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A Comparative Approach to Shoe Polish Production Between Recycled Waste Materials and Other Entrepreneural Growth

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Abstract

This research work aimed at recycling some waste materials to produce leather polish to serve in realizing knowledge based economy. A knowledge based economy is a fusion on proven scientific and economic realities. Paraffin wax, turpentine, paraffin oil, vegetable oil, battery pigment, charcoal powder, spent lubricating oil and methanol were used to produce shoe polish. The shoe polish produced had solidification point of range 30°C to 39°C, melting point 39°C to 46°C, density 0.065g/cm^3, and specific density 0.065. The produced shoe polishes had mechanical and physical parameters that compared favourably well with a control (commercial polish bought from the open market). Entrepreneurial skills tailored towards the development of waste to wealth is of two-fold benefits. Entrepreneurial skills for wealth creation are embodiments of alternative routes that guarantee self-reliance through job creation. Jobs cannot be created without a thorough knowledge of the economics of the trade. Therefore studies like this should include costs and benefits analysis and should be encouraged among the teaming youths in realizing a sustainable knowledge based economy.

Keywords: Battery Pigment, Economy, Leather, Polish, Used Lubricating Oil

Introduction

The emergence of polish technology engineering is apparent offshoot of complexities resulting from the induction of substances that produce desired gloss and provides a protective coating for the surfaces of materials changing it to dry adherent film. Therefore, polish is a substance usually wax based which when applied to sequence, protects, makes it smooth and shiny. It has been discovered that shoe polish industries in Nigeria are at minimum, though the polish industry is economically very important due to its widespread usage [1]. Shoe polish industry as a surface coating provider is as very important venture. The manufacture of surface coating materials of which shoe polish is a part has been estimated with sales of more than 10,000 million yearly [6]. This in essence means that it usage are widespread. In terms of employment, it gives a lot of opportunities. The economic consequences as highlighted above have in turn spurred many into continuous struggle for a good quality product [2].

Lubricant oil is used in automobile engines to lubricate moving parts of the engines, reducing friction, protect against wear and removing contaminants from the engines [8]. It also acts as a cleaning agent, anticorrosive and cooling agents, it picks up a number of impurities and additional components from engine wear [7]. These components include metal particles (iron, steel, copper, zinc, and lead) and other compounds of barium, sulphur, water, dirt, burnt carbon and ash, most of them are highly toxic in nature, therefore, and these contaminants must be separated in order to reuse the engine oil [3]. Furthermore, recycling of spent lubricating oil mostly depends on the nature of the oil base stock and on the nature and amount of contaminants in the lubricant resulting from operations. The contaminants are introduced both from the surrounding air and from the engine [4, 5]. The spent lubricating oil is usually obtained after the servicing and subsequently drainage from engines and generators. Service stations in most parts of Nigeria find it difficult to properly dispose the spent lubricating oil. Hence, large volumes are indiscriminately disposed on land, sewages and drained ditches [2]. Hence, the aim of this research work is to prepare shoe polish from local materials; paraffin wax and waste materials such as charcoal, battery pigment and spent oil.

Materials and Methods

Materials and reagents

The chemicals used are paraffin wax, paraffin oil, charcoal, petroleum jelly, sodium hydroxide (NaOH), sulphuric acid (H_2SO_4), methanol, stearic acid, and battery pigment.

Formulation of Different Shoe Polish Samples

Generally, the formulation of a shoe polish is a mixture of oil base, adhesive, drying agent and colouring agent. Six different formulations of shoe polish were prepared. Kiwi shoe polish obtained from open market was used as the control sample.

Using Paraffin Wax and Charcoal

A 5g amount of Paraffin wax was weighed out and transferred into a beaker and heated until it melts completely. 10g of charcoal was added to the molten paraffin wax to form a mixture. The mixture was then slightly cooled followed by the addition of 30mL of paraffin oil with constant agitation. The mixture was labelled as X1.

Another 5g of the paraffin wax was weighed and transferred into another beaker and heated until it melts completely. 10g of charcoal was added to the molten paraffin wax to form a mixture. The mixture was slightly cooled before adding 25mLof paraffin oil and 5mL of methanol to it, with constant agitation. The mixture was labelled as X2.

Using Paraffin Wax and Battery Pigment

A 20g portion of Paraffin wax was accurately weighed and transferred into a beaker. 25mL of paraffin oil and 3.5g of battery pigment were measured and added to it. The mixture was then heated until it melts completely with continuous stirring. 25mL of turpentine and 5mL of methanol were measured and added to the molten mixture with constant stirring. The mixture was labelled as Y1.

Another 40g of paraffin wax weighed and transferred into beaker. 20g of paraffin oil and 7g of battery pigment were accurately measured and added to the wax. The mixture was heated until it melts completely with continuous stirring. 20mL of turpentine was then added to the molten mixture and stirred to obtain a homogenous mixture. The mixture was labelled as Y2.

Using Used Lubricating Oil

Pre-treatment of Spent Lubricating Oil

A 50g amount of the used lubricating oil was measured and mixed with 100mL of distilled water. 6mL of sulphuric acid was added to the mixture and stirred properly. The acidified used lubricating oil was heated to about 70ºC for 30minutes with continuous stirring to form homogeneous mixture. The acidified used lubricating oil was neutralized with 500mL of concentrated sodium hydroxide solution to pH of 6.8 and washed with one litre. The mixture was poured into the separating funnel for 15 hours for the wasted associated to the oil to settle down at the bottom of funnel. This helped to remove the salty water from the sludge and to obtain the used oil that is free from soil particles.

