__Original Research Article__

Evaluation of the Effect of Filtration Methods of Various Types of Adsorbents on the Quality of Coconut Shell and Kusambi Liquid Smoke as Raw Materials for Processed Meat Smoking

Comment [PRDC1]: Remove the word "Evaluation of the" from the title

Abstract.

This study intends to determine whether there is a change in the value of phenol content, Total Aerosol Residue (TAR), specific gravity, viscosity, total acid, antioxidant, pH, salinity, Total Dissolve Solids (TDS), color, aroma and total yield in liquid smoke filtered with adsorbent. In this study, there were two groups, namely liquid smoke of kusambi and liquid smoke of coconut shells with various treatments of adsorbent filtration with 3 replications. Control treatment is liquid smoke without filtration process with adsorbent, zeolite adsorbent treatment, silica adsorbent treatment, and activated charcoal adsorbent treatment. Analysis of variance showed that different types of liquid smoke and different adsorbent filtration had a very significant effect (P0.01) on antioxidants, total acid, specific gravity, tar, phenol content, pH, salinity, TDS, total yield, L* and b* color, hedonic color and smokey scent in the resulting liquid smoke. Analysis of variance showed that the different types of liquid smoke had no significant effect (P0.05), but the filtration treatment with different adsorbents had a very significant effect (P0.01) on viscosity. And the analysis of variance also showed that the different types of liquid smoke and the filtration of different adsorbents had no significant effect (P0.05) on the color a* of the resulting liquid smoke. The differences in the types of liquid smoke and the treatment of liquid smoke filtration with adsorbents had a very significant effect (P0 .01) on antioxidant, total acid, specific gravity, tar, phenol content, pH, salinity, TDS, total yield, L* and b* color, hedonic color, and smoke aroma in the liquid smoke produced. However, the different types of liquid smoke did not have a significant effect on the resulting viscosity (P0.05) and the different types of adsorbents in the liquid smoke filtration process had a very significant effect on the viscosity (P0.01). Meanwhile, the different types of liquid smoke and the different types of adsorbents in the liquid smoke filtration process did not have a significant effect on the value of the color a* or the reddish color of the liquid smoke (P0.05).

Comment [PRDC2]: Remove the line

Comment [PRDC3]: The sentence is not clear

Keywords: Liquid Smoke, filtration, adsorbent

1. Introduction

Processed meat products are one of the meat products that have been in practice for a long time and are in great demand by the world market. Processed meat products are a source of protein that can be consumed directly as the main food and can also be used as additional complementary foods in various dishes. Meat is a type of food that is included in the perishable food category. According to Kumar, et al. (2017), perishable food is a term for food that is easily damaged in quality both in terms of appearance and quality. This type of food is easily spoiled, deformed, or becomes dangerous if consumed if it is not stored in the refrigerator at temperatures below 4.4˚C or if it is not stored in the freezer at temperatures below 17.8 ˚C (Kumar, et al. 2017). The types of foodstuffs that fall into this category are beef, poultry, fish, dairy products, and their derivatives and offal (Kumar, et al. 2017), so a method is needed to slow down the decay process.

Comment [PRDC4]:

Smoking is one of the oldest methods of preserving meat and its products. The smoking method is a combined food preservation process between drying, salting, and smoking itself (Ghazali, et al. 2014). In general, people smoke meat using traditional methods, namely the method of smoking meat in smoke houses where the source of smoke is obtained directly from the burning of hard woods such as kusambi, acacia, and coconut shells (Lopi, et al. 2014). The purpose of the smoking process is to extend the product's shelf life (Ghazali, et al. 2014). However, in its development, especially today, the aim is not only that but smoking is also aimed at obtaining a certain appearance and taste of smoke in foodstuffs (Girrard, 1992). Upon closer examination, traditional methods also have a negative effect apart from air pollution and increasing the demand for firewood, which has a negative effect in the form of absorption of carcinogenic benzo[a]pyrene. Benzo[a]pyrene is a marker compound for the occurrence of Polycyclic aromatic hydrocarbons (PAHs) which are harmful to health (Saputro, et al. 2021).

One way to improve the quality of processed meat is to use the liquid smoke method. Fumigation using liquid smoke, according to Swastawati (2007) in Ghazali, et al (2014) can produce products that are uniform in appearance, the taste produced is also uniform and the concentration can be controlled, the aroma is consistent, it is more environmentally friendly because it saves more on the use of wood, reduces pollution and also minimizes the deposit of tar compounds. Besides having many advantages as mentioned above, liquid smoke in all types of grades also contains phenol. This phenol content is responsible for the color, aroma, and smokey taste of the final product (Talib, et al. 2020). Phenol compounds are also known to have antimicrobial elements (Donnelly, et al. 1982) so the content of liquid smoke can inhibit or kill microbes that cause spoilage in processed meat. According to Fauziati and Haspiadi (2015), phenol in liquid smoke is also known to have antioxidant activity which is characterized by the aroma it creates, so the existence of liquid smoke in a product can provide many benefits for processed food, especially processed meat because, in addition to being a preservative, it can also be a medium. increase in antioxidant content in processed meat. Behind the benefits and functions of the phenol content found in liquid smoke, the phenol content makes the liquid smoke products of kusambi and coconut shells have a smokey aroma and a sour aroma that are quite strong even in grade 1 liquid smoke.

Comment [PRDC5]: and

Liquid smoke can be made from various types of wood or other hard organic media, one of which is kusambi and coconut shells. These two types of materials are widely available and quite easy to obtain. According to Mekarsari, et al. (2017) the use of kusambi wood increases in line with the increase in the production or production of se'i meat which is increasingly popular and also increases the price of fuel wood. Kupang wood and leaves have been used since the beginning of the appearance of one of the special meats from Kupang, namely se'i. This type of wood is used because the coals obtained are good, and the smoke does not smell bad, besides that the smoke produced gives a distinctive taste of se'i meat, while the leaves of kusambi are used as a cover for se'i so that the smoke is re-exposed to the meat and the heat generated due to smoking is also retained by the leaves so that it ripens the meat and gives it an attractive color (Buntu, et al., 2020).

Comment [PRDC6]: Clarify the word

In the manufacture of a product, especially food products, it is required to pay attention to the preferences of consumers who will become sales targets. Some consumers like the smell of smoke, and some do not like the smell of smoke in their food, because not all types of food will suit the smell of smoke. One thing that can be done to overcome the still pungent smokey smell from the phenol content of liquid smoke is of them by applying additional treatment in the form of purification to grade 1 liquid smoke that you want to use. According to Novita (2011) in Fauziati and Haspiadi (2015) the liquid smoke purification process can be carried out by applying a filter using an adsorbent. Types of adsorbents that are known to have a fairly good adsorption capacity are activated charcoal, silica, and also zeolite. According to Muflihati (2016), adsorption occurs when a solid surface that is in contact with a solution tends to collect layers of solute molecules on its surface due to an imbalance of surface forces. Purification treatment using this adsorption method is expected to reduce the strong odor and also filter the remaining tar compound content in the liquid smoke to produce liquid smoke that is lighter in terms of aroma and also makes it clearer in terms of color. Zeolite can reduce micro-particles such as tar contained in liquid smoke (Maulina and Karo, 2020). Likewise with activated charcoal and silica. According to Polii (2017), the adsorption power of activated charcoal is caused by the presence of a very large number of micropores, causing capillary symptoms which result in adsorption power and this increases the ability of activated charcoal as an adsorbent in the purification of liquids, especially liquid smoke.

This research was conducted to learn more about the effect of filtration methods using various types of adsorbents on the quality of coconut shell liquid smoke and kusambi as raw materials for curing processed meat. This study intends to determine whether there is a change in the value of phenol content, Total Aerosol Residue (TAR), specific gravity, viscosity, total acid, antioxidant, pH, salinity, Total Dissolve Solids (TDS), color, aroma, and total yield.

Comment [PRDC7]: Follow the proper style for writing the reference everywhere

2. Method

Tools and materials

The equipment used in this study consisted of a 100 ml Erlenmeyer (Pyrex), a 100 ml measuring cup (Pyrex), a teaspoon, a glass funnel (Pyrex), a colorimeter (CS-10), a 7in1 water quality tester (C-600), a centrifuge. tube 50 ml (onemed), filter paper 12.5 cm in diameter (beimu), gas stove, gas cylinder (tokai), Teflon, cotton wool, tissue, a digital scale with an accuracy of 0.1 gram, and spatula. The materials used in this study included liquid smoke of kusambi grade A food-grade brand RON Kosambi, liquid smoke of food-grade coconut shell brand Lubna, zeolite obtained from Splendid Malang, silica sand obtained from Aquazone, Malang and activated charcoal from coconut shells with the brand AF carb, aquadest.

