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Physiochemical Analysis and Suitability of Dye Extract in Persea Americana (Avocado Peer) Seed

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ABSTRACT

Physiochemical features and absorbance level of dye from avocado peer seed is the aim of this study. Four wasted avocado peer seeds were collected from a fruit seller in Oja Oba market (King's market) Ikere-Ekiti at no cost. Simple extraction technique using petroleum ether of analar grade with boiling range of 40-60^{o}C was used to extract the grounded peer seeds and filtered and dried at room temperature. The absorption spectrum of the dye extract revealed maximum peak of 1.0 at 440nm. The sample obey Beer Lamberts law. The spectrum showed consistent steady drop in absorbance between 500nm to 625nm wavelength and steady rise in absorbance between 625nm to 700nm wavelength. The sharp peak observed at 440nm, suggest that the dye extract consist only one colour and it is therefore pure. The application of the dye extract on 100% cotton fabric shows a high absorption when the fabric was mordant with Sodium Hydrosulfite. The researcher suggested that extraction of natural dyes from plants, fruit seeds and roots should be encouraged in schools in order to reduce cost of purchase of synthetic dyes and enhance creativity skills that are environmental friendly. The dye extract can also be used as poster and water colours in fine arts.

Keywords: Physiochemical, Suitability, Dye extract, Persea Americana seed.

Aims Research Journal Reference Format:
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1. INTRODUCTION

Dyes are coloured substances used to impact more or less permanent colour to other substances, mostly used in textile fibers and fabrics. Wangboje (1992) stated that the world would have been a dull and miserable place if no colours exist around man. The beauty of an environment and food therefore circles around dyes and colours. Most dyes are short conjugated carbon system whose intensities are considered by using both wavelength and absorption coefficient such as B-Carotene, a conjugated polyene. The substitution of conjugated system is capable of either donating or accepting electron that may extend the conjugation. Oyewole (1998) declared that colours (dyes) can be improvised locally from natural materials found around the environment. He highlighted the use of dyes for painting and craft work.

Until the 19th century, dyes were derived from leaves, twigs, roots, flowers, seeds, animals among others. The first synthetic dye was produced in 1856 by a chemist Sir William Henry Perkin when trying to derive ANALINE from coal-tar. While the first natural dye, ALIZARIN was synthesized in 1868.

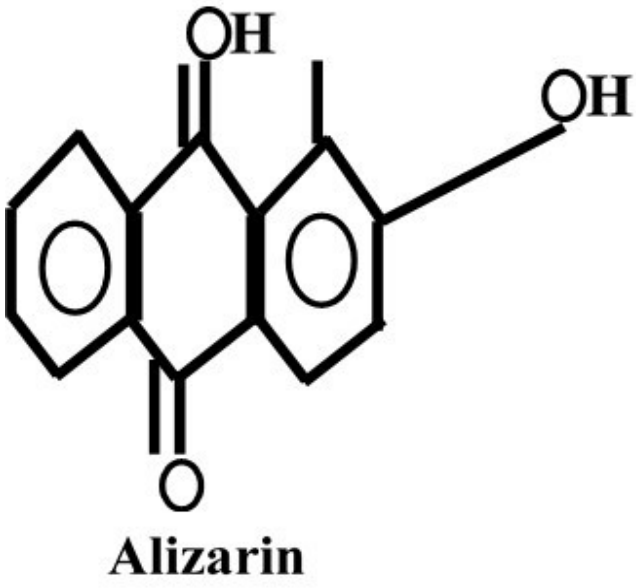

Fig. 1 Structure of Alizarin

Alizarin $C_{14}H_8O_4$

Various classes of dyes exist ranging from vat dyes, sulfur dyes, direct dye, acid dyes among others. The importance of dyes in the textile industries in both developed and developing countries cannot be over emphasized. In Nigeria, dyes are seen in batik, adire, Ankara and much is being spent on importation and purchase of dyes in Nigeria and other developing countries. The urge to contribute to the knowledge of dyes and apply reuse practice of green chemistry principle necessitated this study which is aimed at extracting the colour pigment (dye) present in Persea Americana seeds. vAvocado peer is a tropical fruit also known as alligator peer. It belongs the family Lauraceae. The fruit consist of pulp which is a good source of protein, fiber, monounsaturated fatty acids, antioxidants, vitamins, and minerals such as folic acid, pantothenic acid, copper, potassium, sodium, vitamin K, and vitamin B6 as stated by Ford & Liu,.(2020) in Siol & Sadowska (2022).

