THE EFFECT OF AMYLUM ADHESIVE AND SAWDUST COMPOSITION FOR RUBBER SEED SHELL BIO-BRIQUETTE AS AN ENVIRONMENTALLY FRIENDLY ALTERNATIVE FUEL

Fathia Eka Pratiwi, Pitri yenica, Maulidia Putri
State Polytechnic of Sriwijaya, Palembang South Sumatra
Fathiaekapratiwi1@gmail.com

ABSTRACT
The purpose of this reaserch is to determine the optimum composition of rubber seed shell, sawdust, and amylum adhesive. Experiments were carried out in several stages: aggregate of the raw materials, drain the raw materials, do carbonization or combustion with 600℃temperature for 2 hours, restrict the supply of oxygen so that the materials do not burn to ashes, sieve the materials, weigh each of ingredients in the ratio of 60:20:20, 50:20:30, 40:20:40, and 30:20:50, blend the materials, print the briquettes, drain, and analyze the contents of briquette. This reasearch generates optimum compositionwith ratioof 60% rubber seed shells, 20% sawdust and 2 % amylum adhesive. It is in terms of the parameters that have been analyzed in the form of spesification of inherent moisture is 4.99%, ash content is 4.38%, volatile matter content is 24.75%, fixed carbon is 66.38% and calorific value is 6069 cal/gr.

Keywords: Bio-briquette, Materials composition, Rubber seed shell, Alternatif energy

INTRODUCTION
Energy has an important role in various economic activities and people's lives. Most of the energy are used in the household sector, industry, and transport, while the reserves of fossil fuels such as petroleum, natural gas and coal is as the main energy sources which is decreasing now (Indarti, 2001). Energy is a major problem in the world today. Each year, needs of energy increase paralleling with the rise of human activities. Scarcity and rise of oil prices will happencontinuosly because it is a nonrenewable. This should be matched directly by the provision of alternative renewable energy sources, abundant in number and low in price are so affordable for the public (Herman, 2006).

The use of alternative energy will protect a nation from rise of fossil fuel prices and reduce dependence on other countries for fuel supply. The research of energy resources, must be based on accessible and affordale raw materials for all people. One of alternative energy source is biomass energy which is sustainable and available innature.

Biomass energy is an alternative energy source that needs to be priority in its development compared to the source of additional energy. On the other hand, Indonesia as an agriculturalcountry generate agricultural waste which is lack of utilization. In rural areas, energy consumption of firewood has been done which will bring Deforestation. It forces us to diversify energy sources so that we can utilized the waste maximumly to be the source of alternative energy. Therefore, the briquettes, as alternative energy with appropriate technology that is simple and suitable for rural areas by utilizing waste of biomass such as coconut shells, rice husks and sawdust.

Briquette is a fuel that are solid and come from the remains of organic matter (Hambali, et al., 2009). Briquette is possible to be developed for mass in a relatively short time, given the technology and equipment is so simple. The treatment of charcoal briquettes use waste biomass

such as straw, sawdust, or various shell biomass such as coffee, chocolate, hazelnut, corn, cassava and jatropha waste (Fund2009).

The good quality of briquettes are briquettes that reach the quality of standards to be usedas public necessities. Essential properties of briquettes that affect the quality of the fuel that is physical and chemically characteristic such as moisture content, ash content, fixed carbon content and calorific value. Moisture content, ash content and levels of substance is lost on heating is expected aslow as possiblewhilethe expected of calorific value is as high as possible. Quality of briquettes are also influenced by the presence of gluten in briquette both the number and types of adhesives as well as how the test is used.

Based on Patria, et al., 2011, from his research showed that the highest calorific values are obtained at a variable temperature of carbonization, the composition of the mixture of charcoal rubber seed shells and coal 25%: 25%: 50% have a calorific value of 6611 cal/g. As well as to test the best fuel is a mixture of charcoal, shell and rubber seed at 500oC with a classification temperature of carbonization, red flame and gray smoke was not toomuch.

From the description above, the researchers are interested in making rubber seed shells as biobriket. In this case, the rubber seed shells can be used in biobriket process by varying the composition of rubber seed shells and sawdust with amylum adhesive, which will be used as an alternative fuel.