Research methods

Comment [PRDC8]: This title should be revised as "Statistical method"

The research method used in this study was an experimental method, with a factorial Randomized Block Design (RBD). In this study, there were two groups, namely kusambi liquid smoke and coconut shell liquid smoke with different treatments of different adsorbent filtration media with 3 replications. Control treatment (K), namely liquid smoke without adsorption filtration process with adsorbents, zeolite treatment (Z), namely liquid smoke treatment with filtration using zeolite adsorbents, silica treatment (S), namely liquid smoke treatment with filtration using silica adsorbents, activated charcoal treatment (A) namely the treatment of liquid smoke by filtration using activated charcoal adsorbent. Each treatment was filtrated 3 times with 3 repetitions for each treatment so that the total samples obtained in this study were 24 samples, then the research samples were tested in the laboratory.

2.1.1. Research Procedure

Comment [PRDC9]: It should be numbered as 2.1. accordingly correct the other numbers too

2.1.1.1 Adsorbents Preparation

1. Prepare adsorbents (zeolite, silica, and activated charcoal)
2. Clean the adsorbent again from the dirt residue that is still attached using running water.
3. The adsorbent that has been cleaned is then dried using the heating method with a gas stove until it is evenly dry.
4. The adsorbent is clean and ready to be used as a filtration medium

2.1.1.2 Liquid Smoke Filtration

Comment [PRDC10]: Correct the number

The food-grade liquid smoke obtained from pyrolysis results has been distilled and is then filtered using filter paper to separate the liquid smoke from its contaminants. Here are the steps:

1. Prepare liquid smoke to be filtered
2. Filtration using filter paper with a diameter of 12.5 cm in the form of a cone with a diameter of 9 cm and adsorbents (zeolite, silica, and activated charcoal) with the same thickness level of ±3 cm in a glass funnel.
3. The prepared glass funnel is then inserted into a 100 ml Erlenmeyer tube as a container.
4. Wait until the filtration process is complete

5. Pour the 1st filtered food-grade liquid smoke into a 100 ml measuring cup
6. Re-prepared filter paper with adsorbent as a filter
7. Refiltration was carried out 3 times using filter paper and a new adsorbent for each repetition
8. Liquid smoke has been purified

2.1.2. Data Analysis

Comment [PRDC11]: Correct the number

The data obtained from the test results are tabulated using Microsoft Excel. Data were statistically analyzed using analysis of variance related to the significance of the effect of treatment on phenol content, Total Aerosol Residue (TAR), specific gravity, viscosity, total acid, antioxidant, pH, salinity, Total Dissolve Solids (TDS), color, aroma, and total yield. If there is a difference in effect, then the data from the analysis is continued with the UJBD follow-up test (Duncan's Multiple Range Test) (Sudarwati, et al., 2019).

Comment [PRDC12]: Use proper style of reference

3. Results and Discussion

Analysis of variance showed that different types of liquid smoke and different adsorbent filtration had a very significant effect ($P<0.01$) on antioxidants, total acid, specific gravity, tar, total phenol, pH, salinity, TDS, total yield, color L* and b*, hedonic color and smoke aroma in the resulting liquid smoke. Analysis of variance showed that different types of liquid smoke had no significant effect ($P>0.05$), but the filtration treatment with different adsorbents had a very significant effect ($P<0.01$) on viscosity. And the analysis of variance also showed that the different types of liquid smoke and different adsorbent filtration had no significant effect ($P>0.05$) on the color a* of the liquid smoke produced.

Table 1: The average value of antioxidants, viscosity, total acid, specific gravity, tar, phenol content, pH, salinity, TDS, total yield, color (L*, a*, b*, and hedonic), and smoke aroma in the two groups of liquid smoke different

Comment [PRDC13]: Title can be shorten by simply writing the word biochemical parameter

Parameter	Type of Liquid Smoke Group	
	Kusambi	Coconut Shell
Antioxidant IC_{50} (mg/mL)	$78,2 \pm 2,53^{b}$	$16,27 \pm 0,97^{a}$
Viscosity (cP)	3 ± 0^{a}	$2,33 \pm 0,57^{a}$
Total Acid (%)	$0,37 \pm 0,05^{a}$	$5,84 \pm 0,08^{b}$
Specific Gravity (g/mL)	$1,002 \pm 0,0002^{a}$	$1,022 \pm 0,0002^{b}$
TAR (%)	$0,37 \pm 0,01^{a}$	$0,42 \pm 0,06^{b}$
Total Phenol (%)	$0,79 \pm 0,01^{a}$	$0,94 \pm 0,05^{b}$
pH	$6,26 \pm 0,04^{b}$	$3,10 \pm 0,10^{a}$
Salinity	$0,14 \pm 0,006^{a}$	$0,80 \pm 0,006^{b}$
***Total Dissolved Solids* (TDS) (ppm)**	$30,67 \pm 0,58^{a}$	70 ± 1^{b}
Total Yield (mL)	$89,67 \pm 0,58^{a}$	91 ± 1^{b}
Color L*	$20,58 \pm 0,27^{b}$	$20,03 \pm 0,62^{a}$
Color a*	$-3,40 \pm 0,47^{a}$	$-1,75 \pm 1,65^{a}$
Color b*	$4,86 \pm 0,06^{a}$	$6,25 \pm 0,23^{b}$
Hedonic Color	$2,09 \pm 0,80^{a}$	$1,91 \pm 0,76^{b}$
Smokey Scent	$1,73 \pm 0,71^{b}$	$1,42 \pm 0,5^{a}$

Note: Superscript a and b with different notations in the column of the average color value L* in liquid smoke shows results with significant differences ($P<0.01$)

Comment [P14]: Use the decimal point in the number instead of comma

Table 2: The average value of antioxidants, viscosity, total acid, specific gravity, tar, phenolic content, pH, salinity, TDS, total yield, color (L*, a*, b*, and hedonic), and smoke aroma in the three filtered adsorbents different from liquid smoke kusambi

Comment [PRDC15]: Title can be shorten by simply writing the word biochemical parameter

Parameter	Kusambi Liquid Smoke with Different Adsorbent Filtration

	Zeolite	Silica	Active Charcoal
Antioxidant IC_{50} (mg/mL)	77,88 ± 3,78	95,32 ± 0,77	102,21 ± 2,98
Viscosity (cP)	2 ± 0	5,67 ± 0,58	1,33 ± 0,58
Total Acid (%)	0,1 ± 0,032	0,06 ± 0,006	0,11 ± 0,040
Specific Gravity (g/mL)	1,0007 ± 0,0002	1,0006 ± 0,0001	1,00143 ± 0,0002
TAR (%)	0,257 ± 0,015	0,123 ± 0,020	0,317 ± 0,006
Total Phenol (%)	0,45 ± 0,035	0,56 ± 0,044	0,49 ± 0,023
pH	6,93 ± 0,058	7,07 ± 0,058	6,83 ± 0,058
Salinity	0,06 ± 0,006	0,02 ± 0,006	0,11 ± 0,01
***Total Dissolved Solids* (TDS) (ppm)**	21,33 ± 0,58	18,67 ± 0,58	27,33 ± 0,58
Total Yield (mL)	45,33 ± 0,58	38,67 ± 1,15	46,67 ± 0,58
Color L*	24,74 ± 0,36	26,52 ± 0,28	23,97 ± 0,56
Color a*	-2,37 ± 0,74	-1,39 ± 0,73	-1,34 ± 0,56
Color b*	3,53 ± 0,44	2,44 ± 0,12	3,54 ± 0,37
Hedonic Color	3,15 ± 0,86	2,97 ± 0,84	2,73 ± 0,71
Smokey Scent	2,58 ± 0,74	2,15 ± 0,93	2,67 ± 0,88

Table 3: The average value of antioxidants, viscosity, total acid, specific gravity, tar, phenolic content, pH, salinity, TDS, total yield, color (L*, a*, b*, and hedonic), and smoke aroma in the three filtered adsorbents different from coconut shell liquid smoke

Parameter	**Coconut Shell Liquid Smoke with Different Adsorbent Filtration**		
	Zeolite	**Silica**	**Active Charcoal**
Antioxidant IC_{50} (mg/mL)	14,84 ± 1,36	11,76 ± 0,89	20,67 ± 0,77
Viscosity (cP)	2,33 ± 0,58	5 ± 0	3 ± 0
Total Acid (%)	3,18 ± 0,82	0,51 ± 0,39	4,33 ± 0,14
Specific Gravity (g/mL)	1,010 ± 0,0002	1,098 ± 0,0002	1,010 ± 0,0002
TAR (%)	0,32 ± 0,02	0,20 ± 0,02	0,36 ± 0,02
Total Phenol (%)	0,66 ± 0,02	0,63 ± 0,01	0,62 ± 0,07
pH	4,33 ± 0,15	4,80 ± 0,1	3,77 ± 0,06
Salinity	0,1 ± 0,006	0,08 ± 0,006	0,32 ± 0,01
***Total Dissolved Solids* (TDS) (ppm)**	26 ± 0	23,33 ± 1,15	35,67 ± 0,58
Total Yield (mL)	47 ± 1	39,67 ± 0,58	48 ± 1
Color L*	23,17 ± 0,36	25,32 ± 0,11	21,68 ± 0,43
Color a*	-2,18 ± 0,97	-3,3 ± 0,08	-1,96 ± 0,9
Color b*	4,20 ± 0,12	3,10 ± 0,14	4,61 ± 0,31
Hedonic Color	2,44 ± 0,85	3 ± 0,7	2,36 ± 0,73
Smokey Scent	1,85 ± 0,83	2,45 ± 0,82	2,12 ± 1,04

