Garima Gupta Int. Journal of Engineering Research and Application www.ijera.com
ISSN : 2248-9622, Vol. 8, Issue4 (Part -III) April 2018, pp36-40

RESEARCH ARTICLE OPEN ACCESS

Effect of Antioxidant Property of Vetiveria Zizanioides and Cyanodondactylon Leaf Extract on Shelf Life of Various Edible Oils

Garima Gupta[*], Sumit Kumar[**]

[*]*(Research Scholar, Shri Venkateshwara University, Gajraula, Amroha, U.P., India.*
[**]*(Associate Professor, School Of Life Science, Shri Venkateshwara University, Gajraula, Amroha, U.P., India.*
Corresponding Auther: Garima Gupta

ABSTRACT
Due To Short Term Stability Of Edible Oils The Need To Enhance Their Shelf Life Is An Important Area Of Research. Fortification With Synthetic Antioxidants Has Side Effects At Higher Conc. This Study Aims To Determine The Effect Of Mixture Of Leaf Extract Of Vetiveria Zizanioides And Cynodondactylonon Lipid Oxidation Inhibition Of Vegetable Oils.Oxidative Rancidity Is Mostly Determined By Peroxide Value And Free Fatty Acid Estimation. Three Different Temperatures (20^0C, 37^0C, 50^0C) Were Selected For Accelerated Storage Conditions Studies. According To The Results The Peroxide Value Was Increased With Storage Time. The Peroxide Value Of Oil Sample Without Extract Showed The Maximum Value. This Showed Their Effect On Lowering The Peroxide Formation During The Lipid Oxidation. The Oil Samples With Added Extract Have Shown A Reduction In Free Fatty Acid Content With Reference To Control. The Free Fatty Acid Content Was Reduced To A Larger Amount In Samples Kept At 37^0C When Compared To Samples Kept At 50^0C. This May Have Occurred Due To The Denaturation Of Antioxidants Compound At 50^0C.
Keywords- Accelerated Storage Condition Studies, Shelf Life, Peroxide Value, Free Fatty Acid Content.

Date of Submission: 10-04-2018 Date of acceptance: 24-04-2018

I. INTRODUCTION

Fats And Oils Are Considered As Valuable Components Of Diets; And Also Due To An Increase In Development And Prosperity Of Nations The Use Of Oils And Fats Has Increased In The Foods [1]. Manstates That High Standards For The Safety And Quality Of Foods Are Considered Around The World [2].The Consumers Are Worried About The Time Food Will Last Before It Starts Deteriorating, Food Producers Are Worried About The Long Life Of Food Products Of Shelves And Government Agencies Are Worried About The Time Till When The Food Will Maintain Its Quality As Listed On Its Label. Determination Of Shelf Life Of A Food Product Is A Difficult Task, But Is Required For The Labeling Of The Finished Product. As Some Products Of Oil Degradation Can Be Toxic In Nature, Thus It Is Important To Determine The Shelf Life Of Oil For Safety And Quality Measures [3, 13]. Long Shelf Life Oils Are Of Great Importance During Conditions Of Food Shortage And Natural Calamities [4]. Shelf Life Of Oil Is Mainly Dependent On Its Susceptibility To Auto Oxidation Which Is Determined By Its Fatty Acid Content [4, 5, 6].Naturally All Of The Vegetable Oils Present In The Market Have A Significantly Short Shelf Life. Manufacturers Have Developed Oils With Fewer Amounts Of Fatty Acid And Unsaturation In Order To Increase Its Stability Towards Oxidation [7, 4, 12].Accelerated Shelf Life Testing Is The Method Of Choice To Determine The Shelf Life Of Food Products [6]. The Actual Storage Studies Are Very Time Consuming For The Oils Which Are Highly Stable As The Take Longer Time To Deteriorate. To Increase The Rate Of Deterioration And Reduce The Time Needed For Significant Changes In Quality, Accelerated Storage Studies Are Performed. This Helps To Achieve Deterioration Rates Early At The Defined Temperature [8]. Many Factors Govern The Shelf Life Of Vegetable Oils, Examples Are Temperature Of Storage, Fatty Acid Content, Exposure To Light, Oxygen Concentration, Presence Of Free-Fatty Acids, Presence Of Pro-Oxidants And Presence Of Antioxidants [9, 10].

