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INVASION OF SATURATED VAPOR COCONUT SHELL THE TRANSITION OBAT MERAH TO LIQUID SMOKE COCONUT SHELL AS SOLUTIONS IN THE TREATMENT OF WOUND OUTSIDE

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Abstract

Coconut shell is a waste generated from the use of coconut itself. Utilization of liquid smoke coconut shell that is not widely known by the public is the content of phenols that can inhibit the growth of bacteria / fungi and can be used in the treatment of external injury. Liquid Smoke is

obtained from pyrolysis of coconut shell after heating at temperature variation 300°C, 400°C and 500°C. The result of liquid smoke from pyrolysis is then purified by distillation method with temperature variation 80-100 and 100-110°C for each pyrolysis temperature. After obtaining pure liquid smoke was tested using GC-MS, antibacterial test between liquid smoke and red medicine using Staphylococcus aureus bacteria by diffusion method. It is known from the optimum GC-MS phenol results at 400°C pyrolysis temperature with distillation temperature 100-110 and its content of 13.55%. In antibacterial tests known antibiotic efficacy associated with growth inhibition zone, the larger the diameter, the greater the potential of the antibiotic sample. The widest diameter of 15.6 mm contained at 400°C pyrolysis temperature with distillation temperature 100-110°C while on the red diameter of smaller diameter of 10.0 mm. The results showed that the content of phenol in liquid smoke from coconut shells acts as a substitute for the use of red medication, because of its high antimicrobial potential associated with the treatment of infectious diseases such as blisters and ulcers. This is an alternative solution that is easy to manufacture and does not cost a lot.

Keywords

Antibiotic, External Injury, Infection, Liquid Smoke, Red Medicine, Staphylococcus Aureus

1. Introduction

As agrarian country Indonesia potential have a lot of varieties. Coconut trees are no exception. Coconut (*Cocos nucifera*) is the sole family of Cocos or aren arenan or *Arecaceae*. The area of coconut plantations in Indonesia reaches 3.6 million ha and total coconut production in Indonesia reaches ± 2.9 tons / year (DG 2016). This plant can be used almost all parts by humans so it is considered as versatile plant. The origin of this plant is estimated from the coast of the Indian Ocean, Asian side, but now spread throughout all the tropical beaches across the world. Ripe coconut fruit has weight of coir (35%), shell (12%), endosperm (28%) and water (25%) (Setyamidjaja, 1995).

In addition can be used as hand craft and made charcoal as fuel, coconut shell can also used as a healing remedy. However, general public has not much information about it. Smoke from burning coconut shells contains vapors it can be used as external drugs wound antibiotics, such as acidic compounds, phenols and alcohols (Luditama, 2006). Currently, there are many people still using first aid wound cleanser as wound medicine. First aid wound cleanser was very

popular before independents of indonesia (corpsman using the medicine for wound care of national armed force) until 1980s. The first aid wound cleanser was discovered by Doctor Hugh Young in 1919. In 1998 US Food and Drug Administration was banned this medicine because it has contained mercurochrome (mercury and chromium). Mercury and chrome make the wet wound dry. But in wet conditions, can make microbes like bacteria and fungi to growth.

So it's forbidden to used. Compounds act as antioxidants and antibacterials are phenols, acids and alcohols (Karseno, 2002). Therefore, this liquid smoke has same act role with first aid wound cleanser because it has antibacterial content to process inhibiting and killing bacterial growth (Yulistiani et al, 1997 in Ferayanti research, 2007). Based on this case, we have an idea to use liquid smoke from coconut shell as external drug. This low cost alternative solusion may inprofe the benevit and econimical value.

2. Details Experimental

2.1 Materials and Methods

2.1.1 Materials

The materials used on this research is coconut shell. For analisys materials are used *staphylococcus aureus* bacterial with life contain *tryptose soya agar* (TSA). Instrument used in this research are *furnance* (pyrolysis), *Distillation*, and instrumantion *Gas Cromatografy Mass Spectrometry* (GC-MS).

