Preparation of shoe polish from banana peels and proper utilization of solid waste

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Abstract: *Banana and banana parts serves as a unique ideal and low-cost food source in developing countries where most of the populations depend upon for taking cheaper rate nutrition fruits. Banana peels consists of different mineral content indicate the concentrations (mg/g) of potassium, calcium, sodium, iron, manganese, bromine, rubidium, strontium, zirconium and niobium. Market shoe polishes are made from variety of toxic materials which are very harmful and hazardous for human's health. In this research study, it is described by giving information that how natural and eco-friendly shoe polish can be prepared using natural material. Banana peel is chosen because banana peels as key ingredient many are saying that it has much potential. It is more natural and free from toxic and hazardous substances. In this article main focus on the minerals and proximate composition, anti-nutritional content of banana peels; presence of basic radicals of banana peels; the proper methodology of banana peel extraction; preparation of shoe polish agent from banana peel extract and finally properties of shoe polish. This research tells about the ethical manufacturing and waste management process and emphasizes on resource management. This considerably shows the waste generation process and also its alternate application in another field.*

KEY WORDS: **banana peels; composition; metal ions; shoe polish; eco-friendly; properties**

1.INTRODUCTION

Shoe polish is a paste, cream or liquid used to polish, shine the shoes to extend the footwear's life and improve their appearance. It is a substance that is added externally to shoes to make them look cleaner and help them shine better. Shoe polishing agent is an important 'food' for the shoe. Today, shoe polish is usually made from a mix of natural and synthetic materials, including naphtha, turpentine, dyes, and gum arabic, using straightforward chemical engineering processes. Various natural substances have been used as shoe polish for hundreds of years, such as banana peel, beeswax, tallow, mango shell, charcoal etc. For this study, banana peel is taken as a raw material as it contains huge amounts of potassium and calcium which are able to act on leather surface as cleaning agent as well as shining.

Banana is the common name for a fruit and also the herbaceous plants of the genus *Musa* which produce the commonly eaten fruit. They are cultivated primarily for their fruit, and to a lesser extent for the production of fiber and as ornamental plants. Banana (*Musa sapientum)*, is grown worldwide and consumed as ripe fruit or used for culinary purposes. Peels form about 18-33% of the whole fruit and are a waste product. Global production of bananas is estimated to be around 48.9 MT [1]. It has originated from South–East Asia with M. acuminata and M. balbisiana as its ancestral species. It is an herbaceous plant of the family Musaceae [2]. In Bangladesh, major districts of cultivated Banana are Narsingdi, Gazipur, Tangail, Rangpur, Bogra, Natore, Pabna, Noakhali, Faridpur, Khulna in our country. Bangladesh ranks 14th among the top 20 banana producing countries in the world. The country produces nearly 1.00 million tons of bananas annually [3]. The total per capita consumption in Bangladesh is about 4.7 kg [4]. In addition, banana stood first position among the fruits producing in the country and supplies 42% of the total fruit requirements in the country and also its financial return as a crop is higher compared to other fruits and field crops [5]. Significant quantities of banana or plantain peels, equivalent to 40% of the total weight of fresh banana, are generated as a waste product in industries producing banana-based products [6].

Musa sapientum peels were analyzed for minerals, nutritional and anti – nutritional contents.

Table 1: Minerals composition of Musa sapientum peel [7]

Element	Concentration (mg/g)
Potassium	78.10 +/- 6.58
Calcium	19.20 +/- 0.00
Sodium	24.30 +/- 0.12
Iron	0.61 +/- 0.22
Manganese	76.20 +/- 0.00
Bromine	0.04 +/- 0.00
Rubidium	0.21 +/- 0.05
Strontium	0.03 +/- 0.01
Zirconium	0.02 +/- 0.00
Niobium	0.02 +/- 0.00

The percentage concentrations of protein, crude lipid, carbohydrate and crude fiber were 0.90, 1.70, 59.00 and 31.70 respectively. The results indicate that if the peels are properly exploited and process, they could be a high-quality and cheap source of carbohydrates and minerals for livestock [7].

Table 2: Proximate composition and anti - nutritional content of *Musa sapientum* peel [7].