Natural Antioxidants Are Widely Incorporated Into Foods And Oils To Prevent Oxidation And Extend Shelf Life [14,16]. The Goal Of The Study Is To Investigate The Activity Of Antioxidants Present In Vetiveriazizanioedesand Cynodondactylonto Inhibit Oxidation Of Cooking Oil [11]. From This Study, We Can State That Mixture Of Leaf Extracts Of Vetiveria Zizanioidesand Cynodondactyloncan Be Used As A Potential Natural Antioxidant In Food Industry, Extending Shelf Life Of Cooking Oil.The Oil Samples Used Weresoybean Oil, Mustard Oil,

Olive Oil And Rice Bran Oil.Soybean Oil Is The Most Commonly Used Vegetable Oil.Soybean Oil Constitutes Four Phytosterols:

Sitosterol,Brassicasterol,Stigmasterol And Campestrol.Mustard Oil Extracted From Mustard Seeds Is A Fatty Vegetable Oil.It Has A Slightly Pungent Odor And Appears Dark Yellow In Color [15]. Olive Oil Is Extracted From The Fruits Of Olive Plant. Apart From Being Extensively Utilized In Cooking All Over The World, Olive Oil Has Also Conquered The Cosmetic Industry. Rice Bran Oil Is Produced From The Outer Layer Of The Rice Grain (Bran) And Apart From Its Use As Cooking Oil It Is Also Used For Medicine. In Japan And Asia (Particularly India) Rice Bran Oil Is Commonly Considered As Healthy Oil.Rice Bran Is Utilized In The Treating Diabetes, High Blood Pressure, Alcoholism, Obesity, High Cholesterol, Andaids; For Inhibiting Stomach And Colon Cancer; For Inhibiting Heart And Blood Vessel (Cardiovascular)Disorder; For Improving The Immune System; For Enhancing Energy And Increasing Athletic Capacity;For Increasing Liver Function; And As An Antioxidant [17].

II. MATERIAL AND METHOD

The Shelf Life Of Oil Was Determined By Using Accelerated Shelf Life Testing (ASLT), Where The Product Is Stored At Elevated Stress Conditions (Storage Temperature Of 50 And 20) And Room Temperature. Oil Samples Were Stored Using An Amber Bottle, And The Bottles Were Sealed And Kept In A Dark Room (Inside An Incubator) To Avoid Direct Exposure From Light. The Temperatures Were Selected To Stimulate Relatively Fast Degradation, To Determine The Shelf Life Using ASLT (Without Destroying The Fundamental Characteristics Of Oil). PV And Free Fatty Acid (FFA) Concentration Were Measured In An Accelerated Storage Test. All Laboratory Analyses Were Performed In Triplicate, And Averages Are Presented.

Fortified Cooking Oil Samples Were Analyzed For The Following Parameters: (I) PV; And (Ii) FFA Level. These Two Parameters Are The Most Common Parameters To Characterize Oil Deterioration.

2.1 Estimation Of Peroxide Value

Peroxide Value Is A Measure Of The Peroxides Contained In The Oil [18]. The Peroxides Present Are Determined By Titration Against Thiosulphate In The Presence Of KI. Starch Is Used As Indicator. To Measure PV, The AOCS Cd 8–53 Method Was Used: 5 ± 0.5 G Of Oil Was Dissolved In 30 Ml Of Glacial Acetic Acid (Chloroform Solution). After The Addition Of 0.5 Ml Of Saturated Potassium Iodide With Occasional Shaking For 1 M And 30 Ml Of Distilled Water, The Solution Was Titrated With Sodium Thiosulphate Until The Yellow Color Faded. Starch Indicator Was Added, And The Titration Was Continued Until The Blue Color Disappeared. A Blank Determination Was Conducted, And The PV (Meq/Kg) Was Calculated Using The Following Equation:

