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Improving the Quality of Environmentally Friendly Liquid Smoke Distillation Process to Increase Artisan Income

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Abstract

The problems the Smoke-liquid Craftsman Group often faces are production capacity, product quality, and low selling prices. Low production capacity due to the limited ability distillation machine. The low quality of smoke-liquid products is due to the absence of standard quality. The smoke produced from the coconut shell charcoal production process has the potential to disturb the environment, so it has been carried out the process of melting smoke into liquid, which is then called smoke-liquid. However, the resulting smoke-liquid is still mixed with ash, brown colour, and intense aroma, and still contains much tar, so it does not meet the standard quality for food preservatives the price is low. The objective of this activity is to apply appropriate technology is carried out by enforcing standard product quality and repairing distillation machines to produce high-quality smoke liquid. This one is to support renewable and environmentally friendly energy programs while being able to increase revenue. Appropriate Technology (TTG) is in the form of improvements in distillation technology, which was previously a distiller using annular pipes, where the inner pipe is 1/2 inch. The outer pipe diameter is 1.5 inches and is changed with parallel heat pipe exchanger technology using an inner pipe with a diameter of 1 inch and an outer pipe with a diameter of 4 inches. The result of this service is prototyping a new distillation machine that can increase the production capacity and quality of liquid smoke that meets the specified standard quality and increase the selling price four times.

Abstrak

Permasalahan yang sering dihadapi oleh kelompok pengrajin asap-cair dari arang batok kelapa yang berada di Dusun Murangan, Desa Triharjo, Kecamatan Sleman, Kabupaten Sleman, Daerah Istimewa Yogyakarta adalah kapasitas produksi, kualitas produk, dan harga jual yang rendah. Kapasitas produksi rendah disebabkan mesin destilasi kemampuannya terbatas. Kualitas produk asap-cair yang rendah disebabkan belum adanya penerapan standar mutu baku. Asap yang dihasilkan dari proses produksi arang batok kelapa berpotensi mengganggu lingkungan, maka itu telah dilakukan proses pencairan asap menjadi cair, yang kemudian disebut asap-cair. Namun, asap-cair yang dihasilkan masih bercampur dengan abu (*fly ash),* warna cokelat, aroma menyengat, dan masih mengandung banyak tar sehingga tidak memenuhi standar mutu baku untuk pengawet makanan sehingga harganya rendah. Tujuan dari kegiatan ini adalah untuk menerapkan Teknologi Tepat Guna dengan memberlakukan standar mutu baku produk dan perbaikan mesin destilasi guna memproduksi asap-cair berkualitas tinggi. Hal ini untuk mendukung program energi terbarukan dan ramah lingkungan, sekaligus mampu meningkatkan pendapatan. Teknologi Tepat Guna (TTG) berupa perbaikan teknologi destilasi, yang sebelumnya destilator menggunakan pipa annular, dimana pipa bagian dalam berdiamter ½ inci dan diameter pipa bagian luar 1.5 inchi diubah dengan

teknologi *parallel heat pipa exchanger* dengan menggunakan pipa bagian dalam berdiameter 1 inci dan pipa bagian luar berdiameter 4 inchi. Hasil Pengabdian ini adalah pembuatan prototipe mesin destilator baru yang mampu meningkatkan kapasitas produksi dan kualitas asap-cair yang memenuhi standar mutu baku yang ditentukan serta meningkatkan harga jual menjadi empat kali lipatnya.

