. Bara Alam Utama, PT. Bara Selaras Resources, PT. Andalas Bara Sejahtera, and PT. Mandiri Nusa Pratama, PT. Aman Toebillah Putra, at kecamatan Merapi Barat; PT. Bumi Merapi Energi and PT. Dizamatra Powerindo at kecamatan Merapi Barat and Merapi Selatan; PT. Dian Rana Petrojasa 1, PT. Bima Putra Abadi Citra Nusa, PT. Sarana Cipta Gemilang at kecamatan Merapi Selatan.

(4) CALORIE COAL QUALITY AND VALUE

Coal is composed of several quality ratings. Sequence of low quality coal to high quality is: peat, lignite, bitumin, and anthracite. There is also a mix of coal types above, namely: steam coal, cannel coal. Steam coal is coal which is used for the evaporation of water in the power plant and steam trains. Cannel coal is a massive, noncaking, tough, clean, block coal of fine, even, compact grain, dull luster, commonly conchoidal cross fracture, having a typical low fuel ratio, a high percentage of hydrogen, easy ignition, long yellow flame, black to brown greasy streak, and moderate ash, pulverulent in burning. South Sumatra coal quality is generally low, the type of lignite to subbitumin. The quality of coal is determined calorific value of coal produced. Subbitumin quality lignite coal has a calorific value of up to 50006500 kcal / kg. Here the quality and calorific value of coal.

Quality Name	Figure Calorific value	Quality Name	Figure Calorific value
No 1 Antrasit	 Sumber: www.citg.tudelf.nl dalam http:// atlasnasional. Bakosurtanal Kalor 6100 -7100 kkal/kg	No 3 Lignit	 Sumber: www.citg.tudelf.nl dalam http:// atlasnasional.bakosurtanal Less thsn 5100 kkal/kg
No 2 Bitumin	 Sumber: www.citg.tudelf.nl dalam http:// atlasnasional. Bakosurtanal 5100 -6100 kkal/kg	No 4 Gambut	 Sumber: www.citg.tudelf.nl dalam http:// atlasnasional. Bakosurtanal lam Less than 4000 kkal/kg
Cannel coal	 (James St. John, 2012) Kalor 5200 -7100 kkal/kg	Steam coal	 (Daily mail Reporter, 2009) kalor 4500 – 6000 kkal/kg

(5) USE OF COAL

The main use of coal is the fuel industry to generate further heat energy is converted into kinetic energy and electrical energy; as well as a solid fuel or liquid fuel. In most major Indonesian coal used as fuel power plant. The general reaction in the combustion of coal are: Oxygen reacts with the coal into gases and heat energy



Besides coal is very useful in the production of iron and steel; as raw material for the manufacture of some chemicals such as coal tar and creosote for wood preservatives, naphthalene, phenol, benzene, plastic, and nylon fiber, active carbon for water filters, air filters and filter the blood washing machines ;

and carbon fiber , construction material , the main component of mountain bikes and tennis rackets .

With the depletion of oil reserves , the Government of the Republic of Indonesia reduce / eliminate household kerosene subsidies , and transfers to other fuel substitute for oil , which is a gas . Gas fuel prices are relatively more expensive , so we need to find an alternative . As an alternative to kerosene besides gas is coal . The Government has launched the use of coal for domestic use .

(6) BRIKET COAL

To be easily used in the household , then coal briquettes formed . Briquettes Coal briquettes are made from coal fuel . Regulation of the Minister of Energy and Mineral Resources No. 047 of 2006 on Guidelines for Preparation and Use of Coal Briquettes and Coal -Based Solid Fuel Coal Briquette is stating that the product type briquetting (briquetting) printing process through the solid particles of coal based on certain pressure either with / without a binder (binder) as well as other added ingredients . The main raw material is carbonized coal briquette coal with a percentage between 0-90 % , the remaining 5-15 % is added binders and materials . Added material used is limestone with a maximum level of 5 % , which serves as adsorbant for SO₂ capture. The raw material of bio -coal briquettes consist of : coal, biomass, and lime binder. The composition of the coal mixture is 50-80 % , biomass, 10-40 % , binder 5 -10 % , added ingredients (lime) 0-5 % .