2.1.2. Methods

2.1.2.1 Liquid Smoke Making

The coconut shell have to cleaned up first before burning. Making liquid smoke can we done with kiln machine made by stainless steel equipped with an electrical heater machine 3 condenser and 2 distilled containers. The temperature used are 300 ° C - 500 ° C through Liquid flow to the bottom of cooler, after that distilled containers accomodated in 2 squares with 2 liters of volume. The top of the distillate solution are *pyroligneous liquor* while the bottom is ter (*setteled ter*).

2.1.2.2 Liquid Smoke Purification

The Purification of liquid smoke done by distillation. Liquid smoke put into a distillation flask, heated by using electric heater. This distillation process takes about 2 - 2.5 hours or until maximum distillation temperature are reached. Temperature of liquid smoke in the distillation

flask. The steam that forms and then enters refrigerant pipe (condenser) and the distillate is accommodated in a container or flask.

2.1.2.3 Analyst of GC-MS

The liquid smoke dissolved in ether, then separation of the phase of dissolved in ether and polar phase. Then 5 μ l of the ether phase was taken and injected into GC-MS using standard acetate and phenol. The compound mix that passed gas chromatography will be separated into individual components. Some of the dominant components were further analyzed with a mass spectrophotometer. By computer determinable any types of compounds after consultation with known standard.

2.1.2.4. Analyst of Antibacterial Activity

Antibacterial activity test was done by using paper disk/disc diffusion method. The filter paper disc contains a certain amount of drug placed on a solid medium previously inoculated by test bacteria on its surface. After incubation, the inhibitory zone diameter around the disc used measures the strength of drug resistance to the test organism. This method is influenced by several physical and chemical factors, in addition to factors between drugs and organisms (eg medium properties and diffusion abilities, molecular size and drug stability). As well as the use of antibiotics Ampicilin as a positive control. The media was incubated for 24 hours at a temperature (35-37)⁰C.

3. Result and Discussion

3.1 Pyrolysis and Distillation

Pyrolysis process involves a variety of processes, namely the reaction of decomposition, oxidation, polymerization, and condensation. Reactions occurring during wood pyrolysis are: removal of water from wood at a temperature of 120-150° C, hemicellulose pyrolysis at a temperature of 200-250° C, cellulosic pyrolysis at a temperature of 280-320° C and lignin pyrolysis at 400° C (Maga, 1988, Girrard, 1995).

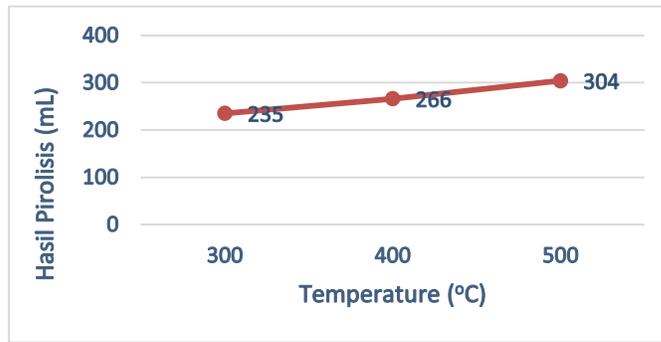


Figure 1: Result of Pyrolysis at Temperature 300^oC, 400^oC, and 500^oC

It can be seen by the figure 1 that the higher the temperature, the more liquid smoke is obtained. This is in accordance with the Arrhenius equation states that the higher the temperature the greater the thermal decomposition constant value, resulting in the pyrolysis rate increases and the conversion rises. The pyrolysis rate of coconut shell can be proved by the Arrhenius equation ($\frac{dy}{dt} = Ae^{-\frac{E}{RT_{wall}}}$) in the table. 1 and figure. 2 by converting the Arrhenius equation to a linear equation.

$$y = ax + c \rightarrow \ln \frac{dY}{dt} = -\frac{E}{R} \frac{1}{T_{wall}} + \ln A$$

So that the activation energy values obtained by the equation:

$$E = -aR$$

Then the value of the pre-exponential factor (A) can be obtained based on the graph $y = ax + c$ cut the y-axis or ($1/T_{wall}$)

