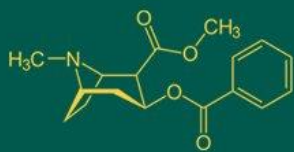


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Meghna S Kelgeri
Department of Resource
Management and Consumer
Science, College of Community
Science, University of
Agricultural Sciences,
Dharwad, Karnataka, India

Veena S Jadhav
Department of Resource
Management and Consumer
Science, College of Community
Science, University of
Agricultural Sciences,
Dharwad, Karnataka, India

Renuka Salunke
Department of Resource
Management and Consumer
Science, College of Community
Science, University of
Agricultural Sciences,
Dharwad, Karnataka, India

Sarojini Karkannavar
Department of Resource
Management and Consumer
Science, College of Community
Science, University of
Agricultural Sciences,
Dharwad, Karnataka, India

TR Shasidhar
Department of Resource
Management and Consumer
Science, College of Community
Science, University of
Agricultural Sciences,
Dharwad, Karnataka, India

Corresponding Author:
Meghna S Kelgeri
Department of Resource
Management and Consumer
Science, College of Community
Science, University of
Agricultural Sciences,
Dharwad, Karnataka, India

Determination of potash content in the cassava peels for soap production

Meghna S Kelgeri, Veena S Jadhav, Renuka Salunke, Sarojini Karkannavar and TR Shasidhar

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Abstract

Tuber crops play an important role in both food and non-food industries, particularly in the paper, textile, soap, and detergent sectors. They contain natural saponins, which act as surfactant compounds responsible for foaming and cleansing properties. Additionally, tubers are rich sources of carbohydrates, vitamins, and minerals that contribute to skin nourishment and moisturizing properties. The present study was conducted to evaluate the suitability of cassava, elephant foot yam, and *Colocasia* peels as potential sources of potash for soap production. The selected tubers were analyzed for their physical characteristics, proximate composition, ash yield, and potash concentration. The results revealed variations in the physical appearance of the selected tubers. Elephant foot yam was round in shape with brown skin and pinkish-orange flesh, *Colocasia* was dwarf with light brown skin and pinkish-white flesh, while cassava was cylindrical with natural oak-brown skin and milky-white flesh. Four kilograms of each tuber were processed, and the peels were sun-dried and burned to obtain ash. Cassava peel produced the highest ash yield (16.00 g) compared to elephant foot yam and *Colocasia*. Proximate analysis showed that moisture content was highest in elephant foot yam peel (22.49%), followed by *Colocasia* (18.30%) and cassava (17.23%). The ash content was highest in cassava peel (14.74%), followed by elephant foot yam (12.69%) and *Colocasia* (10.83%), while fat content was highest in elephant foot yam (2.24%), followed by cassava (1.80%) and *Colocasia* (0.33%). The determination of potash concentration showed that cassava peel ash extract exhibited a colour change from orange to pink during titration with hydrochloric acid using methyl orange indicator, indicating a higher concentration of alkaline compounds compared to elephant foot yam and *Colocasia*. The findings suggest that cassava peel ash has greater potential as a natural source of potash for soap production. Utilization of cassava peel waste for local soap manufacturing can provide a low-cost, sustainable, and eco-friendly alternative raw material while reducing agricultural waste.

Keywords: Tuber crops, cassava peel, potash, ASH, soap production, agricultural waste, alkali source

Introduction

Tuber crops attain as the second most important energy provider crops after cereals. They contribute about dietary and are important sources of animal feed and raw materials for the production of industrial products. Tuber is a thickened underground part of stem. Technically a tuber is either a modified stem or modified root, for example sweet potato, potato, cassava and *Colocasia*. Globally tuber crops are grown in an area of 67 million ha with a production of 887 million tonnes in 2017 (FAOSTAT, 2019) [4]. In Karnataka, Western Ghats region including Sirsi, Joida and Yallapura talukas of Uttara Kannada district and Mysore district are a treasure trove for these tuber crops. More than twenty types of tubers are cultivated in Western Ghats region of Karnataka.

There are many agricultural waste materials generated in homes and littered all over the environment. These materials include palm bunch, coco-pod, plantain peels, banana peels, maize cobs, cassava peels and others. Some of these agricultural waste like coco-pod are adverse to soil fertility and so constitute environmental nuisance to man. So they are a potential viable source which needs to be harnessed for other uses and to save the environment. According to Adewuji, Obi-Egbado and Babayemi (2008) [1], several agricultural wastes of vegetable origin yield a high potash when combusted. These materials include plantain peels, cassava peels, palm bunch, wood and others. The local production of potash