LITERATURE REVIEW

Overviewof Rubber Plant

Rubber is an annualplantation crops such as tree trunks straight.Rubber trees were first grownonly inBrazil,SouthAmerica, however after the experimentmany times by Henry Wickham,thistreeissuccessfully developed in Southeast Asia,where it is today this plant has been developed so that till now Asia is a source of natural rubber. In Indonesia, Malaysia and Singapore began tryingcultivated rubber plant in 1876. The plant'sfirstrubberIndonesiaplanted in Bogor Botanical Gardens(MoA, 2006). According to Nazaruddin and Paimin(1998) botanicalclassification ofplantsrubber isas follows:

Table 1. Botanicalclassification ofplantsrubber

Kingdom	Plantae
Division	Spermatophyta
Subdivisions	Angiospermae
Class	Dicotyledonae
Order	euphorbiales
Family	Euphorbiaceae
Genus	Hevea
Species	Heveabraziliensis Muell. Arg

Rubbertree (*HeveabrasilliensisMuellArg*) is aplant sap-getahan. Because it has a link of many plants that contain latex (latex) and the sap was flowing out when the plant tissue unharmed (Santosa,2007).

Rubber Fruit

Rubber fruit have 3-5 cm in diameter. It is formed by pollinating rubber. It have a clear division of space (3-6 room), and it have ball-shaped room. If it is already old, rubber pieces will be broken by itself in space - space and any fractions will grow individually. But if it

falls into the right space (Wanda, 2013). Part of rubber fruit and estimated comparison can be seen in Figure 1.

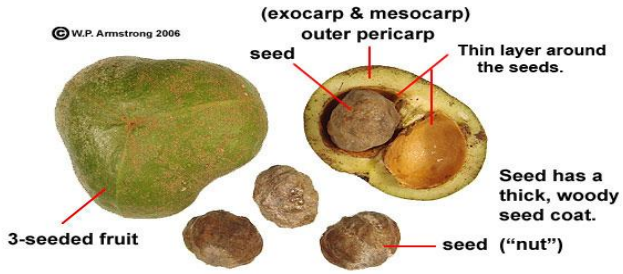

Figure 1. Rubber Fruit
(http://waynesword.palomar.edu/ecoph8.htm)

Rubber Seed Shell

Fresh rubber seeds made up 34.1% of skin; Content of 41.2% and 24.4% water, while the rubber seed that has been dried in the sun for two days made up 41.6% of skin; 8.0% water content;15.3% oil and 35.1% dry matter (Nadarajapilat and Whewantha, 1969). According to Pari in Safitri (2003), the chemical composition contained in a rubber shell consists of cellulose 48.64%, 33.54% Lignin, pentose 16 81%, and 1.25% Abu Kadar (Pani inSafitri, 2003).

Figure 2. Rubber Seed Shell
(https://reginnovations.org/bioenergy)

Rubber Seed

Rubber seed contained in each chamber pieces. Number of seed is approximately three and six seeds in accordance with the amount of space. The color is dark brown with patches of patterned typical. Rubber plant root is ataproot. Based on the dicotyl characteristics.

Figure3. RubberSeed
(http://www.feedipedia.org/node/39)

Sawdust(Wood)
In general, the timbercontains cellulose, hemicellulose, lignin, pentsan and so forth.These elements contained in the cell walls of the wood, the biggest part is cellulose (Editors Poster, 2001: 52). According haygreen (1987 in Sutjipto,19930) wood albasia contains cellulose linin amounted to 48.33% and amounted to 27.28%, while according to Abdurrahim et al (1981), teakhas achemical content of 47.5% in the form of cellulose, lignin 29.9% and 14.4% pentosan. Additionally, saw dust has a calorific value of between 4018.25 cal/g to 5975.58cal/g and has a chemical composition that varies, depending on the variety,type and growing media. Sawdust has a chemical composition consisting of Holosellulos 70.52%, 40.99% cellulose, Liguin 27.88%, 16.89% pentosan, Abu 1:38% and 5.64% Water (Atria, et al, 2002).

Bioarang
Bioarang is charcoal (one type of fuel) are made from a wide range of biological material or biomass, such as wood, twigs, leaves, grass, straw, paper, or other agricultural wastes that can be carbonized. Bioarang can be used through the treatment process, one of which is to briquettes bioarang (Brades and Tobing,
2008).