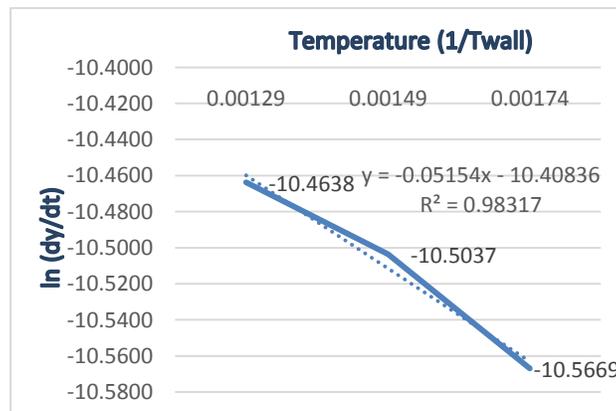


Figure 2: Curve Relation $\ln(dy/dt)$ with $1/T_{wall}$

Table 1: Activation Energy Value and Pre-Exponential Factor on Pyrolysis Process and Rate of Coconut Pyrolysis

t (second)	Y (mass fraction)	dy/dt	ln (dy/dt)	T wall (K)	1 / Twall	E	A	Rate of Reaction
11100	0,31692	2,855,E-05	-10,4638	773,15	1,29341,E-03	0,4283	3,018E-05	3,01771,E-05
12000	0,32923	2,744,E-05	-10,5037	673,15	1,48555,E-03			3,01768,E-05
13500	0,34769	2,575,E-05	-10,5669	573,15	1,74474,E-03			3,01764,E-05

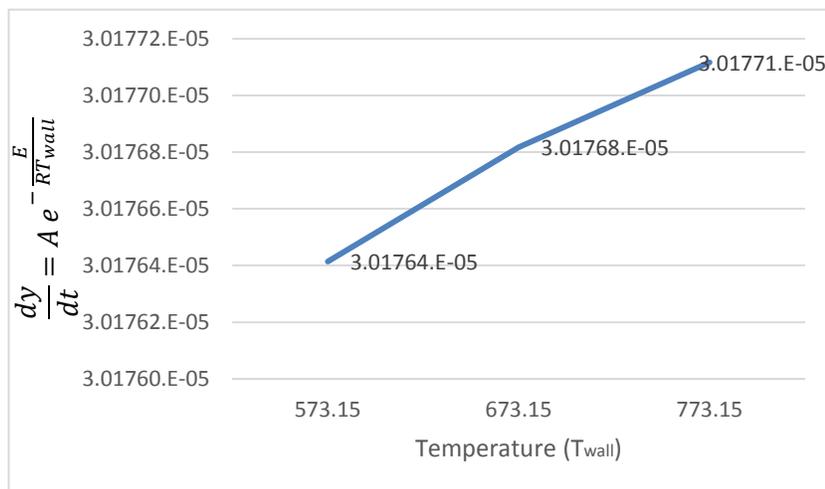


Figure 3: Rate of Coconut Shell Pyrolysis at Temperature 300°C, 400°C and 500°C

Liquid smoke obtained from pyrolysis of coconut shell after heating at temperature variation 300°C, 400°C, and 500°C. Then, it is distilled by distillation method with temperature variation (80-100)°C, (100-110)°C for each pyrolysis temperature.

3.2 Result of GC-MS

Liquid smoke has been purified by distillation method, then tested by using GC-MS. The results show that some of the main components contain in liquid smoke. The main components show in table 2.

Table 2: Result of GC-MS Test Analysis at Temperature Distillation

Temperature of Pyrolysis (C)	Temperature of Distillation (C)	Component	Percentage (%)
300°C	80-100	Phenol	11,80
		Acetic Acid	0,00

	100-110	Phenol	12,78
		Acetic Acid	60,43
	Cairan Hitam	Phenol	21,00
		Acetic Acid	24,32
400°C	80-100	Phenol	7,27
		Acetic Acid	42,26
	100-110	Phenol	13,55
		Acetic Acid	54,09
	Cairan Hitam	Phenol	20,34
		Acetic Acid	17,69
500°C	80-100	Phenol	6,98
		Acetic Acid	44,87
	100-110	Phenol	12,84
		Acetic Acid	50,69
	Cairan Hitam	Phenol	22,20
		Acetic Acid	20,34

Based on table 2, the distillation of liquid smoke reaches optimum condition at 400⁰C. The pyrolysis process involved in various reaction processes, that is decomposition, oxidation, polymerization, and condensation, lignin pyrolysis occurs on temperature 400⁰C, which more phenols and other acidic compounds will produce. Those compounds use to be anti microbial in the process of wound healing using liquid smoke. The acidity is one of chemical properties that determining the quality of produced liquid smoke. Acetic acid is an organic compound that has important role in liquid smoke.