3.1 Antioxidant IC_{50}

Analysis of variance carried out on antioxidant observation data showed that the application of different adsorbents to the filtration of liquid smoke of the kusambi and coconut shell groups had a very significant effect (P<0.01) on the antioxidants produced. The results showed that the different

Comment [P16]: Use the decimal point in the number instead of comma

Comment [PRDC17]: Title can be shorten by simply writing the word biochemical parameter

Comment [P18]: Use the decimal point in the number instead of comma types of liquid smoke showed significantly different results ($P<0.01$) in the antioxidant test. Antioxidant activity test is expressed by IC_{50} (Inhibition Concentration). IC_{50} is the concentration of the sample solution needed to inhibit 50% of the DPPH free radicals (Maryam, 2015). The smaller the IC_{50} value means the higher the antioxidant activity (Leha and Dompeipen, 2018). This opinion is also supported by Jaya, et al. (2020) that the lower the IC_{50} value, the higher the antioxidant activity of the product. The coconut shell liquid smoke group had an average IC_{50} antioxidant value that was smaller than the kusambi liquid smoke group. This shows that the coconut shell liquid smoke group has a more active IC_{50} Antioxidant value than kusambi. The table shows that the IC_{50} antioxidant level in the kusambi liquid smoke group was higher than the coconut shell liquid smoke group, respectively obtaining values of 78.2 and 16.27 mg/mL. This shows that these two ingredients have antioxidant activity that is strong enough for kusambi liquid smoke and very strong for coconut shell liquid smoke. As stated by Wilujeng, et al. (2020) that the antioxidant activity is said to be very strong if the IC_{50} value is ≤ 50 mg/mL, quite strong if the IC_{50} value is in the range of 50-100 mg/mL, weak if the IC_{50} value is in the range of 100-150 mg/mL, quite weak if the IC_{50} value is ranging from 151-200 mg/mL and very weak if the IC_{50} value ≥ 200 mg/mL

The difference in antioxidant levels that occurs between the two types of liquid smoke material groups is thought to be due to differences in lignin content between coconut shell liquid smoke and kusambi liquid smoke. According to Leha and Dompeipen (2018) the longer the drying time of the liquid smoke material, the higher the quality of the lignin content, so the resulting liquid smoke will be rich in aromatic chemical compounds, which play a very important role in antioxidant activity. The wood content consists of lignin, cellulose, and hemicellulose. The decomposition of cellulose takes place at a higher temperature range of 315-400˚C, while lignin is the most difficult to decompose. Decomposition occurs slowly from 300-900˚C (Chen, et al. 2019 in Darmansyah, et al. 2021). Wood is formed from the accumulation of cellulose and lignin in the cell walls of various tissues in wood. The density or density of wood is one of the factors that will determine the level of strength and hardness of wood (Darmansyah, et al. 2021). So, it can be concluded that the higher the strength and hardness of the wood, the thicker the accumulation of cellulose and lignin composition in the wood. Coconut shell liquid smoke material is thought to be drier and has a thicker accumulation of lignin and cellulose in the cell walls of its tissues compared to kusambi wood so it has an impact on high antioxidant activity.

Analysis of variance performed on antioxidant observation data showed that the application of different adsorbents to the filtration of liquid smoke of the kusambi and coconut shell groups also had a very significant effect ($P<0.01$) on the antioxidants produced. The difference in antioxidant levels that occurs between liquid smoke filtration adsorbents is thought to be due to the purification treatment with this adsorbent being able to separate free radical compounds that are not part of a group of antioxidant compounds such as benzopyrene. This opinion is supported by Budaraga and Putra (2020) who argue that purification can separate free radical compounds such as benzopyrene so that purified liquid smoke has a higher antioxidant value compared to that without purification. The best adsorbent in terms of separating benzopyrene compounds so that they can significantly increase antioxidant levels is silica sand. The table shows that filtration with silica adsorbent has stronger antioxidant activity, followed by zeolite adsorbent and then activated charcoal with respective figures of 11.76, 14.84, and 20.67 mg/mL

Adsorbents with activated charcoal filtration have the lowest levels of antioxidants thought to be due to the presence of free radical compounds such as benzopyrene in the charcoal content, and the benzopyrene also enters the filtered liquid smoke after the activated charcoal as an adsorbent has entered its saturated phase in absorbing water. This assumption is supported by Jamilatun and Slamah (2015) in Budaraga and Putra (2020), which states that activated charcoal has a very large absorption power, reaching 25-100% of the weight of activated charcoal used as an adsorbent. The large volume of liquid smoke that can be absorbed by activated charcoal adsorbents will increase the possibility of liquid smoke coming into contact with activated charcoal and increase the risk of carrying carcinogenic substances contained in activated charcoal. Adsorbents with silica are the best in increasing antioxidant content because the content in silica sand, namely the hexagonal-shaped quartz mineral, is very effective in filtering impurities in water (Mugiyantoro, et al., 2017). According to Taufiq, et al., (2020) Absorption with silica can increase the activity of antioxidant enzymes. This opinion is also supported by Ikhsanti, et al. (2018) and Sugiyanta, et al., (2018) that silica can improve water quality and stimulate an increase in enzymes and antioxidant metabolites which can reduce the absorption of toxic ions.

Comment [PRDC19]: Write up must be precise and short. Rewrite the paragraph

3.2 Viscosity

The results of the analysis of variance showed that the different types of liquid smoke did not have a significant effect on the resulting viscosity (P>0.05) and the different types of adsorbents in the liquid smoke filtration process had a very significant effect on the viscosity (P<0.01). The average value of viscosity can be seen in Tables 1, 2, and 3. The results showed that there was no significant difference between the viscosity of the coconut shell liquid smoke and the coconut shell liquid smoke, respectively obtaining a viscosity value of 3 and 2.33 cP. This can happen because the liquid smoke used in this study is food-grade liquid smoke so the two types of liquid smoke have more or less the same viscosity. After all, they have gone through the redistillation stage about 3 times to get food-grade liquid smoke.

The results of the study showed that the liquid smoke of kusambi and coconut shell groups treated with absorption filtration using silica showed significantly different results from the liquid smoke group treated with other absorption filtration with viscosity measurement results of 5.67 and 5 centipoises (cP) respectively. A liquid with a low viscosity can be interpreted as "thin" so that the lower the viscosity value the easier it is for the fluid to flow, while a liquid with a high viscosity can be interpreted as "thick" so that the higher the viscosity value of a fluid, the more difficult it is to move or flow the fluid. This opinion was also expressed by Samdra (2008) in Regina, et al. (2018) namely a type of liquid that easily flows, can be said to have a low viscosity, and conversely, a material that is difficult to flow is said to have a high viscosity.

The results of the research showed that the liquid smoke of the kusambi group with activated charcoal and silica adsorbents had the lowest and highest viscosity with values of 1.33 cP and 5.67 cP respectively. This is presumably due to the different treatments of adsorbent filtration affecting the amount of dissolved particulate matter in each group of liquid smoke, resulting in a very significant effect on the viscosity of liquid smoke (P<0.01). Several factors affect viscosity according to Lumbantoruan and Erislah (2016) Putri and Kasli (2017) stated that the factors that affect viscosity are temperature, solution concentration, dissolved molecular weight, and pressure. Viscosity and temperature are inversely related, if the temperature rises the viscosity will decrease, and vice versa. The concentration of a solution is directly proportional to the viscosity, a solution with a high concentration will also have a high viscosity because the concentration of a solution expresses the number of dissolved particles per unit volume and the more dissolved particles, the higher the friction between the particles and the higher the viscosity (Putri and Kasli, 2017). Liquid smoke treated with silica adsorbent had the highest viscosity values, namely 5.67 and 5 cP for kusambi liquid smoke and coconut shell liquid smoke. This is presumably due to the reaction produced when liquid smoke is poured and filtered using a silica adsorbent. This event is assumed to be the high friction between particles that occurs when the absorption filtration process takes place, causing the viscosity of liquid smoke to be higher after being filtered.

