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Studies on the Inhibitory Effects of *Aloe Vera Bardensis* Extract on Palm Oil and Palm Kernal Oil.

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Abstract: Aloe vera extracts were obtained from the fresh leaves of the plant(Aloe vera bardenesis) through sequential extraction involving soaking in a the solvent ethanol for a period of 48hours.Various concentrations of 2ml. 4ml, 6ml, 8ml and 10mls were prepared from the extract. Samples of palm oil and palm kernel oil were obtained fresh from the source and their physicochemical properties determined. The results obtained were kept as references. The oil samples were then blended with the various concentrations of the plant extract and times varied from 24hours to 120hours.Results obtained from the physicochemical analysis of blended oil samples showed that the effects of the plant extract at various concentrations was distinctively noticed after a period of 72hours of treatment. Results obtained from acid value analysis of the blended oil increased from 7.6mg/KOH/g to a constant value of 8.5mg/KOH/g at 72hours.Peroxide value of 1.6mmol/kg increased steadily to a constant value of 2.1mmol/kg.Value of free fatty acids of 4.1 in the control was steady at the value of 4.7 after 72hours.Iodine value of 58.4mg/g in the control increased steadily to a constant value of 58.4mg/g in the bend after 72hours.Saponification value of 147 increased to a steady value of 151 in the blend even after 48hours.These results indicated that the concentrations of the extract used has some degree of significance and points to the plausibility of using natural sources as antioxidants. Foods, oils and other allied industries may be potential beneficiaries of this botanical resource.

Keywords: Aloe vera, Natural antioxidant, Extract, physicochemical properties, oils.

I. INTRODUCTION

Among plants oils obtained from the fruits of the tropical plant, are palm oil and palm kernel oil from the palm *Elaesis guineesis*.Palm oil usually obtained from the carotene and vitamin E rich fleshy mesocarp of the palm fruit which contains 45-55%oil.This part of the plant is particularly rich in the saturated palmetic acid; with substantial amounts of smaller polysaturated fatty acids and monosaturated oleic acid. This makes palm oil one of the healthiest plant oils (1).Palm kernel oil on the other hand, which is obtained from the kernals enclosed in the endocarp of the palm fruit contains more of the saturated palmetic acid than the unsaturated linoleic acid. The presence therefore, of the unsaturated fatty acids in these oils makes them susceptible to oxidative, hydrolytic and absorptive processes. These processes result to the development of off flavor, off colour and objectionable odor and taste in oils which compromises their nutritional and industrial values (2). Such processes are often referred to as rancidity. Oxidative rancidity results in the of some free radicals and this is further accelerated in the presents of pro-oxidant factors such as the exposure to light and elevated temperatures, presence of metals e.g. iron and copper. These are likely to accelerate auto-oxidation of oils especially during storage.

The sharp, unpleasant ardor experienced during is believed to have resulted from the aldehydes usually of low molecular weights usually formed from the oxidation of fatty acids (3, 4, and 5).

$CH_2 (CH_2)_7CH =CH (CH_2)_7CO_2R+O_2 \rightarrow CH_2 (CH2)_7CHO$+other oxidation products (ketones, alcohols, acids etc.

One of the functions of antioxidants in general is the protection of oil from rancidity.The use of synthetic antioxidant such as Butylated Hydroxyl Toluene (BHT) and Butylated Hydroxyl Anisole. (BHA) have been reported. Interestingly the studies involving natural antioxidant present in plant spices, herbs have been attributed to the presence of flavonoids, vitamins, amino acids and phenolics present in them. These phytoconstituents are believed to posses anti oxidant properties (6). Aloe vera plant(*Synaloe barbadensis miller*) has been reported to contain some of these phytochemicals including anti- cancer, anti-fungal and phenolics(7,8,9). Aloe vera leaf is composed of a large amount of phenolic compounds,a high amount of 1,8-dihydroxy anthraquinone derivatives and their glycosides.Evaluation of free fatty acids, peroxide value, acid value, saponification values of oil could help track the

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efficacy of antioxidants in reducing rancidity since it is these properties that are responsible for or indicators of rancidity of oils as established in literatures(10, 11, 12).

In view of the above this study is aimed at tracking the antioxidant properties or potentials of Aloe vera leave extract by monitoring the above mentioned physicochemical properties.

