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SOAP PRODUCTION USING PLANTAIN PEEL ASH AS A SOURCE OF ALKALI; A STRATEGY FOR IMPROVING ENTREPRENEURSHIP EDUCATION IN TERTIARY INSTITUTIONS IN ANAMBRA STATE.

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ABSTRACT

This research investigated soap production using plantain peel ash as a source of alkali: a strategy for improving entrepreneurship education in tertiary institutions in Anambra State. The researcher utilized the cold method in the soap production process. Ingredients used were palm kernel oil, plantain peel ash, soda ash, salt, citrus fragrance, water, honey, sodium sulphate, and sodium silicates. Adding soda ash (Na_2CO_3) to the plantain peel ash solution enhances the saponification process for better soap quality. The study ensures safety by adjusting the lye's pH to a skin-friendly level, aiming for a final pH of 10. Including additives such as salt, citrus fragrance, and honey contribute to the soap's properties. Salt hardens the soap, citrus fragrance provides fragrance and potential antimicrobial benefits, and honey is a natural humectant, attracting moisture to the skin. These ingredients enhance the overall quality and appeal of the soap. The use of readily available plantain peels not only provides a sustainable source of alkali but also adds value to agricultural waste. The simplicity of the tools and materials required makes this method accessible to small-scale soap makers and communities seeking self-sufficiency in hygienic products. It was recommended, among others, that diving into using other agricultural waste as raw materials to produce sustainable products should be incorporated into the entrepreneurship education curriculum in tertiary institutions in Nigeria. This will give students practical skills and knowledge, fostering innovation and self-reliance.

Keywords: Ash, Entrepreneurship, Plantain peel, Soap production,

INTRODUCTION.

Soap production using plantain peel ash as a source of alkali is a valuable strategy for integrating practical entrepreneurship education in tertiary institutions in Anambra State (Omoregie & Musa, 2020). It promotes

sustainability by utilising agricultural waste and fosters student innovation and self-reliance. In addition, it aligns with Nigeria's agricultural abundance, offering a localized solution to soap production that can empower students with practical skills for small-scale businesses (Ismail & Abdullateef, 2019). Like many other regions in Nigeria, Anambra State faces challenges of unemployment and underutilization of agricultural resources. With its predominantly rural population and agricultural-based economy, there is a need for innovative approaches to entrepreneurship education that harness local resources and promote sustainable economic development. One such approach is soap production using plantain peel ash as a source of alkali (Obinna & Orizu, 2019).

Production of soap using plantain peel ash offers a significant opportunity to improve entrepreneurship education and economic empowerment in Anambra state. Plantain *(Musa paradisiaca*) is a staple food in many parts of Africa, including Anambra State. Consequently, plantain peels, typically discarded as waste, present a substantial environmental challenge. Effective agricultural waste management and utilization are critical for ecological sustainability (Atiku *et al.,* 2014). The rising cost of caustic soda (sodium hydroxide), a key ingredient in soap production, has significantly impacted the profitability of small-scale soap-making ventures, particularly in developing economies like Nigeria. As a result, the high price of commercially produced soap has made it less accessible to low-income communities. Studies demonstrated that plantain peel ash contains high levels of potassium carbonate (K_2CO_3), making it an excellent alternative to conventional alkali sources used in various industrial processes such as soap making, glass production, and fertilizer manufacturing (Zauro *et al*., 2016; Okpala, 2018). This alternative resource can reduce

the reliance on expensive caustic soda, lower production costs, and promote environmentally sustainable practices (Warra, 2013; Adesoji, 2021).

Soap is a cleaning agent composed of molecules with both hydrophilic (water-attracting) and hydrophobic (water-repelling) properties. This dual nature allows soap to emulsify oils and fats, which are not water-soluble, enabling them to be rinsed away with water (Wellman and Tartar, 2002). Soap comprises sodium or potassium salts of various fatty acids but chiefly of oleic, stearic, palmitic, lauric and myristic acids, i.e. the alkali metal salts of long-chain monocarboxylic acids. The process of making soap, known as saponification, involves the reaction of fats or oils with an alkali, typically sodium hydroxide (NaOH) or potassium hydroxide (KOH). The reaction produces glycerol (glycerin) and soap, which is an ionic compound formed by the fatty acid's carboxylate anion and a metal cation (sodium or potassium) (Wilson, 2019).