3.3 Total Acid

Analysis of variance was carried out on the total acid observed data showing that the application of different adsorbents to the filtration of the liquid smoke of the kusambi and coconut shell groups had a very significant effect (P<0.01) on the total acid test of the liquid smoke produced. The results showed that the coconut shell liquid smoke group without filtration treatment using an adsorbent showed highly significantly different results from the liquid smoke group which was given filtration treatment using an adsorbent. The highest total acid test result obtained by the coconut shell liquid smoke group was coconut shell liquid smoke without being filtered using an adsorbent with an average total acid value of 5.84%, followed by coconut shell liquid smoke filtered with activated charcoal, zeolite, and silica with total acid values of 4.33%, 3.18%, and 0.51% respectively. The highest total acid test results in the kusambi liquid smoke group were obtained by kusambi liquid smoke without adsorbent filtration with a total acid value of 0.37%, then followed by kusambi liquid smoke adsorbent filtration of activated charcoal, zeolite and silica with total acid values each by 0.11%, 0.10%, and 0.06%. Based on the results of the study, the total acid value of the two groups of liquid smoke decreased when given filtration treatment with adsorbents. Judging from the two types of liquid smoke groups, coconut shell liquid smoke has a higher total acid value compared to kusambi liquid smoke. This can happen due to differences in organic acid content, namely acetic acid content which is partially formed from lignin and cellulose which are present between the two raw materials for making liquid smoke.

According to Akbar (2013), the high temperature of pyrolysis causes a higher heat in the wood to decompose hemicellulose and cellulose into components of chemical compounds that are acidic, especially acetic acid. The acidity of liquid smoke is also influenced by the phenol content in the liquid smoke, the higher the phenol content in a raw material, the more acidic the liquid smoke will be. This opinion is also supported by Pamori, et al. (2015) that the difference in the total amount of titrated acid is related to the high and low levels of phenolic compounds produced by liquid smoke, so the higher the phenol content in the liquid smoke, the total acid in the liquid smoke will also be higher, and vice versa, the lower the phenol content, the total acid it will be even lower. Based on Saubaki's research (2020) the total phenol obtained from kusambi with pyrolysis of 450˚C is 14.19%. Meanwhile, the phenol content of the coconut shell showed the highest level of 14.96%. The difference in phenol content between the two groups of materials is what causes the difference in total acid levels.

Filtration treatment using an adsorbent produces a lower total acid content compared to liquid smoke without filtration. This can happen because, with the filtration through the adsorbent, there is an organic acid content, namely the acetic acid group which is also absorbed and ultimately eliminated from the filtered liquid smoke. According to Gemala and Ulfah (2020) In the industrial world, activated carbon and zeolite have a very high ability to adsorb water contaminants such as odors, gas, and metal content so that they can increase the pH of the water so that it does not too acidic and tends to be safer to use. Likewise with silica, silica sand is commonly used as a water filter media which can be used effectively for water filtration to separate sludge and lead microparticles in water so that the water can be more suitable for use. The results of the research by Mugiyantoro, et al., (2017) stated that the solution to the problem of water containing high levels of iron, manganese, and magnesium could be reduced by filtering the water using a filter with filtration media of silica sand, zeolite, and charcoal, as well as other materials. These are useful for filtering impurities, binding elements of Iron (Fe), Manganese (Mn), and Magnesium (Mg), and clarifying and eliminating odors in water.

Comment [PRDC20]: Write up must be precise and short. Rewrite the paragraph

Table 4. Japanese Liquid Smoke Quality Standards (Triawan, et al. 2022)

Parameter	Liquid Smoke Standard Quality
Total Acid	1-18%

Referring to the standardization of the total quality of liquid smoke acid, the cusp liquid smoke group, whether filtered or not, is still below the liquid smoke specification standard because it has total acid below 1%, but for the coconut shell liquid smoke group it is included in the standard specification for total liquid smoke acid because is between 1-18%.

3.4 Specific Gravity

The analysis of variance carried out on the observed data on specific gravity showed that differences in the types of liquid smoke groups and different adsorbent filtration treatments in the filtration of liquid smoke groups of kusambi and coconut shells had a very significant effect ($P < 0.01$) on the specific gravity test of liquid smoke resulting from. The results showed that the coconut shell liquid smoke group had a higher specific gravity compared to the kusambi liquid smoke group. Each group of kusambi and coconut shell liquid smoke obtained specific gravity values of 1.0016 and 1.0215 g/mL. The specific gravity or specific gravity of liquids according to Huling and Weaver (1991) is influenced by the content of tar and creosote contamination in the water. This opinion was also added by Wiyantoko (2016) according to API (American Petroleum Institute) the specific gravity or specific gravity of crude oil will be greater if it has a large number of carbon atoms and few hydrogen atoms, the oil will be richer in aromatic compounds. This is in line with the TAR research test, which found that the TAR content of coconut shell liquid smoke was higher than the TAR content of kusambi liquid smoke.

Salinity content also affects the specific gravity of a liquid. According to Cowley, et al. (2009) generally illustrates that an increase in salinity will also be in a straight line with an increase in specific gravity or specific gravity. This opinion is also supported by Nusier, et al. (2008) that the increase in specific gravity and increase in water salinity move hand in hand. This is in line with the results of the study that the salinity content in coconut shell liquid smoke was also higher compared to the kusambi liquid smoke group.

In the treatment of liquid smoke given adsorbent filtration, the specific gravity graph decreases. The specific gravity of purified coconut shell liquid smoke with activated charcoal adsorbent has the highest specific gravity with an achievement of 1.0107 g/ml and purified kusambi liquid smoke with silica has the lowest specific gravity with 1.0006 g/mL. Liquid smoke has a smaller specific gravity number because liquid smoke loses some of the contaminants contained in it during the filtration process. According to Katja, et al., (2008) that the liquid smoke filtration process uses adsorbents, compounds that are polar and non-polar and can be absorbed or absorbed to collect between the adsorbent surfaces so that they can eliminate contaminants in the liquid smoke.

Table 5. Liquid Smoke Quality Standards (Yulistiani, et al. 2020)

Parameter	Liquid Smoke Standard Quality
Specific Gravity	>1,001

Referring to the standardization of the quality of the specific gravity of liquid smoke, the filtered kusambi liquid smoke group is still below the standard specifications for liquid smoke because it has a specific gravity below 1.001 g/mL, but for the filtered coconut shell liquid smoke group it already meets the specification standard for the specific gravity of liquid smoke because it gets numbers more than 1.001 g/mL

3.5 TAR (Total Aerosol Residue)

Analysis of variance performed on the observed data for TAR content showed that differences in the types of liquid smoke groups and different adsorbent filtration treatments for the filtration of liquid smoke in the kusambi and coconut shell groups had a very significant effect ($P<0.01$) on the test for the TAR content of liquid smoke. resulting from. The results of the study showed that the coconut shell liquid smoke group had a higher TAR content compared to the coconut shell liquid smoke TAR group. Each group of kusambi and coconut shell liquid smoke obtained TAR content values of 0.367 and 0.423%. TAR is the result of thermal decomposition in the pyrolysis process which is mostly formed in the lignin pyrolysis process (Sari, 2018). The difference in lignin content in the raw materials for the two liquid smoke groups is what causes the difference in the TAR content in them. According to Pugersari, et al., (2013) coconut shell belongs to the hardwood group, chemically having a chemical composition almost similar to wood which is composed of 36.51% lignin, 33.61% cellulose, and 29.27% semi-cellulose. Meanwhile, according to Mardyaningsih (2016), the chemistry of kusambi consists of 29.51% lignin, 27.62% cellulose, and 15.27% hemicellulose. This is what causes coconut shell liquid smoke to have a higher TAR content than kusambi liquid smoke.

Filtration treatment using adsorbents also had a very significant effect ($P<0.01$) on TAR in each group of liquid smoke. Liquid smoke without filtration using an adsorbent has the highest TAR content, coconut shell liquid smoke and kusambi without a filtration process with an adsorbent respectively have a TAR content of up to 0.423% and 0.367%. This is because, without additional treatment in the form of filtration with an adsorbent, there are still harmful contaminants in the liquid smoke content. The liquid smoke of kusambi and coconut shells filtered with silica adsorbent had the lowest TAR content with 0.123 and -0.203%, then followed by liquid smoke of kusambi and coconut shells filtered with zeolite respectively as much as 0.257% and 0.323% and finally liquid smoke of kusambi and shell filtered coconut activated charcoal adsorbent with 0.317% and 0.363%. This incident shows that the existence of a filtration process using silica, zeolite, and activated charcoal can minimize the TAR content which can be harmful if consumed sustainably. According to Fauzan and Ikwanus (2017), filtration with adsorbents such as zeolite, silica, and activated carbon can filter liquid smoke from hazardous substances such as benzopyrene and TAR.