$$\text{Peroxide Value} = \frac{(S - B) \times N \text{ Thiosulfate} \times 1000}{\text{Weight Of Sample}}$$

$$= (S - B) \times N \text{ Thiosulfate} \times 200$$

Where: Sis The Volume Of Sodium Thiosulphate Used In The Cooking Oil Sample Until The Yellow Color Faded (Ml), Bis The Volume Of Sodium Thiosulphateused In The Blank Sample Until The Yellow Color Faded (Ml), N Is The Normality Of Sodium Thiosulphate (Meq/Ml Used For Titration), W Is The Weight Of The Cooking Oil Sample (G).

2.2 Estimation Of Free Fatty Acids

To Measure Free Fatty Acid (FFA), The Percentage Of Free Fatty Acid In Each Sample Was Determined By The Titration Method (AOCS Ca 5a-40). Ten Grams Of Sample Were Weighed Into A Flask And Then Neutralized With 50 Ml Of 95% Ethanol And 1% Phenolphthalein Indicator. The Mixture Solution Was Heated To A Maximum Of 22 °C In A Steam Bath For 3 Min, And Then 2–3 Drops Of 1% Phenolphthalein Indicator Were Added. The Final Solution Was Titrated Against Potassium Hydroxide Solution (0.01 N) Until A Permanent Pink Color Persisted For At Least 30 S. The FFA (%) Was Calculated Using The Formula As Follows:

$$FFAV = (V \times N(KOH) \times 56)/W$$

Where: V Is The Volume Of KOH Used In The Blank Sample Until The Pink Color Persisted (Ml), N (KOH)Is The Normality Of KOH, W Is The Weight Of The Cooking Oil Sample (G).

III. RESULTS

3.1 Peroxide Value Estimation

The Peroxide Values For Four Different Cooking Oils At Three Different Temperatures Are As Follows:

3.1.1 Peroxide Values Of Water Extract

The Result States That With Reference To The Sample Kept At Room Temperature I. E. 37^0C, The Peroxide Value Remains Approximately Same At 20^0C And Reduced Drastically At 50^0C In All The Oil Samples.This Result States That The Antioxidant Activity Reduces With Increase In Temperature And Thus The Peroxide Value, Which Is An Indicator Of Lipid Oxidation Increases With Increasing Temperature.

S. No.	Oil Sample	Temperature (°C)	Peroxide Value Without Extract (Meq/Kg)	Peroxide Value With Extract (Meq/Kg)
1	Rice Bran Oil	50	15.12±0.04	14.06±0.05
2	Rice Bran Oil	37	11.18±0.07	10.06±0.08
3	Rice Bran Oil	20	11.20±0.05	10.414±0.06
4	Mustard Oil	50	34.71±0.03	33.60±0.03
5	Mustard Oil	37	23.20±0.07	22.132±0.07
6	Mustard Oil	20	24.92±0.05	23.88±0.04
7	Soybean Oil	50	8.23±0.06	7.024±0.06
8	Soybean Oil	37	6.45±0.04	5.2312±0.05
9	Soybean Oil	20	6.524±0.02	5.8288±0.02
10	Olive Oil	50	6.624±0.06	6.024±0.07
11	Olive Oil	37	5.081±0.04	5.072±0.04
12	Olive Oil	20	5.04±0.03	5.03±0.05

Table 1: Peroxide Values Of Water Extract Of Mixture Of Vetiveria Zizanioidesand Cynodondactylon