1. INTRODUCTION

The group of coconut shell charcoal craftsmen in Murangan hamlet, Triharjo Village, Kapanewon Sleman, Sleman Regency, Yogyakarta Special Region was founded in 2015 and led by Agus Winarno, assisted by four people as members, all of whom are residents. Business management is still conventional and has not involved modern Technology (Rinaldo et al., 2021). The level of education of its human resources is generally educated at the high school level and below. The availability of raw materials is relatively abundant in the surrounding area, especially the Sleman Regency area. This group has two furnaces used to process coconut shells into charcoal, with an installed capacity of 24 tons/month, and produce 6.8 tons/month of coconut shell charcoal products. The shell charcoal production process causes quite a lot of smoke and can potentially disturb the surrounding environment. Therefore, the problems often faced by the Coconut Shell Charcoal Liquid Smoke Craftsman Group of Murangan Village, Triharjo Village, Sleman District, Sleman Regency, Yogyakarta Special Region are production capacity, product quality, and low selling prices. Low production capacity is due to the limited characteristics of refiners. The non-fulfilment of quality standards causes the poor quality of liquid smoke products. The smoke produced while manufacturing coconut shell charcoal can interfere with the environment, so the process of melting smoke into a liquid is carried out, which is then called liquid smoke. However, the liquid smoke produced is still mixed with *ash (fly ash*), brown in colour, has a pungent odour, and still contains much tar, so it does not meet food quality standards, so the price is low.

Therefore, applying applicative technology is vital for setting product quality standards and improving distillation machines to produce quality liquid smoke (Gea et al., 2020; Sukirman et al., 2019; Xin et al., 2021). This one will support renewable and environmentally friendly energy programs and can increase revenues. Appropriate Technology (TTG) in the form of enhanced distillation technology. For this reason, there has been an agreement between the service and the artisans' group to improve management by applying quality standards to liquid smoke products and increasing revenue by improving distillation machines to produce high-quality liquid smoke to support renewable and environmentally friendly energy programs. Meanwhile, according to previous research (Tirono & Sabit, 2011), coconut shells can be processed into coal, the raw material for making charcoal briquettes through carbonization. This study aimed to determine the calorific value of coconut shell charcoal at different roasting temperatures. This study aimed to determine the effect of the writing process temperature on the calorific value of coal. In addition, to determine the production efficiency of coconut shells by analyzing the changes in most materials before and after writing. Carbon can also be used to make porous ceramic membranes, as researchers have done before (Dahlan et al., 2011). Although previous researchers (Ikhwan, 2016) also studied the effectiveness of using coconut shell charcoal as a filter in lowering iron content in 6 cm pool water and 9 cm pond water manganese. Based on the results of this study, it is recommended that the general public and the public, in particular, can improve water quality physically and chemically by using filters derived from coconut shell charcoal. In addition to making briquettes, coconut shell charcoal can also be used to make activated carbon (Wulandari et al., 2015). The export potential of coconut shells is very open and has been utilized by Banyumas Regency (Wulandari et al., 2015). Processing palm husk into activated carbon is an easy way to add economic value. Activated carbon has many industrial uses, including desulfurization in gas cleaning and LNG processing, auxiliary materials in filtration processes, and others (Elly, 2008; Ou et al., 2020). This study examines the most recommended methods and concentrations of liquid smoke in mackerel meat fillets and studies sensory characteristics (colour, smoke smell, smoke taste, suppleness, and generality) and physical condition. The results showed that the method and concentration of liquid smoke had no noticeable effect on the sensory characteristics of mackerel meatballs, such as colour and chewiness. Still, they had a different effect on the sensory characteristics of aroma and taste.

The effectiveness of liquid smoke in lowering the lead and heavy metal content in soybeans was evaluated. The results showed that the concentration of lead heavy metal decreased the higher the concentration of liquid smoke in the soaking bath (Hartati et al., 2015). This study aimed to determine the composition of volatile compounds in a mixture of coconut shell fractionated liquid smoke at different redistillation temperatures. This study's original liquid smoke was fractionated using three temperature changes: gradual distillation and condensation: 110ºC. Results showed that the redistribution of liquid smoke at a temperature of 100-110 °C had the highest overall yield of 85.70%. The smoked aroma from the gradual distillation of fractional distillation

