Marker Ink Production from Berry Seed Extract

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Abstract

The Berry liquid was extracted from the berry by cooking, mashing, and also addition of apple cider (vinegar) as a solvent extractor. The extracted liquid was then mixed with gum Arabic, methanol, and dye, this produce a sample of ink. The reagent used and their proportions are apple cider 108ml, methanol 18ml, and 2 teaspoons of gum Arabic solution. The physical properties of the sample ink were tested against the standard ink and the results shows that the produced ink is of high quality, having a pH of 9.3, drying time of 2.3 seconds, and Viscosity of 9.5$\times 10^{-4}$ Ns/m^2.

Index Terms: Berry, Gum Arabic, Dye, Methanol, Extractor, Ink, Pigments, binders, solvents, additives.

1.0 Introduction

Ink can be a complex medium composed of solvents, pigments, dyes, resins, lubricants, solubilize particles matter and other materials. According to Sureh and Shah, 1987, writing inks are usually in fluid forms consisting of suspension prepared from dyes, Pigments, binders, solvent, additives, prints, alcohol and water.

The characteristic of a particular ink being used in writing determine how long and clear the writing can stay over a period of time. The history of writing ink is more than five thousand years old in India. In those days carbon inks were in use for writing on palm leaf before the invention of papers. Writing ink was also prepared by mixing lampblack with a fluid extracts known as Alta (Maurice, 2001).

The ink production now holds, an important place within the chemical industry covering the basic product of chemical. Research coupled with increased knowledge of organic and colloidal chemistry has inks for modern high speed publications, printing, packaging and printing on a wide variety of surfaces and materials (Robert, 1960).Today ink

making has become a major process for science and industry; it requires high technology and the application of a variety of scientific disciplines plus technical and management skills. The advancement in printing process, complex piece of equipment and addition to the ever growing list of materials which can be printed has called for chemical and physical in printing ink. Every day, the ink maker faces challenges to their ingenuity, creativity and professional expertise (Brady et al, 1997).

Ink can be characterized based on the following parameters: depth of colour, durability and indelibility.

Depth of Color**:** Thus the ink must flow from the pen, so that this finest lines and characters may be formed. It must not be thick or form hand crust, when it dries upon the rib. This occurs sometimes with perfectively good ink, and is hen merely a sign that the ink has become to concentrated by evaporation and requires dilution with water, if, however the addition of water does not put the matter right. It proves either that the original composition of the ink was wrong or that the ink has decomposed.

Durability: A good ink should keep its color unchanged for a long time and should not show any material alteration, if the paper becomes damp or wet. A good ink must not go moldy even after greater dilution. This last condition is easily fulfilled as many inks are themselves toxic to molds on in any ease antiseptics can always be added to them.

Indelibility: For certain purposes such as for documents that will possess a historical interest, it is necessary that the ink should be able to withstand merely the ravages of time and also deliberate attempts to efface it by chemical means. Certain inks, especially those which contain dyes as pigments are capable of withstanding ravages of time extremely well.

Ink formulation is a matter of precision combined with foresight and adaptability. It is imperative that the ink markers have a clear understanding of the nature of the raw materials they use, few items are ever used in isolation so they must know, not only their fundamental physical properties but also the influence of those properties exerts

on mixture, such knowledge is a basic from which experimental work can be undertaken.

New materials were designed to meet the stringent demand of some of the more advance inks that were being made for the methods of printing.

The raw materials used in inks making are classified as follows: Pigments and dyes stuffs, Oils and solvents, Resins, Plasticizers and waxes, Driers (Robert, 1960). Oil is the oldest and widest raw material in printing inks formulations. It plays an important role in manufacturing of the printing inks. Oils are either directly mixed in ink formulation or with conjunction of resins and varnish is prepared. This varnish is a body or a vehicle of the inks. There are various type of oils used and they depend on the end use of the inks, different ink have different dying system involved which determines the type of vehicle used in the manufacturer of printing inks.

The ink production now holds, an important place within the chemical industry covering the basic product of chemicals. Research coupled with increased knowledge of organic and colloidal chemistry has inks for modern high speed publications, printing, packaging and printing on a wide variety of surfaces and materials.

Outstanding advances have been made in the development of synthetic resins, drying oil, fast drying inks and inks has meet the strictest environmental standard. Pigments can which will make ink transparent or opaque, glossy or dull, metallic or chemically resistant or any combination of these or other special characteristic(Othman, 1978). Vanishes are now available that permit inks to adhere properly to all kinds of paper, to metals, cloths, rubber, wood, plastic and glass (Brandy, 1997).Large quality of berry seeds were generated during its season and discarded as waste which make it inexpensive. The berry seeds can be used to develop ink which is a useful material in painting, drawing, and writing as well as waste management (Druid, 2002).Due to the abundance of berry tree and lack of its management of its seeds in the environment, this makes it inexpensive and also considered as solid waste in the environment. These

necessitate the need to adequately manage these wastes by transforming them into more useful materials.