3.6 Total Phenol

The analysis of variance performed on the observed data for phenol levels showed that the application of different adsorbents to the filtration of liquid smoke in the kusambi and coconut shell groups had a very significant effect ($P<0.01$) on the phenol content test of the resulting liquid smoke. The results showed that the coconut shell liquid smoke group had a higher phenol content compared to the kusambi liquid smoke group. The liquid smoke group with the highest phenol content was coconut shell liquid smoke without adsorbent treatment with a phenol content of 0.94%, whereas in the kusambi liquid smoke group, the phenol content was achieved by kusambi liquid smoke without control treatment with a value of 0.79%. The difference in phenol content between coconut shell liquid smoke and kusambi is due to differences in the constituent content between the two raw materials for making liquid smoke in both. According to Swaswati, et al. (2007), phenol is the result of the decomposition of lignin in wood due to high temperatures. According to Kanoni (1991) in Swastawati (2007) wood with a high level of density or harder, the wood tends to have high cellulose, hemicellulose, and lignin. This opinion is also supported by Thohari, et al., (2013) hardwood produces good quality smoke containing cellulose, hemicellulose, lignin, methanol, ethanol, phenol, diacetyl, acetone, and benzopyrene which have effects in the form of bacteriocidal, bacteriostatic and can inhibit oxidation of fat. Kusambi wood and coconut shell are both hardwoods. This type of wood is often used as a smoking medium to preserve meat (Malelak, et al., 2017). The coconut shell (Cocos nucifera) is the hardest part of all the parts of the coconut tree. This hard structure is influenced by silicate (SI02), which has quite high levels in the coconut shell (Pratama, et al., 2020). So the phenol content found in each different raw material is not specifically the same, depending on the raw material used (Swastawati, et al. 2007). This is the reason why there is a real difference in the phenol content in coconut shell liquid smoke and kusambi liquid smoke.

Filtration treatment using an adsorbent also had a very significant effect ($P<0.01$) on the phenol content in each liquid smoke group. Phenol levels decreased after filtration treatment with adsorbents. In the kusambi liquid smoke group, the highest phenol content was achieved by purified liquid smoke with silica adsorbent with a value of 0.56%, followed by activated charcoal and zeolite adsorbents with 0.45% and 0.56% phenol content respectively. In the coconut shell liquid smoke group, the highest phenol content was achieved by purifying liquid smoke with zeolite adsorbents, silica and finally activated charcoal with a phenol content of 0.66%, 0.63%, and 0.62% respectively. This can happen because carrying out the filtering process using an adsorbent can eliminate some of the content of liquid smoke. This was also experienced by Mardyaningsih, et al., (2016) in their research it was stated that a decrease in acid, phenol, and carbonyl levels occurred after redistillation and filtering of liquid smoke because some of the liquid smoke was wasted thereby reducing the chemical levels in it.

Table 6. Liquid Smoke Quality Standards (Maulina and Amalia, 2020)

Parameter	Liquid Smoke Standard Quality
Total Phenol	0,1 – 16%

Referring to the standardization of the total phenol quality of liquid smoke, the cusp liquid smoke group and the coconut shell liquid smoke group, both those that have not been filtered and those that have been filtered by adsorbents, both have met the quality standardization of liquid smoke because they have total phenol above 0.1%.

3.7 pH

Analysis of variance was carried out on the pH observed data showing that the differences in the liquid smoke of kusambi and coconut shell groups had a very significant effect ($P<0.01$) on the pH test of the liquid smoke produced. The results showed that the coconut shell liquid smoke group had a lower pH level compared to the Kudus liquid smoke group. The coconut shell liquid smoke group without filtration treatment with adsorbents had the lowest pH, reaching 3.1, whereas in the kusambi wood liquid smoke group without liquid smoke filtration treatment, the lowest pH was 6.26. This suggests that coconut shell liquid smoke is more acidic than kusambi liquid smoke. The results of the pH test are directly proportional to the total acid test. The highest total acid test result obtained by the coconut shell liquid smoke group was coconut shell liquid smoke without being filtered using an adsorbent with an average total acid value of 5.84%, followed by coconut shell liquid smoke filtered with activated charcoal, zeolite, and silica with total acid values of 4.33%, 3.18%, and 0.51% respectively. The highest total acid test results in the kusambi liquid smoke group were obtained by kusambi liquid smoke without adsorbent filtration with a total acid value of 0.37%, then followed by kusambi liquid smoke adsorbent filtration of activated charcoal, zeolite and silica with total acid values each by 0.11%, 0.10%, and 0.06%. The difference in acid content between the two groups of liquid smoke occurs because there is a difference in the phenol content possessed by the two groups. Based on the opinion of Pamori, et al. (2015) that the difference in the total amount of titrated acid is related to the high and low levels of phenolic compounds produced by liquid smoke, so the higher the phenol content in the liquid smoke, the total acid in the liquid smoke will also be higher, and vice versa. In this study, it was also found that the phenol content of coconut shell liquid smoke was higher than kusambi liquid smoke.

The analysis of variance performed on the observed data on pH showed that the application of different adsorbents to the filtration of liquid smoke in the kusambi and coconut shell groups had a very significant effect ($P<0.01$) on the pH test of the resulting liquid smoke. The results showed that after being given filtration treatment with an adsorbent, the pH value slowly increased toward neutral or alkaline. In the coconut shell liquid smoke group, the lowest pH was achieved by activated charcoal, zeolite, and silica adsorbents with pH values of 3.77, 4.33, and 4.8 respectively. Furthermore, in the kusambi liquid smoke group, the lowest pH was achieved by activated charcoal, zeolite, and silica adsorbents with pH values of 6.83, 6.93, and 7.07 respectively. This event is also the same as the study of Mardyaningsih, et al., (2016) in his research it was stated that a decrease in acid, phenol, and carbonyl levels occurred after redistillation and filtering of liquid smoke because some of the liquid smoke was wasted thereby reducing the chemical levels in it.

Table 7. Liquid Smoke Quality Standards (Triawan, et al. 2022)

Parameter	Liquid Smoke Standard Quality
pH	1,5-3,7

Referring to the standardization of the quality of liquid smoke pH, the unfiltered and filtered liquid smoke group are both below the liquid smoke pH specification standard because it has a pH above 3.7 while the unfiltered coconut shell liquid smoke group meets the liquid smoke pH standard quality. because it is between 1.5-3.7, but for the filtered coconut shell liquid smoke group it still does not meet the standard specifications for liquid smoke pH because it gets a pH value above 3.7. According to Susilo, et al. (2023) the lower the pH of a product, the longer the shelf life of that product. This is the reason why one of the most important aspects in determining liquid smoke is its pH level because the administration of liquid smoke also aims to preserve food products by preventing or suppressing the growth of microbes that cause spoilage in food.

3.8 Salinity

Analysis of variance carried out on the observed data on salinity showed that the coconut shell and kusambi liquid smoke had a very significant effect ($P<0.01$) on the resulting liquid smoke salinity test. The results showed that the coconut shell liquid smoke group had a higher salinity level compared to the kusambi liquid smoke group. The coconut shell liquid smoke group that had the highest salinity was found in liquid smoke without filtration treatment with a salinity of 0.8%, while in the kusambi liquid smoke group, the highest salinity was achieved by liquid smoke without filtration treatment with a salinity of 0.14%. This suggests that coconut shell liquid smoke contains more salt than kusambi liquid smoke. Salinity is the level of saltiness or dissolved salt content in water (Ala, et al., 2018). The presence of electrolytes such as salt in water can accelerate the corrosion rate by the additional reaction between the metal and water. Ala, et al., (2018) mentioned again that a large electrolyte concentration can increase the electron flow rate so that the corrosion rate increases. The results of the pH test are directly proportional to the pH test. Water with high salinity tends to have a higher acid content, thus accelerating metal corrosion. The coconut shell liquid smoke group has a lower pH level than the kusambi liquid smoke group, this is the reason why the coconut shell liquid smoke group tends to have a higher salinity as well.

The analysis of variance performed on the observed data on salinity showed that the application of different adsorbents to the filtration of liquid smoke of the kusambi and coconut shell groups had a very significant effect (P<0.01). The results showed that after being given filtration treatment with an adsorbent, the salinity rate decreased. The results showed that liquid smoke filtered with activated charcoal adsorbents had the highest salinity, followed by zeolite and silica adsorbents, respectively having salinity values of 0.11, 0.06, and 0.02%. The results of the research test also showed that coconut shell liquid smoke filtered with activated charcoal adsorbent had the highest salinity, followed by zeolite and silica adsorbents, respectively having salinity values of 0.32, 0.1, and 0.08%. This can happen because, with the filtration process, the polar salt content dissolved in the liquid smoke can be filtered by the adsorbent. Based on Katja, et al., (2008) that polar and nonpolar dissolved compounds dissolved in liquid smoke can be filtered by adsorbents such as activated charcoal, silica, and zeolites because of their large surface area, and hollow surface, and this adsorbent also has a high absorption capacity. high enough.

3.9 TDS (Total Dissolve Solids)

The analysis of variance performed on the TDS observed data showed that the differences in the liquid smoke of the kusambi and coconut shell groups had a very significant effect (P<0.01) on the TDS test of the resulting liquid smoke. The results showed that the coconut shell liquid smoke group had higher TDS levels compared to the kusambi liquid smoke group. The coconut shell liquid smoke group with the highest TDS value was coconut shell liquid smoke without adsorbent filtration with a TDS value of 70 mg/L, while the kusambi liquid smoke group with the highest TDS value was cusp liquid smoke without adsorbent filtration with a TDS value of 30.67 mg/L L. This suggests that coconut shell liquid smoke contains more dissolved substances compared to kusambi liquid smoke. According to Primandasari, et al. (2021), the TDS value is affected by the content contained in a liquid. Based on the salinity test, coconut shell liquid smoke has more salt content than kusambi liquid smoke, so this causes the TDS content in coconut shell liquid smoke to also be higher than the TDS in kusambi liquid smoke. Khairunnas and Gusman (2018) explain that the measurement of TDS (Total Dissolved Solids) can be known by determining the amount of salt concentration in water. The liquid smoke filtered with adsorbent also experienced a significant decrease in TDS levels. This is presumably because the addition of liquid smoke filtration treatment with adsorbents can produce purified liquid smoke so that it can eliminate impurities in liquid smoke.

