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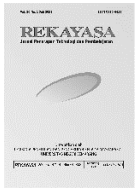

Community Empowerment To Purify Used Cooking Oil From Active Carbon Banana Peels In Pakintelan Village

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Abstract

Conditions The people of the Pakintelan area in village locations have a livelihood of selling cat rice, meatballs, and selling fried food. The repeated use of used cooking oil for frying is damaging human health to cause cancer. The availability of banana peel waste can be found at fried food sellers. This activity aims to increase the cooking oil user community's understanding and purify cooking oil by adsorption of activated carbon, and it can be reused. Increase public knowledge that banana peels can activate charcoal as a cooking oil purifier in the adsorber column. The method used is the socialization and education of conservation on the manufacture of activated carbon and the adsorption of cooking oil with a specific acid number. The results are by SNI and can be reused. Checking the results of purification and evaluation is carried out. Understanding the population using new cooking oil at week 4 reaches 83% of the samples tested. Cooking oil that is used at least five times is adsorbed with an acid number of 0.6. Products can benefit people's health, reduce cooking oil spending and increase knowledge and skills in purifying used cooking oil.

Keywords: used cooking oil, adsorption, purification, free fatty acids, pyrolysis

INTRODUCTION

Users of cooking oil are found in the food sector, Micro, Small, Medium Enterprises, and household scale. Users' habit of reusing used cooking oil for the main reason is cost savings. It is essential because of its relationship with health safety because it can cause carcinomas, among others. The field survey shows that many people process their used oil by adding or mixing it with fresh cooking oil. The behavior of purifying used cooking oil is like that, and traders can save on cooking oil to increase their income. (Suroso, 2013; Suryandari, 2014). People who use cooking oil to make snacks that use cooking oil are also found in Pakintelan Village.

Most women's education level in using cooking oil affects their ignorance and ability to adopt the technology. The innovation of cooking oil purification using activated carbon from banana peels and a practical purification process, use safely and correctly, and reduces the disposal of used cooking oil is a problem faced by people who use cooking oil.

The results were surveyed, and it was found that cooking oil has been used up continuously for a long time as long as the color is still brown

(not yet dark) and there is not much sediment. The trans fatty acid content of tofu products until the fourth frying pan is still within safe limits (Ilmi et al., 2015). Reuse by adding new cooking oil so that the color returns slightly yellowish—the fried food sellers by frying up to 5 times using new oil as the mixture. Mixing old and new cooking oil can reduce foodstuffs' quality due to a degradation reaction in cooking oil which has adverse effects on health, such as diarrhea, sore throat, fatty deposits in blood vessels, coronary heart disease, and cancer.

The oil that is brown with more than three uses will stick to food. The samples taken from the field were then tested for fatty acids (KOH titration), showing that the 1st sample was 1.28% and the 2nd sample was 2.31% after using it eight times with dark brown oil color (survey). The oil is no longer safe because it has exceeded the threshold for the percentage of free fatty acids set by SNI 3741-2013, which contains a maximum requirement of 0.6 (Table 1).

The reduction of cooking oil due to heating, such as free fatty acids, can be reduced by being absorbed using activated carbon. Activated carbon is made by utilizing banana peels only for disposal or as an alternative to goat feed. Based on the analysis of banana peels containing 15.36% cellulose and 18.71% lignin ((Koni, Therik, & Kele, 2013), the main component in the carbon formation synthesis of activated carbon. Banana peels. The research results that have been carried out by activated carbon can reduce the acid number and peroxide number in used oil, which causes a decrease in the quality of cooking oil (Rengga, 2020).

The hope is that used oil with 3-4 uses can be re-functioned because the acid number follows the SNI. There is the manufacture of activated carbon that uses village potential in the form of corn cobs waste, and it has been used to reduce acid numbers. This research has not shown an achievement like the SNI, which is 0.6 (Hadiyanti et al., 2016).