However, there is an ever-growing consumer interest in avocado fruit and industrial processing of avocado into products such as avocado oil and paste has contributed to a vast amount of waste products, including avocado peel and seeds as observed by Duarte; Chaves; Borges & Mendonça 2016 in Siol & Sadowska (2022). The weight of peer seed takes about 18% of the whole fruit which usually is a waste and unused. Many researches have focused on the usefulness of avocado peer seed in compliance with environmental sustainability (Green Chemistry) but much has not been done on dye extract and hence this study aim to investigate the physical properties of the waste peer dye extract and its usefulness in the teaching of dyes and extract from plants.

The seed of the persea americana (avocado peer) is coated greenish yellow pulp usually oval or round shape with two unequal lobes. Fortunately, three categories of avocado peer exist in Nigeria and are planted. Several research has shown that avocado peer seed is rich in carbohydrates, fat, protein, dietary fiber and bioactive compounds Araújo, Rodriguez-Jasso; Ruiz; Pintado & Aguilar, C.N. (2018) and Bhuyan, Alsherbiny; Perera, Low; Basu; Devi; Barooah, Li, & Papoutsis, K. (2019). Researchers have explored the usage of avocado peer seed in snacks preparation previously as stated by Siol & Sadowska (2022).

Dyes as coloured substances which own their colour to the presence of substances in them that absorb light at a particular wavelength range within the visible band of electromagnetic spectroscopy to which they are sensitive. Dyes may be synthesis or extracted from plants, leaves, fruit seeds roots and animals called natural dyes. Natural dyes have many benefits such as eco-friendly, health benefits and thus can lead to greener dyeing techniques that benefits the environment and textile industries Li, Wang, Zhou, Li, Liu & Chen (2022)

Many other substances that are colourless may absorb light of wavelength in their ranges outside the visible, chiefly within the ultra-violet or infra-red and since absorptions do not occur in the visible range, the colour is not observed. The wavelength at which the dye extract of avocado peer seed occurs is the concern in this study and hence the identification of the colour using white cotton and its usefulness in teaching fine arts in schools.

2. MATERIALS AND METHODS

Four wasted avocado peer seeds were obtained from Oba market (Oja-Oba) at Ikere-Ekiti in Ekiti State, Nigeria. The husk of the seeds were removed and grated to tiny pieces and grounded using mortal and pistol and exposed to room temperature to dry. 10 grams of the grounded powder was soaked with 30ml petroleum ether with boiling range of 96^{0}C to defat the powder and was allow to dry in order to obtain a consistent weight. It was further soaked with fresh petroleum ether of analar grade with boiling point range of 40-60^{0}C for 12 hours and sealed with vigorous shaking every one hour. The dye was extracted using simple extraction method (Browster et.al 1977). The resulting mixture was heated to dryness over steam bath. Absorbance of the sample was between 400nm and 700nm and a plot of absorbance against wavelength was obtained. The extract (dye) was applied to white cotton fiber with and without mordant and the results compared.

3. RESULTS

Table1: Physiochemical properties of avocado peer

S/N	Test	Result
1.	Appearance	Orange powder colour
2.	Percentage yield	24.28%
3.	Sample in water	Soluble in water
4.	Melting point	168^{0}C

Source: Author

As shown in table 1 the appearance of the dye-stuff gave orange colour with 24.28% yield. The dye was found to be soluble in water with a melting point of 168^{0}C.