The analysis of variance performed on the TDS observed data showed that the application of different adsorbents to the filtration of liquid smoke of the kusambi and coconut shell groups had a very significant effect (P<0.01). The results showed that after being given filtration treatment with an adsorbent, the TDS number decreased. Liquid smoke by filtration with activated charcoal adsorbents had the highest salinity, followed by zeolite and silica adsorbents, respectively having TDS values of 27.33, 21.33, and 18.67 mg/L. The results of the research test also showed that coconut shell liquid smoke filtered with activated charcoal adsorbent had the highest TDS, followed by zeolite and silica adsorbents, respectively having TDS values of 35.67, 26, and 23.33%. The decrease in the TDS number after the filtration process indicates that the filtration treatment using an adsorbent can reduce the dissolved compounds in the liquid smoke. According to Rinaldi, et al., (2015), the process of distillation and filtering of liquid smoke using various types of adsorbents can be carried out to obtain liquid smoke that is cleaner than harmful substances and has a mild smell of smoke.

3.10 Total Yield

Analysis of variance carried out on the total yield observed data showed that the differences in the liquid smoke of the kusambi and coconut shell groups had a very significant effect (P<0.01) on the total yield of liquid smoke observed. The results showed that the coconut shell liquid smoke group had a higher total yield compared to the kusambi liquid smoke group. The coconut shell liquid smoke group with the highest total yield value was coconut shell liquid smoke without adsorbent filtration with a yield of 91 ml, while the kusambi liquid smoke group with the highest yield value was kusambi liquid smoke without adsorbent filtration with a yield of 89.67 ml. This suggests that coconut shell liquid smoke has a volume of liquid that is more liquid when filtered compared to kusambi liquid smoke. This is presumably because coconut shell liquid smoke has a "thinner" viscosity compared to kusambi liquid smoke according to the viscosity test. In the TDS test, it was also found that coconut shell liquid smoke has a high solubility level, which causes the flow of the liquid to become heavier. Regina, et al. (2018) explained that a type of liquid that easily flows can be said to have a low viscosity, and conversely, a material that is difficult to flow is said to have a high viscosity.

Analysis of variance performed on the total yield observed data showed that the application of different adsorbents to the filtration of liquid smoke of the kusambi and coconut shell groups had a very significant effect ($P<0.01$). The results showed that after being given filtration treatment with an adsorbent, the yield rate decreased. Liquid smoke by filtration with activated charcoal adsorbents had the highest yield, followed by zeolite and silica adsorbents, respectively having yield numbers of 46.67, 45.33, and 38.67 ml. The results of the research test also showed that coconut shell liquid smoke filtered with activated charcoal adsorbent had the highest yield, followed by zeolite and silica adsorbents, respectively having yield numbers of 46.67, 45.33, and 38.67 ml. This can occur due to differences in absorption and also the pores of each type of adsorbent. This is supported by the opinion of Syauqiah, et al., (2011); Reyra, et al., (2017), and Rahayu, et al., (2021) stated that the larger the surface area of an adsorbent, the higher the adsorption capacity, the surface area is determined by the size and number of particles of the adsorbent.

3.11 Color Test

3.11.1 Color L*

Analysis of variance performed on the observed data on the brightness level of the color showed that the differences in the different types of liquid smoke groups in the filtration of the kusambi and coconut shell liquid smoke groups had a very significant effect ($P<0.01$) on the color brightness test of the liquid smoke tested. earn. The results showed that the kusambi liquid smoke group had a higher brightness level than the coconut shell liquid smoke before filtration. The coconut shell liquid smoke without adsorbent filtration has a brightness score of 20.03, while the kusambi liquid smoke with the highest brightness value is in the kusambi liquid smoke without adsorbent filtration with a brightness score of 20.58. This is assumed to have a higher TAR content in the coconut shell liquid smoke compared to the TAR of the kusambi liquid smoke group. According to Maulina and Sinaga (2020) the results obtained from the pyrolysis of the first stage of liquid smoke cannot be used directly as a food preservative, because there are still dangerous compounds that cause a blackish color in liquid smoke, this compound is commonly known as TAR.

The analysis of variance performed on the observed data on the brightness level showed that the application of different adsorbents to the filtration of liquid smoke of the kusambi and coconut shell groups had a very significant effect ($P<0.01$). The results showed that after being given filtration treatment with an adsorbent, the brightness value increased. The addition of filtration treatment with adsorbents also aims to remove liquid smoke contaminants. The research also shows that the difference in the use of adsorbents can increase the brightness level of purified liquid smoke. Liquid smoke by filtration with silica adsorbent has the highest brightness level, followed by zeolite and activated charcoal adsorbents, respectively having brightness values of 26.52, 24.74, and 23.97. The results of the research test also showed that coconut shell liquid smoke filtered with silica adsorbent had the highest brightness score, followed by zeolite and activated charcoal adsorbents, respectively having brightness values of 25.32, 23.17, and 21.68. This indicates that the presence of filtration with an adsorbent can reduce the contamination in liquid smoke. According to Rinaldi, et al., (2015) to produce grade 1 liquid smoke, namely liquid smoke which can be used as a food preservative, liquid smoke needs to be given additional treatment such as a filtration process with zeolite and by using activated charcoal so that the liquid smoke becomes cleaner from harmful contaminants.

3.11.2 Color a*

Analysis of variance was carried out on observed data on the level of redness of the color, indicating that differences in the type of liquid smoke group and different adsorbent filtration treatments in the filtration of liquid smoke in the Kudus and coconut shell groups did not have a significant effect (P> 0.05) on the level of redness test. liquid smoke produced. The results showed that both the coconut shell liquid smoke group and the kusambi liquid smoke group had a sample color level that was more towards white-green than reddish color. The coconut shell liquid smoke without adsorbent filtration has a reddish number of -1.75, while the liquid smoke of the kusambi group with a reddish value of the kusambi liquid smoke without adsorbent filtration has a reddish number of -3.40. This is because the sample used is grade 1 liquid smoke or food grade liquid smoke which is clearer and not polluted by heavy lead such as iron or manganese levels which can cause a reddish color in a liquid. The presence of iron (Fe) in water causes the water to turn a yellowish-red color, gives off a slightly fishy odor, and forms an oil-like layer on the water (Munfiah, et al., 2013). Based on the research of Febrina and Ayuna (2015) water containing manganese will generally look reddish-brown in color.

3.11.3 Color b*

Analysis of variance was carried out on the observational data for yellowish color in liquid smoke, indicating that differences in the types of liquid smoke from kusambi and coconut shells had a very significant effect (P<0.01) on the test for the yellowness of the liquid smoke produced. The results showed that the coconut shell liquid smoke group was more yellow in color than the kusambi liquid smoke group before filtration. The coconut shell liquid smoke without adsorbent filtration has a yellowish number reaching 6.25, while the kusambi liquid smoke with a yellowish value in the kusambi liquid smoke without adsorbent filtration has a yellowish number of 4.86. This shows that coconut shell liquid smoke has more TAR content and other impurities compared to kusambi liquid smoke. This is supported by the opinion of Yulistiani, et al. (2020) that the distillation product of liquid smoke produces yellow liquid smoke because, in the separation process between Polycyclic Aromatic Hydrocarbons (PAH) and liquid smoke, there is a small portion of TAR which cannot settle to be eliminated and eventually dissolves with the liquid smoke.

Analysis of variance was carried out on the observed data for a yellowish color in liquid smoke, which showed that different adsorbent filtration treatments for the filtration of liquid smoke from kusambi and coconut shell groups had a very significant effect (P<0.01). In this study, it was also seen that differences in the use of adsorbents could reduce the yellowness of purified liquid smoke. Liquid smoke filtered with activated charcoal adsorbent had the highest yellowness level, followed by zeolite and silica adsorbents, respectively having a brightness scores of 3.54, 3.53, and 2.44. The results of the research test also showed that coconut shell liquid smoke filtered with activated charcoal adsorbent had the highest yellowness number, followed by zeolite and silica charcoal adsorbents, respectively having yellowness numbers reaching 4.61, 4.20, and 3.10. This indicates that the presence of filtration with an adsorbent can reduce the contamination in liquid smoke. According to Luditama (2006) reducing the amount of PAHs and their derivatives contained in liquid smoke can be done by applying purification to liquid smoke either by extraction, distillation, or absorption.