from these agricultural wastes has been observed to be a cheaper alternative source of this much needed chemical used in the production of soap and other alkalis based products (Adewuji *et al*, 2008). While Onyegbado, Iyagba and offor (2004) ^[1, 7] has observed that alkali content of potash obtained from ashes of plants origin were high and good for soap production. Presently, the art of homemade soap using caustic soda is gaining acceptance because of emphasizes on entrepreneurship education in our educational system. Production of soap using agricultural wastes is a veritable source of gainful employment for individuals. Soap is one of the most essential needs of man used for several purposes. Therefore, soap made with potash characteristically provide fulfillment to the important need of man for maintaining cleanliness. However, in spite of the popularity of homemade soaps and the benefits of its production, homemade soap has not been given the adequate attention that it deserves by students of home economics. Similarly, its potentials as a medium for showcasing creativity is not fully being exploited. Also the concern of this study equally is the fact that the production of homemade soap is a very viable business opportunity for self-employment, which home economics graduates can exploit. The recent emphasis on entrepreneurship in our educational institutions makes it imperative that opportunities that can be exploited for self-employment should never be neglected. Thirdly, several agricultural wastes are littered all over the environment and accumulation of these wastes poses a serious health hazard apart from being an eyesore. Throwing away some of these agricultural wastes is a waste of resources which are potential source of raw materials needed to soap making and also the disposal is a waste of hidden treasure. Therefore, such agricultural wastes could be converted to potash used for soap making.

Homemade soap using local raw materials is an ancient and amazing method that is used in producing soaps for the family use in the olden days. Technically, soap making involves the use of sodium salts (Isaac, 2005) ^[5]. Aesthetically, homemade soap is one of the soaps used in the family cleaning chores. But recently this skill of soap making is gradually fading away that the younger generation may not be able to enumerate the ingredients in soap making not to mention making the soap itself. The making of soap using vegetable matter has been an age-old craft, unfortunately the soaps that were made then, were soft, black, smelly and corrosive to the hands. So there is need for improvement which the study is all about. Soap is one of the cleaning materials needed by every family (Anyakoha, 2011) ^[2]. Soap is so important that there is hardly any family that does not use it in their daily activities either in the solid bars, liquid and detergent forms. Soaps are salts of fatty acids and it may be hard or soft soap depending on the type of ingredients used (Okeke, 2009) ^[6]. Soaps are made by the hydrolysis of fats with caustic soda (Sodium hydroxide), thus converting the glycosides of stearic, oleic and palmitic acids into sodium salts and glycerol. Soaps have a cleansing action because they contain negative ions composed of a long hydrocarbon chains attached to a carboxyl group (Okeke, 2009) ^[6]. The hydrocarbon chain has an affinity for grease and oil and the carboxyl group has an affinity for water. That is why soaps are mostly used with water for bathing, washing and cleaning. They are also used in textile industries for textile spinning. Soaps often occur in form of

solid bars or liquid form. Tubers contain the natural saponins, which are surfactant compounds. Surfactants are responsible for foaming and cleaning properties in soaps and detergents. Tubers are rich in carbohydrates, vitamins and minerals, which help to nourish and moisturize the skin. Production of local soap using ashes is a cheap method and could meet the need for raw materials used in soap production.

Objectives of the study

- To screen the different tubers suitable for extraction of soaps and detergents
- To analyze the analytical properties of selected tubers

Materials and Methods

- **Area of the study:** The area of the study is conducted in University of Agricultural Sciences Dharwad, College of community science, Department of Family Resource Management.
- **Design of the Study:** The study adopted experimental design. The experiment were carried out in the laboratory of College of community science, Department of Resource Management and Community Science. University of Agricultural Sciences Dharwad,
- **Collection of tubers:** The tubers were collected from the field namely cassava, elephant foot yam and *Colocasia* which are locally available. The different tubers were cleaned, washed, peeled separately and then made to sun dry for one week in the laboratory
- **Preparation of ash:** The peels of the tubers were gathered, the dirt from the peels was separated, and it was made to dry in the sun for two weeks until it is properly dried. The peels were burned separately until it is properly burnt, after that the ashes were gathered into a clean container and stored.
- **Determination of Physio chemical properties:** The dried peels were made to grind and then the moisture, fat, ash content in the peels of each tubers were analyzed by AOAC method ^[3]

Determination of potash concentration of the ashes

- 5g of plantain ash
- 5g of cassava ash
- 200mls of distilled water
- Methyl orange
- 2 filter papers
- 0.1m of Na₂ CO₃
- 0.5m of Hcl Laboratory equipment
- Pipette
- Biurette
- Conical flasks
- Retort stand
- Beakers
- Glass stirrer

Procedure for Titrations

- Measure out 100mls of distilled water into each of the beakers
- Add 5g of each ash into the three beakers and stir properly
- Boil the solutions, allow to cool, very well and filter it with filter papers separately
- Measure out 25mls of HCL with the burette
- Take 2mls of each solution and put in a clean conical flask, add a drop of methyl orange Titrate until the colour changes to pink. This shows that the concentration is high.