Adhesives
Adhesive is a substance or material that has the ability to bind two objects through a bonding surface. With the use of adhesive material then the pressure will be much smaller when it compared with briquettes without using amylum adhesive (Josep and Hislop, 1981). The use of an amylum adhesive intended to bind water and form a dense of texture or to bind two substrates to be glued. (Silalahi, 2000).

Bioarang Briquette
Bioarang briquettes are clumps or sticks of charcoal made from bioarang (raw materials). Bioarang is processed into charcoal hard with a particular shape. "Briquetting" the material things is a way to get the desired shape and size to be used for certain purposes (Josep and Hislop, 1981).

RESEARCH METHODS

Research Methods
This research were conducted by interviewing society in Malaka Village Banyuasin, filling out questionnaires in Kuto Market Boombaru, and reviewing some literatures such as journals, scientific magazines, internet, electronic media with a Completely RandomizedDesign (CRD) experimental methods that consists eight samples to test.

The place and time of the research
This research was conducted on July 31, 2016 until August 30, 2016 in the Chemical Laboratory State Polytechnic of Sriwijaya, Bukit Besar, Palembang. Maulidia Putri's house in Malaka III street RT 13 RW 003 NO.088 Kalidoni Ex hill district denies 30114, Palembang.

Data Collection Techniques
The data collection were conducted by using questionnaires, interviewing society to solve the main problem, reviewing some literatures through print media or electronic media and conduct experiments.

Population and Sample
In this research, the population and sample were collected from 20 people questionnaire around Malaka Village and Kuto Market (Boom Baru) Palembang.

Technical Analysis
Analization databased on thequalitative and quantitative analysis. Qualitative data were analyzed for chemically and fisically characteristics of samples, whereas quantitative data were analyzed numerically.

Research Procedures
Chemical Equipments
The tools that were used in this research werefurnace, oven, scales /analytical balance, grinder,sieving tool,gun metal, containers, and briquette printer.

Materials
The materials that were in this research were rubber seed shells, tapioca flour (starch), Sawdust and Water.

Draft and Treatment Research
The treatment experiments conducted on rubber seed shell briquettes are as follows:
1. Prepare raw materials, sawdust, adhesive, and water
2. Prepare chemical equipments
3. Carbonize the rubber seed shells by using furnace
4. Grind the materials by using grinder
5. Do Briquetting.
6. Analyze the briquette includes the analysis of calorific value, moisture content, ash content, volatile matter content, and a fixed carbon content.

Treatment Research
Preparation of Raw Materials
The raw material preparation were using conventional method.
1. Firstly, dry the rubber seed shells in the sun for ± 3 days
2. Then,carbonize the materials. Carbonization process use 350-400 ° C in temperature for For ± 1 hour.
3. After that, Collect and clean the rubber seed shell, Collect sawdust
3. Break it into small pieces and then dry it in the sun to dry for ± 3 days, the sawdust does not need to be dried under the sun.

Carbonization process Raw Materials
After all materialswere dried.Carbonization process aims to increase the calorific value contained in the briquettes produced. Carbonization process is carried out in a heating by furnace about1000ºC. Temperature of carbonization in this research were at 350-400°C for 1 hour.

Shrinking Size of Raw Materials
Sawdust and shells of rubber seed that has been dried and charred still has a relatively large size, therefore it need to bereduced by grinder. Size reduction was done by destroying the sawdust and shells by using a grinder in order to obtain a smaller size.

Preparing Adhesives and Sawdust

The process of making adhesive are as follows:

1. Prepare starch
2. Prepare the sawdustd
3. Scale up approximately 20 gr of sawdust
4. Scale up approximately 300 gr of adhesive
5. Saperate them into each container
6. Add 900 ml of water into adhesive container
7. Heat the adhesive container until it becomes thicky

Briquetting Process

1. Prepare four composition, including rubber seed shell: sawdust : adhesive (30:20:50; 40:20:40; 50:20:30; 60:20:20).
2. Mix all the material homogenously
3. Print theby using the briquette printer
4. Dry out the briquettes in the sun for ± 3 hours and then put in oven at 100 ° C for 1 hour.
5. Analyze includes analysis of water content, volatile matter content, ash content, fixed carbon content, calorific value and flame duration

RESULTS AND DISCUSSION

The results of the analysis of rubber seed shell briquettes products composition: sawdust: starch adhesive.