South Sumatra has had a briquette factory, located in Tanjung Enim, the same city where coal mining. Coal briquettes has some form, as shown in the following figure.



Briquette form of eggs , cylinders , cubes and briquettes .

(6) BRIKET BIO -COAL

Coal briquettes is still less than the wider use of gas, even though the price of briquettes are cheaper than on gas. This is due to coal briquettes is more difficult than with the gas turned on, so the briquettes need di-resapkan/celupkan/rendamkan into the spirit for a few minutes, to be used as a combustion stimulant. To facilitate the start of combustion, need the addition of combustible components in the manufacture of coal briquettes; so they no longer have to soak in rubbing alcohol before burn.

From some research, bio -coal briquettes in the added component of biomass, parts of plants, which contain cellulose. Researchers use skin durian fiber as a bio in the bio -coal briquettes, the raw material ignition stimulant.

Researchers have conducted research that coal briquettes easily ignited. The research conducted is doing blending coal with durian leather fibers. Bio -coal briquettes printed with two variations of the

shape, which is a small cylindrical (s) and the egg -shaped (t). The position of the fiber and bio -briquette coal in coal printed with two variations , namely coal and evenly distributed fiber (m) and partly -mostly coal briquettes (b).

Has studied various forms of bio -coal briquettes, coal composition -durian skin fibers, fiber position and coal briquettes. Results burning briquettes known as follows:

Table of ignition time of bio-coal briquet

No	code	Start igniton (second)	code	ignition time (second)
1	5tm	204	1sb	8123
2	5tb	206	1sm	7774
3	2t	210	1t	7472
4	3sm	210	2sb	7432
5	5sb	210	3sb	7295
6	4tb	213	1tm	7292
7	2sb	214	4sb	7102
8	4tm	214	2tb	7069
9	5sm	214	2sm	7056
10	2tm	215	2tm	6945
11	3tm	215	3tb	6913
12	1tb	216	3tm	6805
13	3tb	217	4tb	6668
14	3sb	218	5sb	6644
15	4sm	220	3sm	6638
16	4sb	223	4tm	6590
17	1sb	224	4sm	6525
18	1tm	224	5tb	6365
19	2sm	224	5tm	6312
20	1sm	226	5sm	6240

As shown in the table above, the most easily known briquettes burning embers longest time is the code 2sb coal briquettes, coal composition (2): fiber: adhesive: lime: clay; 100: 20:10:1:1, cylindrical (s), the position of most coal-briquettes in part (b).

Picture to the left: a bio-coal briquettes before burning. Image right: bio-coal briquettes burning



Optimization is done with quality briquette briquette composition around code 2sb; The



composition is approximately 100:20 made is (a) 100:15; (b) 100: 17.5; (c) 100:20; (d) 100:22,5; and (e) 100:25. The results of the determination of the speed of burning and long burning of the fifth variation of the above is shown in the following table.

Table ignition time of bio-coal briket

No	composition	weight (gram)	Start of ignition (second)	full ignition (second)	Ignition finish (hour,minute,second)
1	100 : 15	60	67	4 m 12 s	2.24.32
2	100 : 17,5	60	60	3 m 58 s	2.20.25
3	100 : 20	60	52	3 m 50 s	2.14,22
4	100 : 22,5	60	50	3m 45 s	2.12.45
5	100 : 25	60	50	3 m 40 s	2.10.21

The results of this study indicate that the best is to form cylindrical briquettes, coal composition: fiber: adhesive: lime: silica is 100: 17.5: 10: 1: 1 with the position of most of the fiber with the majority of coal in coal briquettes. Determination of bio-coal briquettes is by measuring the heat generated by each briquette.

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