Using Pre-treated Used Lubricating Oil

50mLof treated sludge was measured and transferred into flask; 40g of paraffin wax and 20mL of vegetable oil were measured and added to it and heated with continuous stirring until homogeneous mixture is formed. 20mL of turpentine was then measured and added to the molten mixture. The mixture was labelled as Z1. The use of turpentine in this formula is the game changer.

Another 50 mL of the treated sludge was measured and transferred into a flask and mixed with 40g of paraffin wax and 20mLof vegetable oil. The mixture was heated with continuous stirring until homogeneous mixture is formed. 20mL of turpentine and 10mL of methanol were added to the molten mixture with continuous stirring. The homogenous mixture was labelled as Z2.

Characterisation of the Prepared Shoe Polish

Melting Point: Each 5g of the resulting polishes were put in test tubes. In each case, a thermometer was inserted and the test tube with its content was heated in a water bath. The temperature at which each sample melted was noted and recorded.

Solidification Point: The molten samples were allowed to cool while the temperature of solidification was noted and recorded by inserting a thermometer.

Density: Each 10g of polish sample was weighed and put in a beaker. The same quantity of polish was transferred in a measuring cylinder containing a known sample of water. The change in volume was noted and recorded. The density was calculated as;

$$Density = \frac{mass(g)}{volume(mL)} \quad \text{--- (1)}$$

Specific Density: This refers to the density of the wax with reference to the density of water. The specific density was calculated using equation below [1].

$$sp.density = \frac{density(gmL^{-1})}{density_{H_2O}(gmL^{-1})} \quad \text{--- (2)}$$

Results and Discussion

Results

The results obtained from various analyses (melting point, solidification point, density and specific density) and physical tests carried out on the formulated polish samples are presented in the Table 1 and 2:

Table 1: Properties of the Formulated Leather Polish Samples

Formulation Number	Melting Point (°C)	Solidification Point (°C)	Density (gmL^{-1})	Specific Density
Kiwi polish (Standard)	45	38	0.065	0.065
X1	45	35	0.065	0.065
X2	40	37	0.065	0.065
Y1	45	30	0.065	0.065
Y2	44	39	0.065	0.065
Z1	46	36	0.065	0.065
Z2	39	35	0.065	0.065

Table 2: Physical Properties of the Formulated Shoe Polish Samples

Formulation Number	Colour	Gloss Quality	Comment
X1	Pale black	Fair	Fair: though oily and soft, melts when room is very hot
X2	Black and white	Poor	Not smooth: coarse and did not form homogeneous mixture
Y1	Black	Good	Smooth: cracks when fully dried
Y2	Black	Very good	Good
Z1	Brown	Very good	Good
Z2	Brown	Good	Smooth: though it cracks a little after drying

Discussion

From Table 1, it can be observed that the standard Kiwi polish (control sample) has a melting point of 45ºC, solidification point of 38ºC, density of 0.065 gmL^{-1} and specific density of 0.065, whilst A1 polish formulated from paraffin wax, paraffin oil and charcoal has the same melting point, density and specific density value, but there was a slight difference in the solidification point. X1 has a solidification of 35ºC.

X2 polish produced from paraffin oil, paraffin wax and charcoal has low melting point and solidification point when compared with the melting point and solidification point values of the Kiwi polish. This shows that there is a tendency for X1 to melt easily when there is a slight increase in temperature. Also, it was observed that X1 and X2 were coarse due to the inability of the charcoal powder to dissolve properly in the paraffin wax and oil. Therefore, the ingredient (charcoal) and method used in the formulation of X1 and X2 polish is not suitable for producing a good quality polish. In this research work, charcoal powder cannot be used as a pigment (dye/colour) in shoe polish production. This can be attributed to high surface area observed in the charcoal powder.

Y1 polish produced from paraffin wax, paraffin oil and battery pigment has similar melting point, density and specific density when compared with the control sample, but a low solidification point of 30ºC was observed as against 38ºC of the control sample. This indicates that there is a tendency for Y1 to dry slowly when there is slight decrease in solidification point. It was observed that Y1 forms a smooth polish but cracks when fully dried.

B2 polish produced from paraffin oil, better pigment and paraffin wax has the same density and specific density values with that of the control sample, but there was a slight difference in the melting and solidification point. Y2 has a solidification point of 39ºC and melting point of 44ºC.

Y1 and Y2 contain substances composed of heavy metals which make it unsafe to be used for producing shoe polish. Z1 polish produced from spent lubricating oil, paraffin wax, vegetable oil and turpentine resulted in a brown colour shoe polish with melting point of 46ºC, solidification point of 36ºC, density of $0.065 g/cm^3$, and specific density of 0.065. This sample was observed to have similar properties when compared with the control sample.

Z2 polish produced from paraffin wax spent lubricating oil, vegetable, turpentine and methanol resulted in a polish with low melting point when compared with that of Kiwi polish (control). This shows that there is a tendency for Z2 to melt easily when there is a slight increase in temperature. Also, the Z2 sample was observed to be smooth but cracks upon complete drying.

Conclusion

The results of this study confirmed that shoe polish can be produced from spent lubricating oil and battery pigment but not from charcoal powder. Shoe polish from spent lubricating oil and battery pigment compared favorably with the control giving brown and black polish respectively. Similarly, based on the results obtained it can be concluded that shoe polish production from battery pigment is unsafe due to its heavy metals content. The research provided alternative raw materials (waste products) for shoe polish production which are readily available at low or no cost. These waste products can be recycled to produce shoe polish thereby providing a sustainable environment through waste management. The economic advantage of this research is that wealth generation and employment opportunity can be created.

Recommendations

1. Other waste materials in our environment should be recycled and made to contribute in wealth creation.
2. Unemployed youth should be encouraged to take advantage of this method to become self-reliant.
3. Government should fund this recycling process in order to reduce the unemployment rate in the society.

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