Inherent Moisture

Figure 1.Shows a inherent moisture graph of variations in the composition of the raw material and the adhesive rubber seed shell starch product to water content of the briquettes.

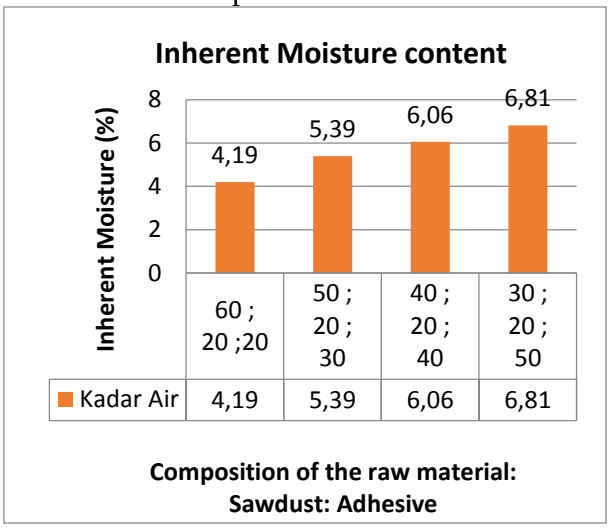

Figure 4. Graph of the Inherent Moisturefor raw material: Sawdust: adhesive variation

The lower the water content the higher the calorific value and combustion power, and vice versa. This is due to the produced energy absorbed to evaporate the water. The graph shows that the composition of 60:20:20 hasthe lowest moisture content that is 4,19 allowing combustible briquettes produced. While the highest with 6.81% water content is in the composition of 30:20:50. This proves that the more adhesive the higher water content.

Ash content

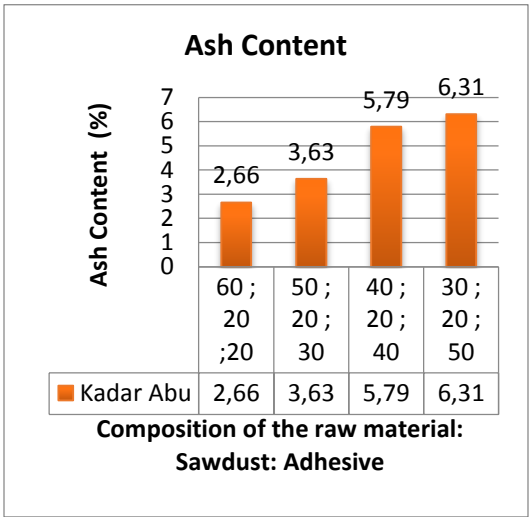

Figure 5. Graph of the Ash Content for raw material: Sawdust: adhesive variation

Seen from the graph, the composition of the shell, sawdust and adhesives with a ratio of 60:20:20 has the lowest ash content that is 2.66%. So that, thebriquette with this composition hasgood quality because of high calorific value. Goodprocessofcombustion. According Jamilatun(2011), the ash contained in the solid fuelisnon-flammable mineral remains after thecombustionprocess and the accompanying reactionsare complete. Ash willdecrease the qualityofsolid fuel because it can decrease heating value.

Volatile Matter

Figure 3.shows a graph of the effect of variations in the composition of raw materials and adhesives rubber seed starch to the ash contentbriquettes.