The high level of acidity and phenols are useful as anti-microbial. The role of phenol and acetic acid is increased when those compounds are present together (Darmadji, 1995). In additional, Fenol could be use to antioxidant. (Pszczola, 1995).

3.3 Antibacterial Test

Determination of sensitivity bacteria pathogens to antimicrobials could be doing with one of two method principal, that is dilution or diffusion. It is important to use standard method for controlling all of factor that affect in antimicrobial activity (Jawetz et al., 2005).

The method which is often used is method diffusion of gels (agar). Paperdisc contain any number of certain drug that placed on the solid medium that was bacteria inoculation test on the surface . After that, diameter resistor zone around discs used measure power resistant drug to organism test. Method this affected some facors physical and chemistry, besides factor between drug and organism (eg. the nature of the medium and ability diffusion, size molecular and stability medicine). Nevertheless, standardization factors are allowed to do sensitivity test properly (Jawetz et al., 2005)

Diffusion Process

- 1) The diffusion that occurs is the removal antibiotic solution from backup through a microbial gel (agar) test.
- 2) Diffusion can occur in two ways: linear diffusion and radial diffusion.
- 3) When incubation occurs, the microbe undergoes a phase of adaptation (lag), then breeds to a level where many cells absorb antibiotics.
- 4) Diffusion solution from antibiotic will prevented, so, there are area obstacles growth.

Linear Diffusion and Radial

- Diffusion linear occurs when backup relative great (center line > 8)
- Radial diffusion occurs on backup small (like *paperdisk* which is 1.5 mm in diameter)

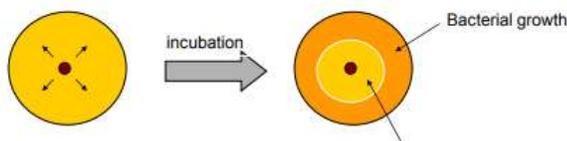


Figure 4: Effectiveness of Antibiotics

Result

- Antibiotics diffuse in to the agar.
- Concentration of antibiotics decreased when depart from the disk.
- After incubation, look on clear area on the gel (agar) surface and called as inhibition zone.

The effectivity of antibiotics is related to the zone growth of inhibition. The larger the diameter, the better antibiotic sample potential. Here the categories of inhibition of bacteria, according to David and Stout (1971) in Ambarwati (2007), if rate the inhibition of bacterial growth is 5 mm or less, categorized as weak, 5-10 mm are categorized medium, 10-19 mm categorized strong, and 20 mm or more categorized very strong.

Table 3 show that the results of bacteria test using diffusion method with Tryptose Soya Agar (TSA) with incubation for 24 hours and temperature range between 35-37 °C and using positive control of ampicillin antibiotic.

Table 3: Result of Bacterial Test

No.	Sample	Result of Observation (mm)
1	300 (80-100)	10,4
2	300 (100-110)	13,3
3	400 (80-100)	12,6
4	400 (100-110)	15,6
5	500 (80-100)	11,5
6	500 (100-110)	12,2
7	Obat Merah	10,0
8	Kontrol +	25,9
9	Kontrol -	0

Based on Table 3, show that at temperature 400 °C with distillation result at 100-110 °C the result of bacteria test with including strong category in bacterial inhibition level, ie 15.6 mm.

4. Conclusion

The Liquid smoke are natural ingredients, that made from burning of hemicellulose, cellulose, and lignin from hardwoods to produce antimicrobial, antibacterial, and antioxidant effects, including phenols, carbonyls, acids, furans, alcohols, esters compounds, and so on. Liquid smoke is widely used in the food industry, health, insecticides and pesticides, and plants.

From the result of many experiment, the higher pyrolysis temperature the greater smoke that produced. However, optimum temperature of pyrolysis in coconut shell is only about 400 °C. This is also as evidenced by the result of bacteria test in pyrolysis temperature 400 °C and

distillation temperature at 100-110 °C show that rate of bacterial inhibition is 15.6 mm, which is included in the strong category in inhibiting bacterial growth.

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