METHOD

The steps to implement the application of cooking oil adsorption in the field, especially the use of cooking oil in small businesses and households, are the method of socialization/counseling/awareness to partners through the socialization of the importance of the process of purifying cooking oil from used cooking oil (brown) to clear cooking oil and SNI. (acid number, iodide number). For four weeks, the team checked the acid number at the service location to find out the acid number in cooking oil that has been used for frying. This stage or method is carried out to determine the level of success of the service program that has been carried out. Evaluation is carried out until the occupation understands which cooking oil can be used and reaches a minimum of 80%.

Making Activated Carbon

The working procedure that supports the conservation of cooking oil and banana peel waste was to conduct socialization on the conservation of cooking oil purification using activated carbon from banana peels. People use oil purifiers to purify used cooking oil and reduce the waste of banana peels.

Procedure for making activated carbon of banana peels as follows. Dry banana peel slices carbonated at 400°C for 2 hours. The banana peel carbon was then sieved to 200 mesh. Chemical activation of KOH was used on the carbon of banana peels to improve its adsorption performance. The ratio used was KOH, as much as three times the weight of carbon. The mixing temperature between KOH and carbon was 200°C for about 5 hours until it becomes slurry. This slurry was activated in a furnace at 800°C for 1 hour by flowing nitrogen gas from the furnace (Rengga, 2020). The activated carbon that has been removed from the furnace is then washed with HCl, followed by washing the distilled water until pH 6-8. If the carbon is dry, then crushed again until it passes the 200 mesh sieve.

Table 1. A snippet of SNI 3741-2013 Cooking Oil Quality Requirements

Requirements test	unit	Criteria
Smell	-	Normal
Color	-	Normal
Moisture content and volatile matter	% w/w	0,15 max
Acid number	mg KOH/g	0,60 max
Peroxide number	Mek O_2/1 kg	1,00 max
Linolenic acid (C18:3) in the oil fatty acid composition	%	2 max

Determination of the acid number

The acid number was used as an indicator of the quality of cooking oil. The acid number calculation was the number of milligrams of KOH needed to neutralize 1 g of the sample. The acid number was calculated from the% value of many fatty acids in a 250 mL Erlenmeyer flask. To the sample, 50 mL of hot, neutral alcohol and 2 mL of phenolphthalein (PP) are added and then immediately titrated using 0.1 N KOH until the color changes from colorless to pink, not go away for 30 seconds. The number of acids can be expressed in terms of the percent of free fatty acids, calculated using equation 1.

Veq is mL of the volume titrant consumed by the oil sample and 1 mL of spiking solution at the equivalent point, beq is mL of the volume of titrant consumed by 1 mL of spiking solution at the equivalent point. The molecular weight of KOH is 56.1 g/mol. Weil is g of the mass sample.

$$AN = \left(V_{eq} - b_{eq}\right) N_{KOH} \frac{56.1}{W\ oil}. 1000 \quad (1)$$

Adsorption procedure

In the series of tools in Figure 1, the adsorber column was filled with 10 g of activated carbon. The bottom and top were given a glass wool support to keep the activated carbon down and up. The cooking oil adsorbed was put into the hopper and flowed into the adsorption column with a 4 mL /minute flow rate with a setting on the tap. The oil after adsorption was collected in a slightly closed container. Furthermore, the adsorbed oil was tested to obtain the acid number. Comparison with the Equilibrium Curve with data in the field, so those data deviations were known from decreasing cooking oil levels in Pakintelan Village.

RESULT AND DISCUSSION

Implementation of Science and Technology for Communities in Pakintelan Village, Gunungpati District, Semarang City. Observation activities, residents want to provide knowledge and skills in the form of socialization of activated carbon benefits as a used oil purifier. They are checking the acid number data for four weeks to determine that the public already understands cooking oil for a maximum of 5 times for frying. This monitoring was carried out to determine when activated carbon is regenerated using activated carbon. The population showed the students monitored an increase in the five senses and the frying number, the acid number of the used cooking oil. The longer the acid number of cooking oil that has not been used is lower than the previous acid number as in Table 2. The acid number test results were informed to the occupant who owns the sample and keeps it from more than 0.6. In Table 1, it is presented that in In the first week, the use of cooking oil and up to 5% of the samples taken had understood not to continue their cooking oil for frying.