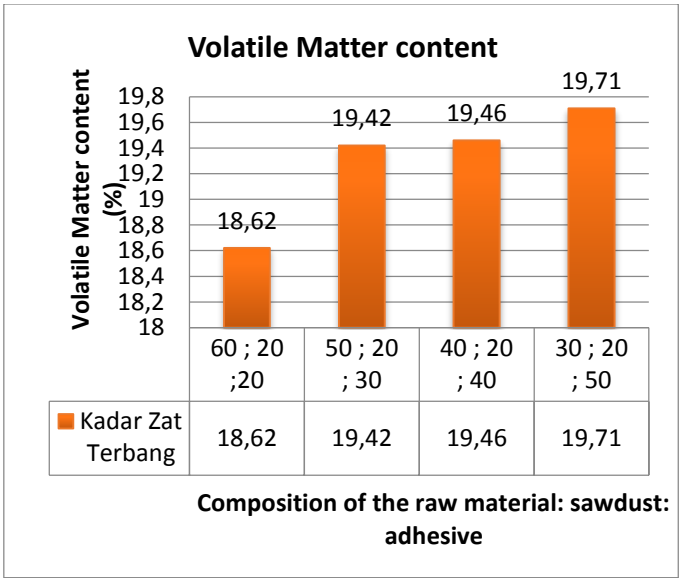

Figure 6. Graph of thecalorofic value to composition variation of the raw material : sawdust:adhesive.

Content of volatile substance that is high in briquettes will cause more smoke relatively when the briquettes ignited. It was caused the reaction between carbon monoxide (CO) with from alcohol derivatives (Hendraand Pari, 2000). The chart briquette the ratio of 60:20:20 has 18.62% of water content. This indicates that the briquettes is environmentally friendly. The greater volatile the matter content the higher the level of pollution in the air so that the briquettes is not environmentally friendly.

Fixed Carbon

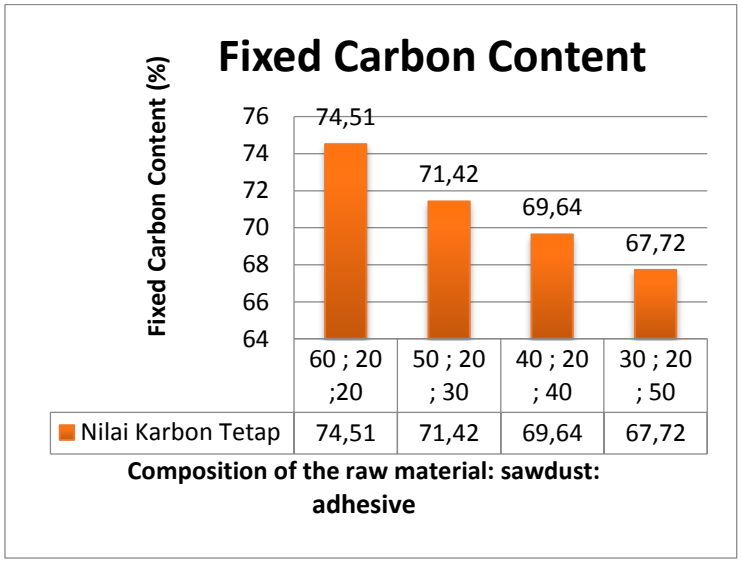

Figure 7.Graph of between the calorific value of the raw material composition variation : Sawdust: adhesive.

From the data analysis resultsof fixed carbon content, the all variationsobtained of briquettes with a carbon content ranging between 57-75%. Fixed carbon value of briquettes does not becauseit is the Indonesian National Standard still below 77%. Fixed carbon value can be increased by reducing the moisture content, ash content and volatile matter content.

Calorific Value

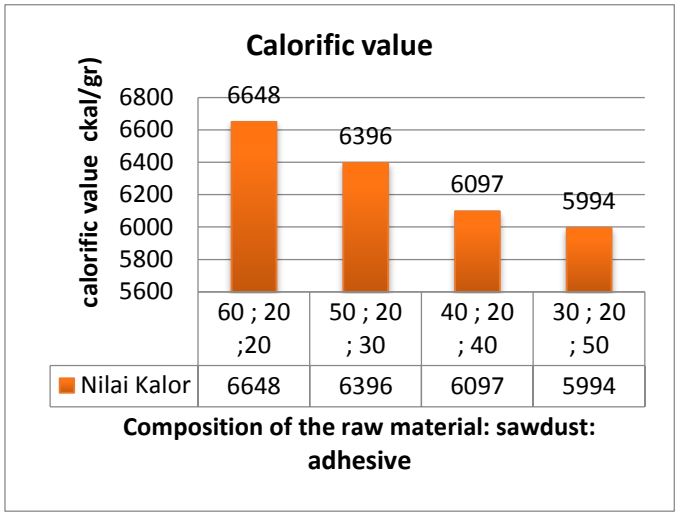

Figure 8. Graph of the calorific value to the composition variations of the raw material: Sawdust: adhesive.