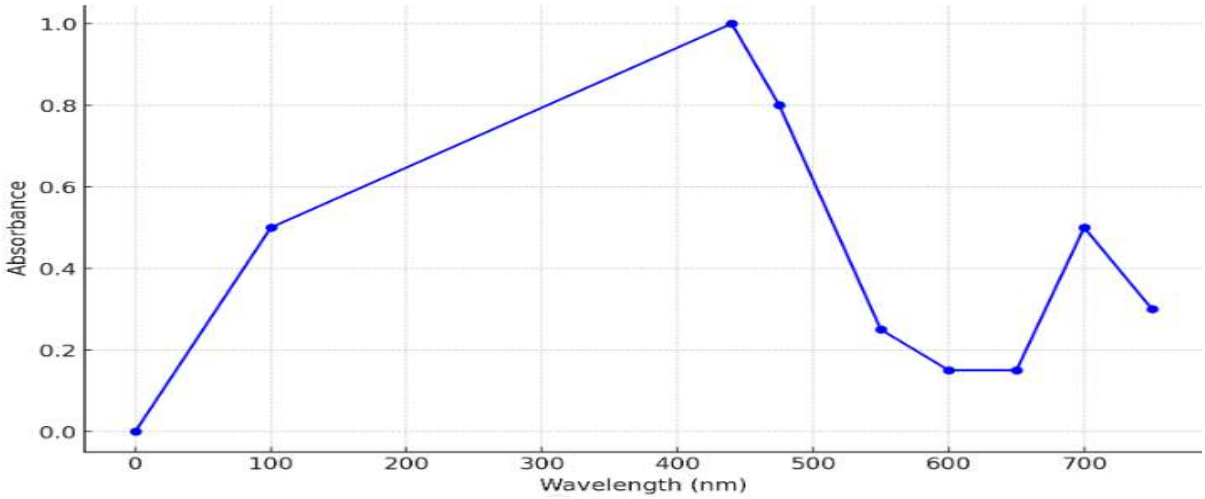

Figure 2.: A plot of absorbance against the wavelength

Figure 2 revealed the uv/visible spectrum of the extract obtained from avocado peer showed a major characteristics displayed by extract revealed in the absorbance peaks at 440nm, 445nm and 700nm with maximum absorbance of 1.00 at 440nm. On addition of the dye extract to 100% cotton fabrics without mordant, the cotton gave a duel burnt orange colour but on addition of mordant to the dye extract, the cotton gave a very bright orange colour.

4. DISCUSSION

The dye extract gave 24.28% yield which was suitable enough with an orange colour. This is in line with the findings of Siol & Sadowska (2022) study replacing 18% of wheat flour with avocado peer seed powder gave a significant colour on the finished snacks as orange. They further suggested that wasted avocado peer seed could be used as a natural colorant. Further investigation on the solubility of the dye extract shows that it (dye extract) is very soluble in water at room temperature. But further research can be carried out for a better yield using soxhlet extractor. The percentage melting point of the dye was found to be 168^{0}C.

Hue, Trink, Thi, kim, Huong, Mai & Bui (2022) stated that avocado peer seed dyes are suitable attractive natural colour used to dye cottons. While Oyewole (1998) view dyes obtained from seeds as in-organic type used in fine arts. Such groups of dyes are not permanent in nature since some colours change in outlook as time goes on. This is true of the sample (dye extract) because on application of the extract without mordant to a piece of white cotton gave a brighter and more permanent orange colour. However, the extract can be used readily on papers by children as poster colour in art work in schools.

The uv/visible spectrum of the extract obtained from avocado peer dye revealed that, the extract have absorbance peaks at 440nm, 445nm and 700nm with maximum absorbance of 1.00 at 440nm.The sharp peak indicates that the sample is pure and may not consist of other spectral colours. This is in line with Balji (2022) and some artists who believe orange is a secondary colour and that secondary colours can be obtained from two or more colours specifically mixture of yellow and red.

5. CONCLUSION

Dyes are essential substances for beautifying materials in all fields of science and technology. The nutritionists' emphasis flavoring of foods to attract consumers and the artists derives pleasure in the manipulation of colours/dyes in painting and art work. The textile industries cannot be appreciated without dyes. The sample will be suitable for poster and water colours for artists. The extract is found not to be a threat to human health and environment as opined by Philip (2002) that synthetic dyes are not threat to man. Also the residue decays easily as manual.

6. RECOMMENDATIONS

The following recommendations are suggested by the researcher:

1. Government should organize seminars, workshops and conferences for teachers on the need to expose learners to simple extraction techniques that are benign.
2. Curriculum designers should incorporate reuse technique of green chemistry principles in all levels of science teaching.
3. Locally made dyes should be encourage for use in schools, textile and food industries
4. Further research should be carried out on the residue in order to maximize the use of avocado peer seed

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