Parameter	Concentration
Moisture (%)	6.70 + 02.22
Ash (%)	8.50 +1.52
Organic matter (%)	91.50 + 0.05
Protein (%)	0.90 + 0.25
Crude Lipid (%)	1.70 + 0.10
Carbohydrate (%)	59.00 + 1.36
Crude Fibre (%)	31.70 + 0.25
Parameter	**Concentration**
Hydrogen cyanide(mg/g)	1.33 + 0.10
Oxalate (mg/g)	0.51 + 0.14
Phytate (mg/g)	0.28 + 0.06
Saponins (mg/g)	24.00 + 0.27

As a raw material of polishing agent, banana peels are very preferable. The oils and the potassium of the banana polish preserve shoes. The natural oils in the banana soak into the leather, helping shoes to last longer, whilst potassium, a key ingredient in commercial shoe polish, is found in abundance in bananas. The most significant approach in preventing environmental pollution is the idea that prevention is better than reuse, reuse is better than recycling, and recycling is better than disposing of the wastes. Here keeping this motto, banana peelings are used for the production of shoe polish. As a result, extraction of banana peel may be used as an ingredient of shoe polishing. It is very economic as well as toxic chemical free which saves our environment and reduce wastage.

2. Materials and Methods

2.1. Materials

Banana peeling is the raw material to work as a shining agent for shoe polish. The banana peelings were collected from public markets and another locality and processed.

2.2. Chemicals and Instruments

Beeswax($C_{15}H_{31}COOC_{30}H_{61}$), Soap flakes(concentration of pure castile soap), Gum arabic powder (hardened sap of *Acacia nilotica* tree), Icing sugar (milling normal granulated sugar into powdered state), Carnauba wax [aliphatic esters (40 wt%), diesters of 4-hydroxycinnamic acid (21.0 wt%), ω-hydroxycarboxylic acids (13.0 wt%), and fatty acid alcohols (12 wt%)], Lemon grass oil (extracted through the process of steam distillation of dried lemongrass) and others raw materials were purchased from Hatkhola Road, Dhaka Bangladesh. All materials are analytically graded. For the determination of the concentration of certain metal ions (Na and K) in banana peel extract samples has been done by the flame photometer device. Electric Wall Oven was used to dry banana peel extract liquor. Hot water was used for banana peelings extraction. Electrical Balance (Model: SPB 31, max 300 gm, Deviation: 0.1 mg, Kaifeng Group Co.) Hot Plate Stirrer (Material: Ceramic, Temp: Up to 350°C, Thermolyne Mirak), Beaker (1000 ml), Measuring Cylinder (250 ml), Volumetric flask, Bunsen burner, Electric rotator, Glassware, Glass rode, P^H meter, Filter paper, Foil Paper, Besin, Tristand, Wirenet were used.

2.3. Extraction Process

For the extraction of the potassium from the banana peels, the main raw material are banana peelings were taken into a considerable amount. Peels were washed with distilled water. Then they had to dry for 2-3 days in the sun and then dried in oven at 50 ±1°C. The dried peel was grounded into powder using a lab grinder and stored in air-tight. A record of the yield of peel from fruit and after converting to powder was maintained and stored in a wide mouth plastic bottle in refrigerator until use.

2.4. Preparation of Banana Peel Extract

Sample -1: 10gm of ashes or powder of banana peels were taken into a beaker and 100 ml normal water (at room temperature) was mixed into it. Then a gravity filtration was performed. Sample -2:10gm of ashes or powder of banana peels were taken into a beaker and 100ml hot water was mixed into it. Then after cooling, a gravity filtration was performed. Sample-3: 20 gm powder was added with 80 ml acetone for 24 h at room temperature. Extracts was filtered and concentrated under reduced pressure at 40°C using a rotary evaporator until a crude solid extract were obtained which were then freeze-dried for complete solvent removal. Sample-4: Fresh banana peel was used for the extraction. By the deep-freezing method, with two fresh banana peels were added with 80 ml ethanol. 20 ml water was added to the extract, which was then filtered using filter paper. Sample-5: 20gm of fresh banana peel was added into 100ml of deionised water and boiled for 10 minutes. The content was cooled for few minutes. It was then filtered using filter paper.

Table 3: Concentration of Potassium and Calcium in banana peel extract sample

Sample No	Potassium (ppm)	Calcium (ppm)
Sample 1	3649.9	192.63
Sample 2	3906.38	146.235
Sample 3	56.31	3.26
Sample 4	2181.619	39.726
Sample 5	3290.1	31.986

2.5. Result

The concentration of Potassium in mg/g in Banana Peel Extract Sample

Sample No	Potassium (mg/g)	Calcium (mg/g)
Sample 1	36.499	1.92
Sample 2	39.0638	1.46
Sample 3	0.225	0.013

Sample 4	2.371	0.043
Sample 5	14.54	0.32

From the result, in Banana peel extract sample 2, the concentration of Potassium is high (39.0638 mg/gm) and in Banana peel extract sample 1, the concentration of Calcium is high (1.92 mg/gm). So, Banana peel extract sample 2 is best for the producing of banana peel extract as the concentration of potassium is high.