The higher the value the calorific briquettes, the better the quality. The experimental as obtained 5994 kal/gr kal/gr 6648 calorific value of briquette to mixture with sawdust. Based on the data it can be concluded that the rubber shell briquettes can be used as friendly environmentally alternative materials for firewood. Sudrajat cited in fauziah (2011) , increased levels of ash can occur due to formation of mineral salts during the Carbonization production process when Continued process will form fine particles mineral salts. This may be due to the mineral content to make in the main biomass material to make carbon.

CONCLUSION

From the four samples of briquettes produced, the best composition based on its physical characteristic is briquette with composition ratio of seed shell; adhesive and sawdust 60:20:20, spesification of inherent moisture is 4.99%, ash content is 4.38%, volatile matter content is 24.75%, fixed carbon is 66.38% and calorific value is 6069 cal/gr. The results due to the high density of briquette good produced so that briquette has combustion rate and lasting combustion. The moisture content, ash content, and calorific value of briquette sample are based on Indonesian National standard (SNI NO. 01/6235/2000), while volatile matter content do not meet Indonesian National Standard.

REFERENCES

Jamilatun S. 2011. Kualitas Sifat-sifat Penyalaan dari Pembakaran Briket Tempurung Kelapa, BriketSerbukGergaji KayuJati, BriketSekamPadidanBriketBatubara.Di dalam Prosiding Seminar NasionalTeknik Kimia“Kejuangan”2011.

Hendra Ddan PariG.2000.Penyempurnaan Teknologi Pengolahan Arang. Laporan Hasil Penelitian Hasil Hutan. Balai PenelitiandanPengembangan kehutanan, Bogor.

Anwar, C., 2001. Manajemen dan Teknologi Budidaya Karet. Pusat Penelitian Karet. Medan.

Deptan., 2006. Basis Data Statistik Pertanian (http://www.database.deptan.go.id/). Accesed on 5th of May 2009.

Santosa. 2007., Karet. (http://id.wikipedia.org/wiki/karet). Accesed on 21st of March 2009.

Nazaruddin dan F.B. Paimin., 1998. Karet. Penebar Swadaya. Jakarta.

Siregar, T.H.S., 1995. Teknik Penyadapan Karet. Kanisius, Yogyakarta.