II. MATERIALS AND METHODS

2.1. Materials

Fresh palm oil and palm oil was bought from Mubi market in Adamawa State of Nigeria. Aloe vera plant materials were collected from a fallow land in Mubi.Fresh leaves samples was used.

2.2. Methods

2.2.1. Sample Preparation

Fresh leaves of Aloe vera were cut into pieces and soaked in 20mls of ethanol for succession for 48hours.The extracts were collected into sterile universal bottles and kept in the refrigerator for further use according to the methods of (1)

2.2.2. Sample Blending

The extracts were blended with oil samples in various ratios of 2mls, 4mls, 6mls, 8mls and 10mls.These were left to stand for varying periods of 24hours, 48hours, 96hours and 120hours.

2.3. Determinations of Physicochemical Properties

The methods described by (13) were adopted for the determinations of peroxide value, acid value, free fatty acid, iodine value and saponification values. These involved the average of three determinations.

2.3.1. Determination of peroxide Value

This was also determined using the methods described by (AOAC, 2000) with slight moodification.For peroxide value, a mass of 1g of each oil seed oil sample was weighted into a 250cm^3 flask. To the sample, 25cm^3 of n-hexane and 1g of potassium iodide was added and the mixture allowed to stand in the dark for a minute while 25cm^3 of distilled water and 3cm^3 of 1% starch solution were also added. The resulting mixture was titrated with 0.1M sodium thiosulphate ($Na_2S_2O_3$).A blank was also determined under the same conditions.

2.3.2. Determination of acid Value

The acid value was also determined according to the methods described by AOAC, (2000). A sample of the oil (2g) was transferred into a 250ml conical flask, following solution of 25ml of 90% alcohol was added and neutralized with 0.1M NaOH using phenolphthalein as an indicator.

The acid value was calculated from the mathematical formula below:

Acid value = [Titre value (cm^3)] x 5.61/Weight of sample taken

3.3.3 Determination of Saponification Value

The method given under was (AOAC, 2000) was adopted for the determination of saponification value. A known quantity of oil is refluxed with excess amount of alcoholic potassium hydroxide (KOH) after which the remaining KOH was estimated by titration against a standard acid (HCl).

A known mass of the oil sample (0.5g) was transferred into a 250 cm^3conical flask fitted with a condenser. To this, 10 $cm^3$of alcohol and 10mls of 2.5 % potassium hydroxide (KOH) were added. The mixture was reflux for one hour with constant shaking to achieve uniform temperature. The solution was refluxed allowed to cool and then titrated against 1 cm^3oxalic acid with phenolphthalein as indicator. A blank was determined under the same conditions and the saponification value of the oil was determined using the mathematical formula below:

$SV= [56(V_1-V_2)] \times 1000/2000xW$

Where SV is the saponification value

V_1 = volume of acid consumed in the blank

V_2= volume of acid consumed by the sample

W = weight of sample taken

2.3.3. Determination of Free Fatty acids (FFA)

This was also done according to the methods described by (AOAC, 2000) with slight modification. A known mass of the oil (2g) was transferred into a 250 cm^3 conical flask and 25 cm^3 of 100% alcohol was added and properly mixed by mechanically shaking. The solution was titrated against 0.1M NaOH using phenolphthalein as an indicator.

The percentage free fatty acid was calculated as follows:

%FFA = FFA X 100

Where W = weight of sample taken

2.3.4. Determination of iodine Value

The Iodine value was determined the methods of (AOAC, 2000) was adopted. A known mass of the Guna oil (2g) was transferred into a glass stopper flask (500 cm^3) and dissolved in 25 cm^3 chloroform. To the mixture, 30 cm^3 of Wi j's solution was added; the flask was corked and allowed to stand at 35^oC for a period of 30minutes with continuous shaking after which 30ml of 15% potassium Iodide (KI) solution was added. The mixture was titrated with 0.1M sodium thiosulphate ($Na_2S_2O_3$) using starch as an indicator. A blank was solution was titrated in the same way. The Iodine value was calculated using the mathematical formula given below:

$IV = [(V_1-V_2) \times M\ X127\ X100]/W \times 1000$

Where IV is the iodine value

M= molarity of sodium thiosulphate

W= the weight of the sample taken.