varies from firm to very strong/spicy. The results of GCMS testing showed that liquid pipe smoke contains 42 different organic compounds. The compounds that affect the smell of liquid smoke are phenolic compounds, guaiacol derivatives, eugenol derivatives, and isoeugenol (Kadir et al., 2010). At the same time, studies were conducted to determine the effect of smoke liquid concentrations on rubber wood and coconut shells in reducing mass air pollution. As a coagulant, 15n 10% wood smoke liquid rubber coconut shell smoke produces good lump quality, perfect lumps, no strange smell, KKK 1 quality level, and meets the quality requirements of SNI 062047 2002. Therefore, liquid rubber wood and coconut shell smoke are environmentally friendly coagulants (Kadir et al., 2010). As seen previously, a large amount of smoke is generated in the production process, which can disrupt the environment. Therefore, it is necessary to liquefy exhaust gases into a liquid called liquefied exhaust gas to avoid disturbing the environment. However, the liquid smoke produced is still mixed with fly ash, so the price is low.

2. METHOD

As mentioned above, two problems faced by the partners are related to production problems and management problems (raw material, production process, product quality assurance management). So that the implementation method is needed in the form of counselling activities to the craftsman group, training in the production process and quality assurance, direct assistance to artisans, and measurement of the success of program implementation. Counselling is carried out to the group artisans so that they can gain insight and then want to adopt this improvement idea. Training on the production process of quality coconut shell charcoal, liquid smoke production, product quality assurance, and management training is carried out to improve the understanding and ability of artisans. Meanwhile, it is necessary to assist artisans directly in producing quality liquid smoke and management assistance starting from raw material management, production process management, and product quality assurance management. This activity is carried out by measuring the success of program implementation. It is important to know how successfully the programs and activities have been carried out, whether they are following the plan or not, as well as the obstacles encountered and the follow-up plan.

3. RESULTS AND DISCUSSION

The prototype of the existing distillation equipment is shown in Figure 1. This prototype requires several improvements to produce better-quality liquid smoke. The appearance of the improved distillation process is shown in Figure 2. There are improvement in new distillation equipment like dimensional change of the pipe.

Figure 1. Photo of previous Distiller Tools

Figure 2. Photo of the new Distillator tool

Appropriate technology is defined as any object, process, ideas, or practice that enhances human fulfillment through satisfaction of human needs (Hazeltine & Bull, 2003). Appropriate Technology (TTG) is in the form of improvements in distillation technology, which was previously distilled using annular pipes, as shown in figure 1, where the inner pipe dwells in a seter of 1/2 inch and the outer pipe diameter of 1.5 inches. After calculating and analyzing the rate of heat change, dimensional changes are carried out in parallel heat *exchanger* technology using an inner pipe with a diameter of 1 inch and an outer pipe with a diameter of 4 inches, as shown in Figure 2. This change produces a greater heat transfer rate, resulting in a more significant amount of liquid than before and a clearer, odorless, and non-tar-containing liquid-smoke quality, as shown in figure 4—smoke-liquid conditions before the distillation/distillation process, as shown in figure 3.

Figure 3. Liquid smoke before the distillation process

Figure 4. Liquid smoke after the distillation process

Unlike Figure 4, Figure 3 covers liquid smoke before the distillation process with characteristics: of brown color and intense aroma, still containing much tar and cannot be used for food preservatives. Figure 2 describes liquid smoke after the distillation process with characteristics: clear color and aroma are no longer intense, does not contain tar, and can be used for food preservatives or cosmetics. The economic review showed a significant increase in revenue before and after repairing the distillation machine. After the distillation process is carried out on coconut shell liquid smoke with this new machine, the sales price of liquid smoke increases from the price of Rp. 10,000 / L to Rp. 35,000 / L. Originally, the production of liquid smoke within 24 hours produced 80 L; for now, it has 129 L. An overview of the progress of artisans' income for seven months, from January to July 2022, can be seen in Figure 5.