Entrepreneurship is designing, launching, and running a new business, typically a startup offering a product, process, or service. It involves the willingness to take risks and the initiative to capitalize on market opportunities. The concept encompasses developing, coordinating, and managing business activities to make a profit while tackling challenges and uncertainties. Entrepreneurship education in tertiary institutions is critical for fostering innovation and economic growth. Students can launch their businesses by learning to produce and market products derived from locally sourced raw materials such as plantain peel ash, thus fostering regional economic development. However, traditional curricula often lack practical components that connect theoretical knowledge with real-world applications (Kuratko, 2015). Using plantain peel ash as a substitute for caustic soda in soap

production to foster entrepreneurship education remains underexplored. This study, therefore, investigated the feasibility and effectiveness of using plantain peel ash in soap production as a cost-effective strategy to enhance entrepreneurship education in tertiary institutions, equipping students with practical and sustainable skills.

MATERIALS AND METHODS

Sampling and Sample Preparation

Sourcing of Plantain Peel

Unripe plantain peels were collected from Umunze in Orumba South LGA Anambra State. The collected plantain peels were sun-dried. The dried plantain peels were placed in a metal container and set on fire in an open, well-ventilated place, allowing them to ash completely. This took place at 400°C to 500°C. Once cooled, the plantain peel ash was collected and stored in an airtight container.

Gathering/Purchase of Oil

The prepared palm kernel oil was purchased from Nkwo Umuchu, Nkwo, in Aguata LGA of Anambra state.

Extraction of alkali from plantain peel ash.

Plantain peel ash weighing 1kg was measured using a hand scale. The measured ash was placed in a large bucket, and 1 litre of water was added. The mixture was thoroughly stirred. It was allowed to sit overnight to let the soluble potassium hydroxide (KOH) dissolve in the water. The solution was filtered through a fine sieve to remove the solid particles, leaving a clear lye ash solution.

Reducing Excess Alkali:

The pH of the lye solution was measured using a pH hydrometer. A typical strong lye solution's pH is 12.25, which is too caustic for

direct skin application. The excess alkali was reduced to 10 for a skin-safe level by slowly adding soda ash solution while continuously stirring and monitoring with a pH hydrometer.

Table 1: Ingredients for soap production and their measurement.

The primary ingredients are**:**

Ingredient	Quantity	Chemical Composition
Palm kernel oil.	2 Litres	Mainly lauric acid ($C_{12}H_{24}O_2$)
Plantain peel ash.	1 kg	Potassium carbonate (K_2CO_3) and potassium hydroxide (KOH).
Soda ash (sodium carbonate).	1 kg	Sodium carbonate (Na_2CO_3).
Salt (sodium chloride).	50g	Sodium chloride (NaCl).
Citrus fragrance	100ml.	Contains linalool ($C_{10}H_{18}O$) and linalyl acetate ($C_{12}H_{20}O_2$)
Water.	2 Litres	H_2O.
Honey.	50ml	Mainly fructose ($C_6H_{12}O_6$) and glucose ($C_6H_{12}O_6$).
Sodium Sulphate	1 teaspoon.	($Na_2S_I0_3$)
Sodium Silicates	50ml	(SLS)

Procedure for the Soap Production

The cold process method was used during the soap production. The procedures involved in soap production using plantain peel ash alkali include the following:

Step one: Plantain peel ash of 1kg and 1 Litre of water were mixed in a pot and boiled for 15 minutes. The mixture was then allowed to cool to room temperature.

Step Two: Palm kernel oil of 2 litres was measured into a plastic bowl.

Step Three: The cooled plantain peel ash solution was added to the palm kernel oil and stirred together.

Step Four: After dissolving the soda ash in water, one teaspoon of sulphate was added to 1 litre of soda ash solution.

Step Five: The soda ash solution was mixed with the plantain peel alkali and palm kernel oil and stirred continuously.

Step Six: To the solution in step five above, 50 ml of silicate, 50 grams of salt, and 50 ml of honey were added and stirred vigorously.