3.12 Hedonic Color

Analysis of variance performed on the organoleptic test results for the color of liquid smoke showed that the different types of liquid smoke had a very significant effect (P<0.01) on the panelists' preference for the color of liquid smoke. The color that has the most scores from the panelists is the kusambi liquid smoke group compared to the coconut shell liquid smoke group. Coconut shell liquid smoke without adsorbent filtration with a score of 1.91, while the cusp liquid smoke group with a hedonic scoring value in kusambi liquid smoke without adsorbent filtration with a score of 2.09. This is due to the average brightness and clearness of the coconut shell liquid smoke group. The less lignin content causes the content of contaminants such as TAR to be less than that of the coconut shell liquid smoke group. According to Maulina and Sinaga (2020), TAR contamination produced in the pyrolysis process causes a dark color in liquid smoke.

Purified liquid smoke with various types of adsorbent treatments also had a very significant effect (P<0.01) on the panelist's scoring of the most preferred liquid smoke color. Liquid smoke by filtration with zeolite adsorbent became the favorite color and received the highest score, followed by zeolite adsorbent and activated charcoal, each of which had a hedonic score of 3.15, 2.94 and 2.73 respectively. The test results also showed that coconut shell liquid smoke filtered with silica adsorbent was the favorite, followed by zeolite and activated charcoal adsorbents, each of which had a hedonic score of 3, 2.44, and 2.36 respectively. The liquid smoke group without being given filtration treatment got the lowest score because the color tends to be darker than purified liquid smoke with an adsorbent. The highest score was obtained by the kusambi liquid smoke group treated with zeolite adsorbent. Zeolite is used as a liquid smoke filtration medium to obtain liquid smoke that is completely free of harmful substances such as TAR which is a benzopyrene compound (Rinaldi, et al., 2015). Likewise, the opinion of Fauzan and Ikhwanus (2017) explains that liquid smoke filtration with zeolite aims to get liquid smoke that is cleaner than harmful contaminants.

Table 8. Liquid Smoke Quality Standards (Triawan, et al. 2022)

Parameter	Liquid Smoke Standard Quality
Color	Bright yellow or slightly reddish

Referring to the standardization of color quality, both the kusambi and coconut shell liquid smoke groups have met the standardized liquid smoke color, as well as filtered liquid smoke which also has a bright yellow color because the liquid smoke raw material used is grade 1 liquid smoke or liquid smoke. food grade so it has very minimal impurities

3.13 Smokey Scent

Analysis of variance was carried out on the observed data for the concentration of smoke aroma, indicating that the different types of purified liquid smoke groups had a very significant effect ($P<0.01$) on the level of concentration of smoke aroma. panelists assessed that the two groups of liquid smoke without adsorbent treatment had a high concentration of smoke aroma. Coconut shell liquid smoke without adsorbent filtration with a score of 1.41, while the kusambi liquid smoke without adsorbent filtration with a score of 1.71. The smaller the score, the more the panelists judge that the aroma produced smells like smoke. This is because the phenol content in liquid smoke is still high before the purification process is carried out. According to Jamilatun, et al., (2016), the smell of smoke produced from liquid smoke is due to the presence of phenolic compounds which are compounds that form a specific aroma in smoked products. This is also supported by Kasim, et al., (2015) that the results of pyrolysis of cellulose and lignin produce acetic acid and phenols which play a role in producing aromas in smoking products, the aroma compounds in question are phenols and other phenolics such as guaiacol (2-methoxy phenol)., syringol (1,6-dimethoxy phenol) and their derivatives. Phenol besides giving effect to the aroma also influences the pH level. Likewise with the opinion of Rinaldi, et al. (2015) In addition, phenol levels also affect the pH of liquid smoke because phenol has an acidic nature which is the influence of its aromatic ring

After the purification process was carried out, the results of the scoring increased the concentration of smoke aroma, which means that the concentration of smoke aroma in liquid smoke decreased. Liquid smoke by filtration with activated charcoal adsorbent became the favorite aroma and received the highest score, followed by zeolite adsorbent and silica charcoal, each of which had a hedonic score of 2.67, 2.58 and 2.15 respectively. The test results also showed that coconut shell liquid smoke filtered with silica adsorbent was the favorite, followed by activated charcoal and zeolite adsorbents, each of which had a hedonic score of 2.45, 2.12, and 1.85 respectively. Liquid smoke with active charcoal adsorbent in kusambi is the highest because the ability of activated charcoal is quite high in terms of absorbing sharp aromas. This is also supported by the opinion according to Rinaldi, et al., (2015) that activated charcoal aims to obtain liquid smoke filtrate with a mild and non-stinging smoke odor. Besides that, liquid smoke with silica adsorbent is also the favorite aroma from the coconut liquid smoke group. This is because considering that silica is also very effective in filtering impurities in dissolved water, so it can reduce the smell of smoke in liquid smoke (Mulgiyantoro, et al., 2017)

Table 9. Liquid Smoke Quality Standards (Triawan, et al. 2022)

Parameter	Liquid Smoke Standard Quality
Scent	Smokey scent

Referring to the standardization of aroma, both the kusambi and coconut shell liquid smoke groups have met the standardization of liquid smoke aroma, as well as liquid smoke that has been filtered also has a smoky aroma that is quite light and not too thick because the raw material for liquid smoke used is grade liquid smoke. 1 or food-grade liquid smoke so the smell of liquid smoke is lighter.

4. Conclusion

Different types of liquid smoke and liquid smoke filtration treatment with adsorbents had a very significant effect ($P<0.01$) on antioxidants, total acid, specific gravity, tar, phenol content, pH, salinity, TDS, total yield, L* color and b*, hedonic color, and smoke aroma in the resulting liquid smoke. However, the different types of liquid smoke did not have a significant effect on the resulting viscosity ($P>0.05$), and the different types of adsorbents in the liquid smoke filtration process had a very significant effect on the viscosity ($P<0.01$). Meanwhile, the different types of liquid smoke and the different types of adsorbents in the liquid smoke filtration process did not have a significant effect on the value of a* color or the reddish color of the liquid smoke ($P>0.05$).

References

[1] Ala, A., Y. Mariah., D. Zakiah and D. Fitrial. 2018. Analysis of the Influence of Salinity and Degree of Acidity (pH) of Seawater in the Port of Jakarta on the Corrosion Rate of Ship Material Steel Plates. National Scientific Journal of the Jakarta High School of Marine Science METEOR STIP MARUNDA. Vol 11(2):33-40.

[2] Budaraga I.K., Arnim., Y. Marlida and U. Bulanin. 2016. Liquid Smoke Production Quality from Raw Materials Variation and Different Pyrolysis Temperature. International Journal on Advanced Science Engineering Information Technology. Vol 6(3):306-315.

[3] Budaga, I.K. and D.P. Son. 2020. Analysis of Antioxidant IC50 Liquid Smoke pH Cocoa Skin with Several Purification Methods. International Conference on Sustainable Agriculture and Biosystems. 757:1-9

[4] Buntu, Y., S. Sinaga and K. Suradi. 2020. The Effect of Smoking Time Using Kosambi Wood (Schleichera oleosa) on the Physical Properties and Acceptability of Pork Se'I. JITP. Vol 8(1):37-44.

[5] Darmansyah, A. Khalid., M. Kasim and T. Suprianto. 2021. The Effect of Powder Size and Hardness of Wood on SYNGAS Quality from Pyrolysis of Biomass. Journal of Syntax Admiration. Vol 2(4):593-600.

[6] Fauzan and M. Ikhwanus. 2017. Purification of Coconut Shell Liquid Smoke Through Distillation and Filtration Using Zeolite and Activated Charcoal. National Seminar on Science and Technology. 1-5.

[7] Febriana, L and A. Ayuna. 2015. Study of Decreasing Levels of Iron (Fe) and Manganese (Mn) in Groundwater Using Ceramic Filters. Vol. 7(1):35-44.

[8] Gemala, M and N. Ulfah. 2020. The Effectiveness of the Combination Method of Zeolite Sand and Activated Charcoal in the Treatment of Leachate in Final Disposal Sites (TPA). Journal of Chemical and Environmental Engineering. Vol 4(2):162-167.

[9] Ghazali, R.R., F. Private and Romadhon. 2014. Analysis of Smoked Manyung Fish (Arius thalassinus) Processed with Different Smoking Methods. Journal of Processing and Biotechnology of Fishery Products. Vol 3(4):31- 38.

[10] Girrard, J.P. 1992. The technology of Meat and Meat Products. New York Ellis Horwood.

[11] Huling, S.G and J.W. Weavers. 1991. Ground Water Issue Dense Nonaqueous Phase Liquids. Washington DC: United States Environmental Protection Agency.

[12] Jamilatun, S., S. Salamah., L. Aslihati and E.W. suminar. 2016. Effect of Soaking Tilapia with Liquid Smoke on Storage Capacity. National Seminar on Science and Technology. 1-8.

[13] Jaya, F., D. Rosyidi., L.E. Radiati., S. Minarti., Mustakim., A. Susilo., R.H. Muslimah and M. Husolli. 2020. Antioxidant Activity and Microbiological Quality of Bee Bread Collected from Three Different Species Honey Bee. IOP Conference Series: Earth and Environmental Science. Vol 475:1-7.