2.1 Methodology

Experimental Procedure

In producing the ink, the following steps were followed accordingly.

Step 1: 448.8kg of ripe and fresh huckleberries was collected and put into a stainless steel pot, and was subjected to heat at very low temperature of about 30^{o}C

Step 2: In the process of heating the berries were continuously mashed and stirred using potato masher.

Step 3: While mashing and stirring, the berries stuck together and become thicker, which implies that, it needs a liquid to loosen up. 108ml of apple cider (vinegar) was added which was used as a preservative. The berries were simmered for 15 minutes, mashing and stirring to prevent burning.

Step 4: The pot of the berries was removed from the heater and allows to cool at atmospheric air.

Step 5: When the berries was cooled, then the liquid was strained into a clean bowl using strainer that have a thicker weave and then working down to strainer with smaller holes. The process was repeated using fine straining materials until the liquid flow nicely and doesn't have any bits or particles in it.

Step 6: The liquid gotten from the straining process was poured into a mixer bowl which serve as a reactor. 18ml of methanol was added and stirred for 10 minutes to achieve homogeneity.

Step 7: The homogeneous mixture was divided into two portions. For each portion, 2 teaspoon of gum Arabic was added and stirred well to form an ink mixture. The gum Arabic is to improve the ink's viscosity.

Step 8: Black dye was added to the ink as a colorant and also to improve the quality. The final product was stirred continuously for ten minutes to achieve perfect homogeneity.

Step 9: Finally, the ink produced was subjected to some physical analysis.

This relationship was used to determine the viscosity of the ink, where time = t and viscosity = μ

$$\frac{time\ of\ flow\ of\ water\ (t)}{time\ of\ flow\ of\ ink\ (t)}\frac{time\ of\ flow\ of\ water\ (t)}{time\ of\ flow\ of\ ink\ (t)} = \frac{viscosity\ of\ water\ (\mu)}{viscosity\ of\ ink\ (\mu)}\frac{viscosity\ of\ water\ (\mu)}{viscosity\ of\ ink\ (\mu)}$$

(McCabe et al, 1986) ---- Equation (1)

3.0 Result and discussion

Table 1: Physical Properties of ink Produced from Berry Extract

Erasability	Drying time (second)	Color	pH	Viscosity (Ns/m^2)
Noteasily erasable	2.3	Black	9.3	9.5 x 10^{Λ}-4

Table 2:Physical Properties of Standard Ink

Erasability	Drying time (second)	Color	pH	Viscosity (Ns/m^2)
Easily erase	1-3	Black	5.5	0.00147

3.1 Discussion

The sample ink as depicted in table 1 has a pH of 9.3 which is alkaline**,** because it is produced using plant extract (berry) and the chlorine content is low. Also the drying time was noted to be 2.3 seconds which is within the range of a standard ink. The sample ink produced does not easily erase with a dry duster except with a little dense duster. This is because berry has a little property of permanent ink. The viscosity of the sample ink was calculated from Equation 1 to be 9.5 x $10^{\Lambda-}$4Ns/m^2, while that of the standard ink was obtained to be 0.001474Ns/m^2, thus the viscosity of the ink affects the drying time, therefore, the more viscous the ink, the longer the drying time. The parameters obtained from the sample ink produced indicate that the sample ink has a good quality when compared with the specification of the standard ink as shown on table 2.

4.0 Conclusion

From the experiment conducted, it was discovered that berry liquid has the prerequisite properties for ink production. Therefore, it can be concluded from the produced ink and the results stipulated in the table above that the sample ink produced is of good quality when compared with that of the standard ink. The pH, Drying time, Color, erasability and viscosity were basic parameters for this comparison.

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References

Brady George (1997) material handbook, MCGraw Hill Book Company 11th edition pp.110.

Druid Philips (2002), Berries Production and Processing Products 2nd edition. Pp.219-231.

Maurice Audin (2001), "A History of Technology and Invention "app.630.

MC Cabe et al (1986) Unit Operation of Chemical Engineering Mc, Graw Hill, International Book Company Singapore 4th edition pp. 258-260.

Othmer, Kirk (1978) Encyclopedia of Chemical Technology, Mc Graw Hill, International Book Company New York pp. 611-613.

Robert F. (1960) what the printer must know about ink, Penroylvania GATF.PP.120-123.

Sureh, Shah. (1987) writing and printing inks SBP consultants and engineers PVT Ltd. R.K GUP for SBP consultant pp. 284-345.