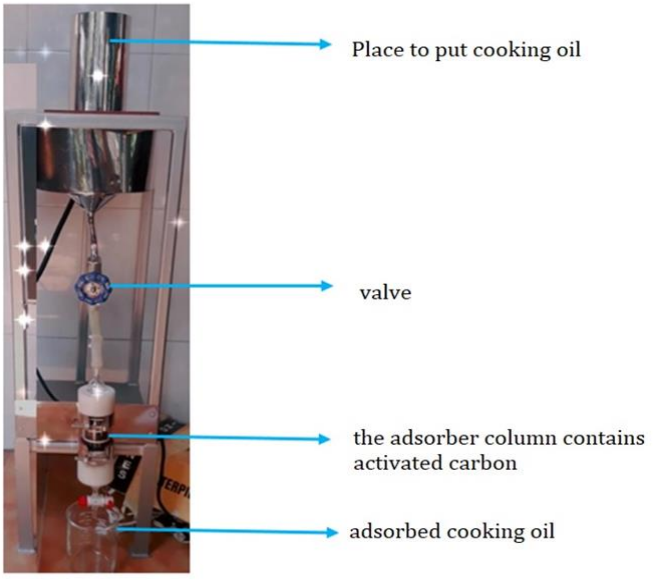

Figure 1. The process of purifying oil with activated carbon in the adsorber column

Tabel 2. The results of checking the acid number in used oil samples in the field

Week-	R1	R2	R3	R4	R5	R6	% which fulfills SNI
1	0.84	0.58	0.76	0.50	0.9	0.42	50
2	0.88	0.54	1.3	0.51	0.96	0.46	50
3	0.65	0.3	0.7	0.52	0.61	0.57	66
4	0.61	0.48	0.67	0.55	0.62	0.47	83

Seven respondents were sampled once per week for four weeks (Code R1 to R6)

The minimum requirement of SNI is 0.6

The information on the excessive acid number causes a warning for them to reduce the oil used again. Moreover, at week 4, they better understand cooking oil, which reaches 83% of the sample has reached a maximum acid number of 0.62. Continuous frying results in chemical reactions such as oxidation, polymerization, and hydrolysis, which changes the food system's physical and chemical properties of fats and, consequently, many byproducts such as free fatty acids (Nayak et al., 2016). Food is improved in quality by decreasing browning tendency and oil absorption, which causes chemical reactions related to foodstuffs that are still not fully understood due to Maillard reactions and starch gelatinization during frying (Xu et al., 2020). In the frying process, high-temperature oil conduction occurs, forcing the water out of the foodstuff in the form of bubbles. The technique of frying food at temperature and low pressure keeps the nutritional quality of the food intact, and the oil used does not spoil quickly and becomes saturated oil harmful to human health (Setyawan et al., 2013).

The primary determinant of the level of oil damage is water content. With the presence of oil-water, it will be easier to undergo the hydrolysis process, which is the beginning of the following oil decomposition process. The oil-containing, the more water, the more hydrolysis it increases. This designated water is water that is physically bound to oil. Therefore water can be separated from the oil by drying in an oven at 100–105 °C. Most of the oil damage was caused by oxidation and hydrolysis processes (enzymatic or nonenzymatic) (Venkata & Subramanyam, 2016). At the first time of the oxidation process, a peroxide compound was formed, an unstable compound and easy to react (Khanum & Thevanayagam, 2017). Furthermore, free fatty acid compounds were formed, a sign that the oil has been damaged.