Results and Discussion

Table 1: Physical appearance of the tubers

Types of Tubers	Appearance	Skin Colour	Flesh Colour	Size/Weight
Elephant foot yam		Brown	Pinkish orange	Large (2-5 kg/tuber)
<i>Colocasia</i>		Light Brown	Pinkish White	Small (50-300 g/tuber)
Cassava		Natural Oak Brown	Milky white	Medium to large (0.5-3 kg/tuber)

Table 1 represents the physical characteristics of the selected tubers, namely elephant foot yam, *Colocasia*, and cassava. The results showed variations in their appearance, size, skin colour, and flesh colour. Elephant foot yam was observed to be round in shape with a large tuber size, brown skin colour, and pinkish-orange flesh. *Colocasia* was comparatively smaller in size with a dwarf and round appearance, light brown skin, and pinkish-white flesh colour. Cassava showed a cylindrical and elongated appearance with medium to large tuber size, natural oak-brown skin colour, and milky-white flesh colour. The differences in physical characteristics indicate the variation among tuber species, which may influence their processing properties and utilization for industrial applications such as soap production.

Table 2: Price of tubers from growers to local market

Tubers	Market price (Rs)	Field price (Rs)
Elephant foot yam	75	Below 25
<i>Colocasia</i>	50	
Cassava	220	

Table 2 represents the market price and field price of the selected tubers. The results showed that there was a considerable difference between the market price and the price received by growers. Among the selected tubers, cassava recorded the highest market price of ₹220/kg, followed by elephant foot yam (₹75/kg) and *Colocasia* (₹50/kg). However, the field price of all the tubers was found to be below ₹25/kg, indicating a large variation between producer-level and market-level prices. The higher market value of cassava suggests its greater demand and economic importance, while the low field price indicates the

possibility of value addition through processing activities such as extraction of potash from peels for soap production.

Table 3: Proximate composition of different tuber peels

Peels of tubers	Moisture (%)	Fat (%)	Ash (%)
Elephant foot yam	22.485±0.12	2.24±2.16	12.69±1.52
<i>Colocasia</i>	18.299±1.40	0.33±1.16	10.83±2.32
Cassava	17.23±1.32	1.80±1.42	14.74±1.83
F- value	3.180	20.125	5.623
SEM	0.180	0.489	0.090
CD	1.12*	0.32*	1.38*

Table 3 represents the proximate composition of different tuber peels, including moisture, fat, and ash content. The results revealed significant differences among the selected tuber peels. The moisture content was found to be highest in elephant foot yam peel (22.48±0.12%), followed by *Colocasia* (18.29±1.40%) and cassava (17.23±1.32%). The lower moisture content observed in cassava peel indicates better suitability for drying and ash preparation.

Regarding fat content, elephant foot yam peel recorded the highest value (2.24±2.16%), followed by cassava (1.80±1.42%) and *Colocasia* (0.33±1.16%). The ash content, which indicates the mineral composition and potential alkali availability, was highest in cassava peel (14.74±1.83%), followed by elephant foot yam (12.69±1.52%) and *Colocasia* (10.83±2.32%). Statistical analysis showed significant differences among the tuber peels for moisture, fat, and ash contents, as indicated by the F-values and critical difference (CD) values. The higher ash content of cassava peel suggests greater mineral concentration and potential for potash extraction for soap production.

Table 4: Determination of Potash Content in Different Tuber Ashes

Tuber Ash Sample	Indicator Used	Observation During Titration	pH Value	Interpretation
Elephant Foot Yam	Methyl Orange	No distinct colour change observed	6.70	Slightly acidic; low potash content
<i>Colocasia</i>	Methyl Orange	Slight colour change observed	8.10	Mildly alkaline; moderate potash content
Cassava	Methyl Orange	Colour changed from orange to pink	9.37	Moderately alkaline; high potash content

Table 4 presents the determination of potash content in the ash obtained from different tuber peels using methyl orange as an indicator. The results showed noticeable differences in the alkalinity of the ash extracts. Cassava peel ash exhibited a distinct colour change from orange to pink during titration and recorded the highest pH value of 9.37, indicating a higher concentration of alkaline compounds and potash content. *Colocasia* ash showed a slight colour change with a pH value of 8.10, suggesting moderate alkalinity and potash concentration. In contrast, elephant foot yam ash showed no distinct colour change and recorded the lowest pH value of 6.70, indicating comparatively low alkalinity and potash content. Based on the pH values and titration observations, cassava peel ash was found to be the richest source of potash among the tubers studied, making it more suitable for soap production.

Conclusion

The present study demonstrated that tuber peels, particularly cassava peels, possess significant potential as a sustainable source of potash for soap production. Among the three tubers evaluated, cassava peel exhibited the highest ash content (14.74%), the highest pH value (9.37), and a distinct colour change during titration, indicating a greater concentration of alkaline compounds essential for soap making. In contrast, elephant foot yam and *Colocasia* showed comparatively lower alkalinity and potash content. These findings confirm that cassava peel ash is more suitable for the production of locally manufactured soaps and detergents.

The utilization of cassava peel waste for potash extraction offers an eco-friendly and cost-effective alternative to commercial alkalis, while also addressing agricultural waste disposal challenges. Converting cassava peels into value-added products can promote resource utilization, environmental sustainability, and rural entrepreneurship. Therefore, cassava peel ash can serve as a promising raw material for small-scale soap industries and community-based enterprises. Further studies involving quantitative analysis of potassium content and soap quality evaluation are recommended to enhance its commercial application.

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