Maryadi., 2005. Manajemen Agrobisnis Karet. Gadjah Mada University Press. Yogyakarta.
http://fristawandap.blogspot.co.id/2013/02/pemanfaatan-biji-karet-sebagai-bahan.html (Diaskses tanggal 26 Juli 2016)
https://raymoon760.wordpress.com/2013/06/19/manfaat-briket-arang-dan-cara-pembuatan-briket/ (silaban serbuk kayu, diakses tanggal 26 Juli 2016)
https://www.researchgate.net/publication/42349015_Uji_Komposisi_Bahan_Pebuat_Briket_Bioarang_Tempurung_Kelapa_Dan_Serbuk_Kayu_Terhadap_Mutu_Yang_Dihasilkan (Accesed on 25th July 2016)
Badan Peneliti dan Pengembangan Kehutanan. 1994. Pedoman Teknis Pembuatan Briket Arang. Departemen Kehutanan. Bogor.
BadanStandarisasi Nasional.2000. Standar mutu briket dipasaran (SNI16235-2000).Jakarta.
BadanStandarisasi Nasional.2011.Standar mututapiokadipasaran(SNI3451-2011).Jakarta.
Banks, W. dan C. T. Greenwood 1975.Starch and Its Components.Edinburgh : University Press
Damanik, dkk. 2010. Budidaya dan Pasca Panen Karet. Bogor: Pusat Penelitian, Pengembangan dan Perkebunan.
Djatmiko B, dkk. 1985. Pengolahan Arang dan Kegunaannya. Departemen Teknologi Hasil Pertanian.Fakultas teknologi Pertanian, Institut Pertanian Bogor. Bogor
Fuad, M. 2009. Pemanfaatan Limbah Cangkang Kopi untuk Pembuatan Bioket Bioarang Menggunakan Perekat Amilum. Palembang: Politeknik Negeri Sriwijaya.
Hambali, Erliza et al. dalam Liza Magdalena Sastri.2009. Pembuatan Briket Arang dari Campuran Cangkang Jarak Pagar dan Sekam Padi Menggunakan Perekat Amilum.Palembang : Politeknik Negeri Sriwijaya.
Hasbullah.2000. Teknologi Tepat Guna dan Agroindustri Kecil Sumatera Barat. Sumatera Barat : Dewan Ilmu Pengetahuan, Teknologi dan Industri
Iskandar.1983. Pengantar Budidaya Karet Program Diploma 1.Bogor : Jurusan PLPT Perkebunan-IPB.
Ismail, Muammar. 2013. Karbohidrat Polisakarida. (online), (http://we-rock1.blogspot.co.id) diakses 12 Juni 2016 pukul 19.45 WIB.
Kurniawan dan Marsono. 2008. Superkarbon Bahan Bakar Alternatif. Jakarta : Penebar Swadaya.
Kurniawan, Ade. 2013. Pembuatan Briket Arang dari Campuran Cangkang Bintaro dan Bambu Betung Menggunakan Perekat Amilum. Palembang: Polteknik Negeri Sriwijaya
Lehninger, Albert. 1982. Dasar – DasarBiokimia. Erlangga: Jakarta.
Lusianti, Marnia. 1989. Pemanfaatan Tempurung Biji Karet (Havea Brasiliensis) untuk arang aktif. Bogor: Institut Pertanian Bogor.
Maarif, S., 2004, Pengaruh PenambahanArang Tempurung Kelapa dan Penggunaan Perekat terhadap Sifat-Sifat Fisika dan Kimia Briket Arang dari Arang serbuk Kayu Sengon, Universitas Gadjah Mada, Yogyakarta
Nadarajapillat, N. dan R.T. Whewantha. 1967. Productivity Potential of Rubber Seed. RRIC Bulletin, 2:8-16.
Pane, Julham Prasetya, dkk.2013. Pengaruh Konsentrasi Perekat dan Penambahan Kapur Dalam Pembuatan Briket Arang Berbahan Baku Pelepah Aren (Arenga Pinata). Departemen Teknik Kimia, Fakultas Teknik, Universitas Sumatera Utara.
Patria, Diyoeshi Rizqi, dkk. 2011. Pembuatan biobriket dari campuran tempurung dan cangkang biji karet dengan batubara peringkat rendah. Yogyakarta: Tidak diterbitkan.
Raharjo, Imam Budi. 2006. Pembuatan Biobriket dari Campuran Kulit Kacang dan Serbuk Gergaji sebagai Bahan Bakar Alternatif. Institut Teknologi Sepuluh Nopember.
Sastri, Liza Magdalena. 2009. Pembuatan Briket Arang dari Campuran Cangkang Jarak Pagar dan Sekam Padi Menggunakan Perekat Amilum.Palembang : Politeknik Negeri Sriwijaya.
Suda. Jessi Dwi. 2014. Pembuatan Briket Berkarbonisasi dengan Menggunakan Campuran Bambu Betung dan Buah Bintaro.Palembang: Polteknik Negeri Sriwijaya
Sudrajat R, Soleh S. 1994. Petunjuk Teknis Pembutan Arang Aktif. Badan Peneliti dan Pengembangan Kehutanan. Bogor.

Sudrajat R. 1983. Pengaruh Bahan Baku, Jenis Perekat, dan Tekanan Kempa Terhadap Kualitas Briket Arang. Laporan No. 165. Pusat Penelitian dan Pengembangan Hasil Hutan. Bogor.

Suryani A. 1986. Pengaruh Tekanan Pengempaan dan Jenis Perekat dalam Pembuatan Briket Arang dari Tempurung Kelapa Sawit (Elaeis quinensis jacq). Departemen Teknologi Hasil Pertanian, Fakultas Teknologi Pertanian, Institut Pertanian Bogor. Bogor.

Vinsiah, Rananda, dkk. 2013. Pembuatan Karbon Aktif dari Cangkang Buah Karet (Havea brasilliensis).Palembang : Universitas Sriwijaya.