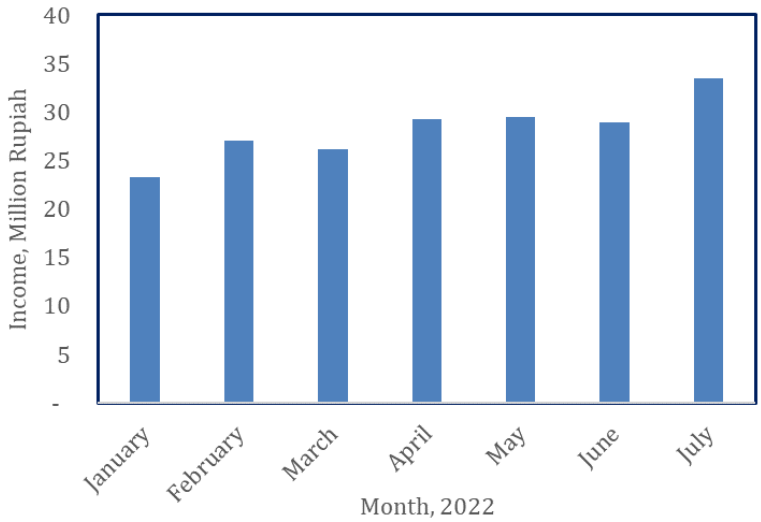

Figure 5. Income for seven last month

From Figure 5, it can be explained that there has been a very significant increase in artisan income over the past seven months because of the improvement of the distiller machine. Previously, research has been carried out related to the smoke-liquid content of shell charcoal. Meanwhile, research on the use of liquid smoke has been carried out by researchers before; for example, one of the goals is to obtain liquid smoke as a food preservative. The parameters observed are the production of liquid smoke, phenolic content, acetic acid, and benzo[a]bene. The results are phenol content of 1.20-1.35%, acetic acid of about 3.7 n, and benzo[a] bena content of 200-1400 µg/l. A good redistillation liquid smoke was obtained with a phenolic content of 1.2 N acetic acid of 3.69% in 4 distillations. Benzo[a]pyrene does not meet the requirements for natural food because The allowable amount of benzo[a]pyrene food preservatives is one ug/kg or one ug/l (Pangestu et al., 2014). This study aims to determine the effect of liquid smoke distillation and coconut shell redistillation on chemical properties (moisture, pH, phenol), microbiological properties (TPC), and sensory properties (colour, aroma, texture, and wholeness). Control of Pindang kites (Decapterus spp.) during conservation is also carried out. The results showed chemical properties, which include water content (61-67%), pH (5-7), phenol (0.226-0.566%), and microbiological properties (TPC) (1,85,104-3,15,105 CFU/g). Based on sensory characteristics (colour, aroma,

texture, and texture), fish cooked with liquid distillation smoke treatment is better than liquid distillation liquid smoke treatment. Regarding chemical, microbiological, and sensory properties, the redistillation liquid smoke treatment significantly differs from the distillation liquid smoke treatment. Previous research showed chemical and microbiological properties. 35% distillation liquid smoke treatment is the best treatment, while the sensory properties of liquid smoke treatment, 30% redistillation, are most in demand compared to other treatments (Himawati, 2010).

Previous researchers have also conducted studies to determine the effect of the liquid smoke cleaning process resulting from coconut shell pyrolysis on the composition of liquid smoke. Stage a distillation process carries out I purification at a temperature of 125 °C for 3 hours, and distillate is declared as Class II liquid smoke, followed by Stage II purification by an adsorption process using active zeolite so that Class I liquid smoke is obtained. 2.5; 3; 3.5 and 4 grams and 30 times zeolite contact; 50 and 70 minutes. The results showed that pyrolysis liquid smoke does not contain polycyclic aromatic hydrocarbons (PAHs) and undergoes changes in composition, especially phenols, whose percentage area increases from 34.72% to 81.28% after the distillation process and increases again after adsorption. The process is 89.22% complete. Changes in pH and color also occur in liquid smoke after the distillation and adsorption purification process, with the highest pH of 3.8 and the lowest of 3 (Septian & Nur, 2020).