2.6. Preparation of Shoe Polish Sample from the Banana Peel Extract (Sample 2)

For the production of the polishing agent from the banana peel, the process of the banana peel extract sample 2 has been repeated. First a beaker (1000 ml) and a measuring cylinder (250 ml) were cleaned by water and dried them in an oven at 100°C. 150 gm banana peelings powder was taken and put it to the beaker. 500 ml hot water was added into the beaker and powder was dissolved with the help of glass rod. Then gravity filtration was done by the filter paper.380 ml liquor was found after filtration. Heat was given to the beaker by the bunsen burner. When the liquor was half of its amount, then besin was used to dry it more by using water bath. Then oven was used to dry it more at 40°C. After some time almost, dry dye of polishing agent was found. The total weight of the dry dye is 52 gm. So, the result is 35.18% for the 100 gm banana peels powder.

2.7. Shoe polishing recipes

Table 5: Comparison table of the constituents of three polish sample

Constituents	Sample -1	Sample -2	Sample -3
Banana Peel Extract	5 gm	10 gm	15 gm
Beeswax	20 gm	20 gm	20 gm
Soap Flakes	5 gm	5 gm	5 gm
Gum Arabic Powder	10 gm	10 gm	10 gm
Icing Sugar	8 gm	8 gm	8 gm
Carnauba Wax	10 gm	10 gm	10 gm
Water	150 ml	150 ml	150 ml
Lemon Grass Oil	1ml	1 ml	1 ml

2.8. Procedures

First a beaker (500 ml) and a measuring cylinder (250 ml) were cleaned by water and dried them in an oven at 100 °C. Banana peel extract, Beeswax, Soap flakes, Gum arabic powder, Icing sugar and Carnauba wax was taken by weighing and was done by electric balance and put it for next use. Distilled water was poured into the beaker (measuring was done by the measuring cylinder). The beaker was placed on the tristand and water was boiled by applying heat of bunsen burner. The beeswax was sliced and when water was in boiling form, beeswax was added into it and the mixture had to stir with glass rod. After melting the Beeswax, Carnauba wax, Soap flakes and Banana peel extract was added into the mixture. The mixture was boiled until it turned into a smooth paste. Then the heat was turned off and icing sugar, gum arabic powder and lemon grass oil were mixed into the mixture. Then the sample was rotated with the help of electric rotator for some minutes. The polish sample was ready after cooling.

Sample 1	Sample 2	Sample 3

Fig: Polish sample 1, 2, and 3

2.9. Quality Assessment of Prepared Shoe Polish

Table:6 Analysis of Characteristics of Tested Sample

Sample No	Melting Point	pH	Moisture Content
Sample 1	66° C	5.32	84.25%
Sample 2	52°C	6.68	86.71%
Sample 3	60°C	7.81	97.27%

3. RESULTS AND DISCUSSION

3.1. Melting Point

Sample-1 contains higher melting point and Sample-3 contains lower melting point. Very higher and lower melting point is not suitable for shoe polish except some special cases. Higher melting point contain shoe polish is very hard type and lower melting point contain shoe polish is liquid type. Here among three samples, sample-3 is best for our country.

3.2. P^H

Here sample-1 contains lower pH and sample-3 contains higher pH. Sample-1 pH is stands on the medium acidic range but high acidic range is not considered as a better shoe polish. Sample-2 pH is stands on the medium acidic range or slightly near neutral and this range is considered as a better shoe polish. pH of sample-3 is stands on the neutral range and this range is considered as a better shoe polish.

3.3. Moisture Content

If moisture content is so high, then polish should turn into liquid form and if so low then should turn into solid form. Solid form is very difficult to use as a shoe polish. Liquid form is better when the polish is water based but when not then it is bad. From the above data sample-1 contains lower moisture content and sample-3 contains higher moisture content. Sample-3 is relatively best for shoe polish.

4. CONCLUSION

Shoe polish is an important finishing part of shoe giving the nice appealing and glossy look. And besides that, shoe polish also helps to improve the water repellency property of the leather. So, for getting of these properties, banana peel is the best option. Because, it contains a very significant part of potassium and calcium which works as cleaning and shining agent. Since banana is one of the fruits that we usually have in

our house and we almost eat every day. By this research, the trash we throw everyday become lesser and make something much useful from it than its usual use. It also promotes good health because whenever we buy shoe polish in the market we are not able to buy or even see a shoe polish that doesn't have any harmful chemical mixed with it; in this experiment no harmful chemicals are involved because a natural material is used. If all the districts of our country can be brought under banana cultivation, there is a large scope to producing a better-quality shoe polish and we can also export them to earn foreign exchange. And besides that, we can also keep our environment cleaner, greener and safer.

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