Step Seven: A citrus fragrance of 100ml was added to the soap mixture and stirred.

Step Eight: The soap mixture was poured into a prepared mould (plastic mould).

Step Nine: The mould was tapped to remove air bubbles.

After curing, the soap mixture Was allowed to cure for 24 hours, after which it was removed from the mould.

RESULTS AND DISCUSSION

The cold method process of soap production was used in this research work due to its advantage of preserving the beneficial oil and additives used while producing the soap. The study's method of extracting alkali is by dissolving the ash in water, boiling the ash, and filtering the solution (alkali) to obtain a clear lye solution efficiently. This traditional

technique is well-documented in literature on indigenous soap-making practices, where various plant ashes have been used successfully for centuries (Hojjat, 2017).

Adding soda ash (Na_2CO_3) to the plantain peel ash solution enhances saponification, improving soap quality. The study ensured safety by adjusting the lye's pH to a skin-friendly level, aiming for a final pH of 10. This is crucial because an excessively alkaline soap (pH above 10) can be harsh on the skin. Neutralizing excess alkali with an acidic substance like soda ash and purifying with salt helps achieve the desired pH balance, making the soap suitable for personal use (Bhatt *et al.,* 2023). Including additives such as salt, citrus fragrance, and honey contribute to the soap's properties. Salt hardens the soap, citrus fragrance provides fragrance and potential antimicrobial benefits, and honey is a natural humectant, attracting moisture to the skin. These ingredients enhanced the overall quality and appeal of the soap.

This method of soap production is highly feasible in local contexts where commercial lye may be inaccessible or expensive. The use of readily available plantain peels not only provides a sustainable source of alkali but also adds value to agricultural waste. The simplicity of the tools and materials required makes this method accessible to small-scale soap makers and communities seeking self-sufficiency in hygiene products (Failor, 2020).

The study found that the texture of the soap produced using plantain peel ash as an alkali source was generally smooth and firm. The addition of salt (sodium chloride) helped in hardening the soap, resulting in bars that were solid and durable. The soap’s texture was consistent with commercially produced soaps, indicating that the plantain peel ash lye was effective in saponification. The natural colour of the soap was influenced by the

ingredients used. Plantain peel ash typically imparts a greyish-to-brown hue to the lye solution, which can affect the final soap colour. However, adding palm kernel oil, usually light yellow or white, helped lighten the overall colour. The final product had a natural, earthy tone, which can appeal to consumers looking for natural and eco-friendly products; this is in line with Olabanji *et al*.,(2012). No synthetic colourants were used, maintaining the soap's natural aesthetic. The overall quality of the soap was high. It was effective in cleaning, lathering well, and leaving the skin feeling soft and moisturized without any harshness. The balanced pH level of 10 ensured the soap was gentle on the skin, making it suitable for regular use. The study showed that using plantain peel ash as an alkali source did not compromise the soap's effectiveness, and adding natural ingredients like honey and essential oils enhanced its quality. By utilizing agricultural waste (plantain peel ash) for soap production, students will learn about the importance of sustainability and waste management in business. This approach aligns with global trends towards green entrepreneurship (organic materials) and will inspire students to develop businesses that prioritize environmental conservation (Ghosh *et al*., 2016).

CONCLUSION AND RECOMMENDATIONS.

The study demonstrated plantain peel ash as an effective and viable source of alkali for soapmaking, yielding a product that is both high quality and safe for skin use when adequately processed. This traditional method, supported by careful pH adjustments and beneficial additives, offers a sustainable and accessible approach to soap production in local contexts. The cold method of soap production using plantain peel ash as a source of alkali demonstrates that traditional techniques can be effectively utilized to

create high-quality, natural soap. The results indicated that plantain peel ash, combined with other natural ingredients such as palm kernel oil, honey, and citrus fragrance, produced soap with desirable characteristics: smooth texture, natural colour, pleasant aroma, and overall high quality.

The study recommended using agricultural wastes to produce sustainable products, which could be incorporated into the entrepreneurship education curriculum in tertiary institutions in Anambra state. This would give students practical skills and knowledge, fostering innovation and self-reliance.

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