[14] Kasim, F., A.N. Fitrah and E. Hambali. 2015. Application of Liquid Smoke on Latex. SURE

Comment [PRDC21]: Not found this reference in manuscript

Journal. Vol 9(1):8-34.
[15] Katja, D.G., E. Suryanto., L.I. Momuat and Y. Tambunan. 2008. Effect of Adsorbent on Antioxidant Activity of Cempaka Wood Liquid Smoke (Michelia champaka Linn). Chem. Prog. Vol 1(1):54-59.
[16] Kumar, V., S. Chandra., K. Kumar., S.K. Goyal., L. Kumar and A. Kumar., 2017. Perishable and Non-Perishable Food Product Roles in Environment. South Asian Journal Food Technology Environment. Vol 3(1):465-472.
[17] Leha, M.A. and E.J. Wallet. 2018. Antioxidant Activity of Liquid Smoke from Walnut Shells (Canarium indicum Leenh). BIAM Magazine Ministry of Industry of the Republic of Indonesia. 45-50.
[18] Lopi, F., G.M. Sipahelut. and B. Saturday 2014. The Effects of Using Liquid Smoke of Kusambi (Schleichera oleosa) at Different Levels on Nutrient Content, Cholesterol and Taste of Se'i Beef Meat. Journal of Animal Husbandry Nucleus. Vol 1(2): 117–122.
[19] Mardyaningsih, M., A. Leki and S.S Engel. 2016. Technology for Making Kesambi Leaf Liquid Smoke as a Fumigation Material for Processed Fish Typical of East Nusa Tenggara. Proceedings of the National Seminar on Chemical Engineering "Struggle".1-6
[20] Maryam, S. 2015. Antioxidant Levels and IC50 Red Bean Tempeh (Phaseulus vulgaris L) Fermented with Different Fermentation Time. Proceedings of the UNDIKSHA FMIPA National Seminar V. 347-352.
[21] Maulina, S and R. Amalia. 2020. Quality Improvement of Liquid Smoke from Oil Palm Frond Purolysis through the Adsorption-Distillation Process using Activitade Carbon as Adsorbent. IOP Conf Series: Materials Science and Engineering 801:1-6
[22] Maulina, S and F.A. Sinaga. 2020. Improving the Quality of Liquid Smoke from Oil Palm Fronts Through Adsorption and Distillation Processes. Materials Science and Engineering 801. 1-7.
[23] Muflihati, I. 2016. Reduction of Smokey Flavor and Color Intensity of Liquid Smoke Through Multilevel Adsorption Using Activated Charcoal from Rice Husk. Technoscience Scientific Journal. Vols 2(1):50-55.
[24] Mugiyantoro, A. 2017. The Use of Natural Materials Zeolite, Silica Sand and Activated Charcoal with a Combination of Shower Techniques in Filtration of Fe, Mn and Mg in Groundwater at UPN "Veteran" Yogyakarta. Preceeding National Earth Seminar. 1127 – 1137
[25] Munfiah, S., Nurjazuli and O. Setiani. 2013. Physical and Chemical Quality of Water from Dug Wells and Drilled Wells in the Working Area of Guntur II Public Health Center, Demak Regency. Indonesian Journal of Environmental Health. Vol 12(2):154-159.
[26] Nusier, O.K., A.A. Al -Mufty and R.A. Jaradat. 2008. Determination of Saline Soils Specific Gravity. Jordan Journal of Civil Engineering. Vol2(1):1-19.
[27] Pamori, R., R. Efendi and F. Restuhadi. 2015. Characteristics of Liquid Smoke from the Pyrolysis Process of Young Coconut Coir Waste. SAGO. Vol 14(2):43-50.
[28] Polii, F.F. 2017. Effect of Temperature and Time of Activation on the Quality of Activated Charcoal from Coconut Wood. Journal of Plantation Products Industry. Vol 12(2):21-28.
[29] Pratama, J.W.A., S.M. Yanestria., P. Tomy and A. Rahayu. 2020. The Effectiveness of Smoking Using Kesambi Wood (Schleichera oleosa) Compared to Coconut Shells (Cocos nucifera) on Pork on TPC, Organoleptic and Early Decay. Vitek Journal of Veterinary Medicine. Vol 10:10-14
[30] Primandasari, E.P., A. Susilo and D. Masyithoh. 2021. The Effect of Moisture Content in East Nusa Tenggara Forest Honey on Viscosity, pH and Total Dissolved Solids. IOP conference series: Earth and Environmental Science. Vol 788:1-4.
[31] Pugersari, D., A. Syarief and D. Larasati. 2013. Experimental Development of Commercial Value Functional Products Made from Young Coconut Shell Raw Materials with Softening Techniques. ITB J. Vis. Art & Dec. Vol 5(1):74-91.
[32] Putri, A and E. Kasli. 2017. The Effect of Temperature on the Viscosity of Cooking Oil. Proceedings of the MIPA National Seminar III. 464-649.
[33] Rahayu, E., P. Luna., S. Usmiati and Sunarmani. 2021. Optimization of the Synthesis and Application of Adsorbents from Rice Husk Biosilica Extraction Waste. Warta IHP Journal of Agro Based Industry. Vol.38(1):36-45.

[34] Regina, O., H. Sudrajad and D. Syaflita. 2018. Viscosity Measurement Using Alternative Viscometers. Geliga Science Journal. Vol 6(2):127-132.
[35] Reyra, A.S., S. Daud and S.R. Yenti. 2017. The Effect of Mass and Particle Size of Pineapple Leaf Adsorbents on Fe Removal Efficiency in Peat Water. Come on FTECHNIC. Vols 4(2):1-9.
[36] Rinaldi, A., Alimuddin and A.S. Panggabean. 2015. Purification of Liquid Smoke from Durian Skin Using Activated Charcoal. Molecule. Vol.10(2):112-120.
[37] Saputro, E., D. Rosidi., L.E. Radiati and Warsito. 2021. Literature Review: Cancer Triggers in Satay, Chicken/Duck/Grilled/Fried Fish and Shredded Shredded. Sukowati Research and Development Journal. Vol 4(2):60-78.
[38] Saubaki, M.Y. 2020. Production of Kesambi Wood Liquid Smoke (Schleichera oleosa Merr) and Its Application as Se'i Meat Flavoring. partners. Number 2:115-126.
[39] Sugiyanta., I.M. Dharmika and D.S. Mulyani. 2018. Application of Liquid Silica Fertilizer to Increase Growth, Yield and Drought Tolerance of Lowland Rice. J. Agron. Indonesia. Vol 46(2):153-160.
[40] Susilo, A., E. S. Widyastuti., H. Evanuarini and M. W. Apriliyani. 2023. Comparison of the Quality of Fermented Sausages with the Use of Yogurt Starter and Lactobacillus plantarum (pH, aw, and Proximate values). Journal of Research in Science Education. Vol 9(5):2319-2324.
[41] Syauqiah, I., M. Amalia and H.A. Kartinin. 2011. Analysis of Time Variation of Stirring Speed in the Adsorption Process of Heavy Metal Waste with Activated Charcoal. Technical Info. Vol 12(1):11-20.
[42] Swaswati, F., T. W. Agustini and E. N. Dewi. 2007. Liquid Smoke Performance of Lamtoro Wood and Corn Cob. Journal of Coastal Development. Vol 10(3):189-196.
[43] Taufiq, F., B.A. Kristianto and F. Kusmiyati. 2020. Effect of Silica Fertilizer on Soybean Growth and Production in Saline Soil. Journal of Agronomy Research. Vol 22(2):88-93.
[44] Talib, A., A. Husen and S. Gunawan. 2020. Organoleptic Test Characteristics of Smoked Skipjack Fish Using Liquid Smoke from Coconut Shell, Coconut Fiber and Mangrove Wood. Journal of Fisheries Agribusiness. Vol 13(1):69- 75.
[45] Triawan, D.A., A.V. Nasution., T.D. Sutanto., N. Nesbah., E. Widiyanti., M. Adfa., C. Banon. and R. Nurwidiyani. 2022. Preparation and Characterization of Liquid Smoke from Wood Sawdust Azadirachta excelsa (Jack) M. Jacobs and its Application as a Natural Rubber Coagulant. IOP Conf. Series: Earth and Environmental Science. 1108:1-6.
[46] Wilujeng, S., P. Laksitarahmi, Suharnanik and P. Tiaranisa. 2020. Antioxidant Maja Fruit (Aegle marmelos (L) Carrea) Lowering Blood Sugar Mus Musculus. Budapest International in Exact Sciences Journal. Vol 2(3):362-367.
[47] Wiyantoko, B. 2016. Petroleum Chemistry Lecture Module. Yogyakarta : Indonesian Islamic University.
Yulistiani, F., A. Husna., R. Fuadah., Keryanti. R.P. Sihombing., A.R.Permanasari and W. Wibisono. 2020. The Effect of Distillation Temperature in Liquid Smoke Purification Process: A Review. International Seminar of Science and Applied Technology. Vol 198:532-536.