III. RESULTS AND DISCUSSIONS

3.1. Results

Table4.1.1. *Physicochemical properties of blended palm oil*

Palm oil	Peroxide value(mmol/kg	Acid value(mgKOH/g	Free fatty acid (%)	Iodine(mg/100g)	Saponification value
Control	1.6±0.05	7.6±0.06	4.1±0.1	55.8±0.06	147±0.06
2mls of extract for 24hrs	1.8±0.06	7.9±0.05	4.3±0.05	57.1±0.05	148±0.1
4mls of extract for 48hrs	1.9±0.08	8.2±0.05	4.5±0.05	58.0±0.01	150.7±0.01
6mls of extract for 72hours	2.1±0.1	8.4±0.01	4.7±0.05	58.3±0.01	151.6±0.08
8mls of extract for 96hrs	2.1±0.05	8.5±0.05	4.7±0.05	58.4±0.07	151±0.02
10mls of extract for 120hrs	2.1±0.05	8.5±0.05	4.7±0.05	58.4±0.07	151±0.07

Table 4.1.2:*Physicochemical properties of blended palm kernel oil*

Palm oil	Peroxide value(mmol/kg	Acid value(mgKOH/g	Free fatty acid(%)	Iodine(mg/100g)	Saponification value
Control	1.7±0.05	15.2±0.05	9.1±0.05	41.9±0.07	248±0.08
2mls of extract for 24hrs	1.9±0.07	15.7±0.05	9.3±0.05	42.3±0.1	252±0.1
4mls of extract for 48hrs	2.2±0.02	16.1±0.06	9.5±0.03	43.1±0.1	258.3±0.1
6mls of extract for 72hours	2.3±0.12	16.3±0.02	9.9±0.01	43.7±0.05	260.9±0.05
8mls of extract for 96hrs	2.3±0.05	16.4±0.05	10.1±0.08	43.9±0.04	260.9±0.05
10mls of extract for 120hrs	2.3±0.03	16.4±0.05	10.1±0.20	43.9±0.04	260.1±0.08

IV. DISCUSSIONS

Table 4.1.1 shows the physicochemical properties of blended and unblended palm oil determined over a period of 24hours through 120hours.The result show a consistent deterioration of oil samples in blended and unblended samples. This is characterized by a consistent increase in the acid value and the percentage of free fatty acid, steady increase in peroxide value as well as saponification value and acid value. The rate deterioration persisted in all blended samples for all the physicochemical properties under observation until the 72nd hour when all the values of the physicochemical properties under observation became constant. At this point, the inhibitory effects of the extract were seen to have manifested.

Table 4.1.2 shows the physicochemical properties of blended and unblended palm kernel oil also determined over the same periods of 24hours through 120hours.From the table, it was observed that there was a consistent deterioration in of oil sample (blended and unblended).This was occasioned by persistent increase in peroxide values, acid value, iodine value and saponification values. This consistency in the inhibition activities of the plant extract on the two oil samples underlines the effects the of extract on the deterioration oil samples.

For the effects of the extract on the physicochemical parameters, the two oil samples continuously deteriorated until a constant value was reached for all the parameters under consideration. These values were however maintained at the 72nd hour. It was also observed that acid values, free fatty acid value and saponification value for both blended and unblended palm kernel oil are almost twice the values seen in the case of the same parameters in the case of palm oil samples. This is consistent with the reports in literature (12) indicating that palm kernel oil is composed of about 85% saturated fatty acids as against 53% saturated fatty acids content of palm oil.

The observed inhibitory of the extract effects therefore underscores the claim by some research groups(14) that linked this to presence of flavonoids,phenols,saponin found in Aloe vera plants. Interestingly, this sums up the contributions of phytoconstituents in the inhibition of oxidation.

V. CONCLUSION

The result obtained from this investigation showed that the leave extract of Aloe vera plant contain photochemical in amounts substantial enough for inhibition of rancidity. Since this plant exist in the wild as a weed and this can be utilized for industrial purposes involved in the production of edible oil.

The use of aloe vera leaf extracts is of advantage because it is a natural antioxidant and therefore reduces the presence of substances that may otherwise pose serious health hazards in the long run. The only limitation suffered in the use of Aloe vera as a natural antioxidants is its bioavailability which may result in competitions by various industries for its application. The efficacy of thiextract may be3 improved with a more robust structural elucidation.

VI. RECOMMENDATION

It will be highly recommendable if further research is carried out to ascertain the toxicity of the plant. Further research activities should be carried based on instrumentations such as FTIR, differential scanning calorimetry to determine the function groups and heat changes. This will further provide information on a number of likely applications of the plant extract.

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