Research to determine the effect of coconut shell liquid smoke on the intensity and mortality of Thrips parvis pinus pest attacks was conducted using an experimental method with a One-Way Complete Randomized Design (RAL)/factorial variance analysis (F Test) and high consistency. True Honest Distance Test (BNJ). Three concentrations of liquid smoke were used in this study, namely control, 3 ml, and 9 ml The average results observed for attack intensity one month after application of the control treatment, with an infestation of 49.6% (weight) and mortality of thrips were observed. does not occur, and the death criterion is ineffective. With a treatment of 3 ml, the intensity of death of 21.9% (mild) and the death of thrips 46% of the mortality criteria were quite effective. With a treatment of 9 ml of mortality intensity of 19% (mild) and death of thrips 56% effective mortality criteria. Coconut shell liquid smoke affects the intensity of the attack and death of the pest Thrips parvis pinus. This is because liquid smoke contains phenolic compounds, namely lilac and guaiac, which are gastric toxins.

The design of an incinerator with the Pahl and Beitz methods has also been carried out. This design provides comfort and convenience for the community in burning environmentally friendly waste and can also increase people's economic income by utilizing charcoal and liquid smoke. After designing an environmentally friendly incinerator that produces charcoal and liquid smoke is designed according to plan, this waste burner construction is made of drum material with a diameter specification of 0.58 M high 0.89 M with a capacity of 200 litres. Burned waste is solid waste. This incinerator can be used to reduce landfill waste and as a medium for household waste management for people in the Bangkinang district of the city (Ramadhani et al., 2022). Efforts have been made to increase the income of the coconut shell charcoal craftsman group "Maju Adil Makmur" in Murangan 7 Hamlet, Triharjo Village, Sleman District, Sleman Regency, Jogjakarta Special Region. The main problem is that the smoke produced from this production process can disrupt the environment due to its large volume. Therefore, a distillation process was developed that processes smoke into a liquid, which is then called liquid smoke. However, the liquid smoke is mixed with fly ash, so the price is low.

Therefore, the process of recycling liquid smoke has been carried out with advanced distillation methods to produce liquid smoke so that the price increases. As a result, the artisans created liquid smoke of much higher quality than before (Sukamta et al., 2020). Meanwhile, making liquid smoke by processing coconut shells, coconut shells, and mangrove wood was also studied and continued with sensory tests, including the appearance, taste, color, and texture of smoked fish products. This study used quantitative and qualitative analysis of the liquid smoke treatment of skipjack tuna. This study showed that liquid smoke from coconut shells was better than other treatments, with the highest scores for all parameters (appearance, taste, color, and texture) (5.92; 6.04; 6.4; 5.92 and 6.24). while other treatments with lower values (Talib et al., 2020).

Liquid smoke/wood vinegar/liquid smoke is a liquid product resulting from the condensation (condensation) of steam produced by direct or indirect combustion of lignocellulose materials. The main components of this liquid smoke are alcohol, phenol, and acetic acid. Its chemical compounds are plant protective agents and increase livestock productivity, odor control, health, medicine, and beauty. The raw materials for making liquid smoke can vary according to the type of waste in the environment, such as wood waste, palm nails, coconut shells, shells, spruce fruit, sawdust, eucalyptus leaves, etc. Many factors, such as the type of wood, moisture content, and combustion temperature, influence the composition of smoke. In Japan, the technology of making liquid smoke is developing rapidly, and many people use it daily, from preserving food to treating various diseases (Wianto et al., 2021).

4. CONCLUSION

This research produced a distillation machine prototype that was better than before. The increase in quality was due to changes in the new machine, including changes in the pipes' dimensions from an inner pipe diameter of 1.2 inches and an outer pipe diameter of 1.5 inches to an inner pipe diameter of 1 inch and an outer pipe diameter of 4 inches. The change in diameter causes an increase in the production capacity of liquid smoke which is more than the previous machine, and the quality of the liquid smoke produced. This research was also able to improve the quality of production according to predetermined quality standards. The selling price of liquid smoke produced from the new distillation machine is four times higher than the liquid smoke produced from the previous machine.

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