The damage to cooking oil due to the presence of free fatty acids, which was finally adsorbed using the activated carbon of banana peels, is depicted in the equilibrium shown in Figure 2. Cooking oil analyzed at an acid number above 0.5 is then adsorbed for reuse. If the cooking oil had two free fatty acids, the activated carbon was adsorbed because it is saturated, and the viscosity becomes thicker than before. In the equilibrium graph of Langmuir free fatty acids with activated carbon of banana peels (previous research), the adsorption data obtained in the field are close to the equilibrium data obtained from previous research results with low deviations 7.4%.

The heating effect of cooking oil causes the oil to break down into free fatty acids and glycerol. The brown color of used cooking oil was caused by the bonding of carbohydrate and protein molecules, known as the Maillard Reaction, which is the reaction between the carbonyl group and the protein's amino group. The dark color of the oil can also occur during processing, storage, and oil use. Heating was too high and repeatedly causes polymerization reactions and Maillard reactions which cause the oil to thicken and darken. The number of acid numbers was reduced through the adsorption process with banana peels' activated carbon. Apart from free fatty acids, a small portion of protein undergoes acrylamide base formation from the used cooking oil portion during high temperatures (up to 200°C) and in less than 8 minutes (Daniali et al., 2018). However, the cooking oil used from the adsorption results shows the specifications under SNI.

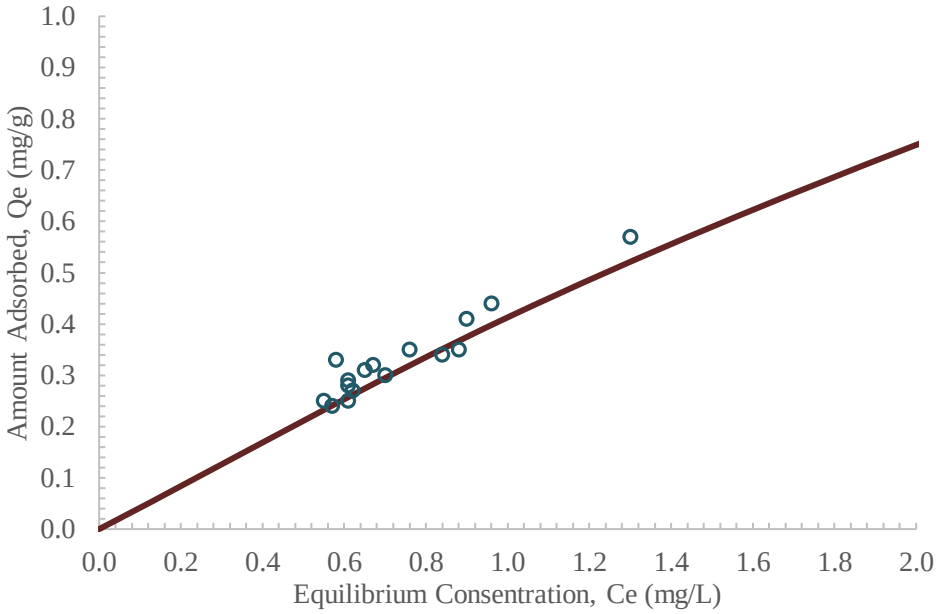

Figure 2. The equilibrium of used cooking oil from the population after adsorption

Evaluation is carried out on the entire program implementation to determine the usefulness of activated carbon. It has been proven that the color of used cooking oil is more straightforward than before, and the acid number can meet the permissible requirements. The presence of activated carbon makes it easier for snack food entrepreneurs to maintain the quality of cooking oil, impacting the snack products' quality. Treatment of used cooking oil with adsorbents can improve the quality of fried food and extend the life of cooking oil (Wonglamom & Rakariyatham, 2014).

CONCLUSION

The community understands that banana peel waste can be processed into activated carbon and used as an absorber for free fatty acids in used cooking oil. The community knows the correct use of cooking oil using an average of 3 to 4 times of frying from monitoring in the field. After monitoring for one month, the population's understanding found that only 17% had not met the criteria. In other words, the acid number was still high. The oil is adsorbed using activated carbon and has succeeded in decreasing it until it meets the requirements of less than 0.6. The oil can be reused for frying.

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