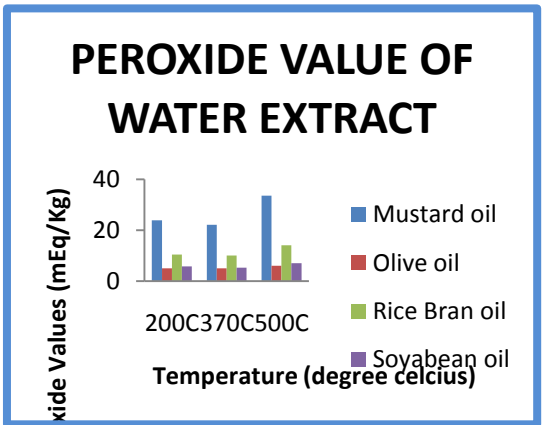

Figure 1: Peroxide Values Of Water Extract Mixture Of Vetiveria Zizanioidesand Cynodondactylon

3.1.2 Peroxide Values Of Ethanol Extract

The Ethanol Extracts Have Shown Better Results Than Water Extracts With Reference To Reduction In Peroxide Content. The Result Shows That With Reference To The Sample Kept At Room Temperature I. E. 37^{0}C, The Peroxide Value Remains Approximately Same At 20^{0}C And Reduced Drastically At 50^{0}C In All The Oil Samples.This Result States That The Antioxidant Activity Reduces With Increase In Temperature And Thus The Peroxide Value, Which Is An Indicator Of Lipid Oxidation Increases With Increasing Temperature.

S. No.	Oil Sample	Temperature (°C)	Peroxide Value Without Extract (Meq/Kg)	Peroxide Value With Extract (Meq/Kg)
1	Rice Bran Oil	50	10.58±0.04	9.255±0.04
2	Rice Bran Oil	37	5.72±0.02	4.028±0.02
3	Rice Bran Oil	20	4.29±0.08	3.615±0.07
4	Mustard Oil	50	20.28±0.03	18.51±0.05
5	Mustard Oil	37	15.58±0.03	14.084±0.03
6	Mustard Oil	20	16.02±0.04	14.88±0.04
7	Soybean Oil	50	6.55±0.04	5.414±0.06
8	Soybean Oil	37	4.37±0.03	3.218±0.05
9	Soybean Oil	20	3.58±0.03	2.818±0.03
10	Olive Oil	50	6.32±0.05	5.072±0.04
11	Olive Oil	37	5.34±0.03	4.024±0.03
12	Olive Oil	20	5.22±0.04	4.024±0.05

Table 2: Peroxide Values Of Ethanol Extract Of Mixture Of Vetiveria Zizanioidesand Cynodondactylon

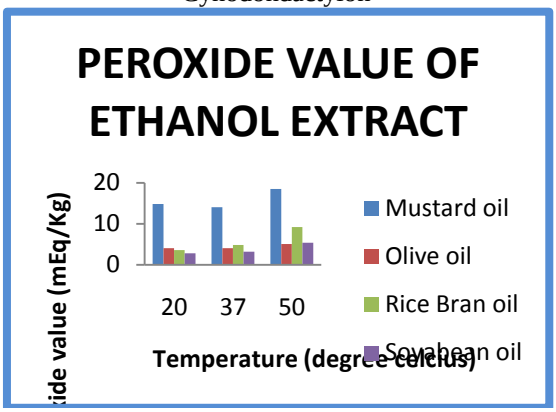

Figure 2: Peroxide Values Of Ethanol Extract Of Mixture Of Vetiveria Zizanioidesand Cynodondactylon

3.2 Free Fatty Acid Estimation

3.2.1 Analysis Of Free Fatty Acid Values Of The Oil Samples With Water Extracts

The Effect Of Mixture Of Leaf Extracts Of Vetiveria Zizanioidesand Cynodondactylon In Water On The Free Fatty Acid Content During Accelerated Storage Conditions (20^{0}C, 37^{0}C, 50^{0}C) Is Shown In Table 3. The FFA Value Of Oil Samples With Extract Has Shown Lower Values As Compared To FFA Values Without Extract. The FFA Values At Elevated Temperatures I.E. 50^{0}C Have Shown Increased Values Which States That The Antioxidant Capacity Of The Extract Is Reduced By Increasing Temperature As Stated Previously.

S.No.	Oil Sample	FFA Value Without Extract (Mg Of KOH)	FFA Value With Extract At 50°C (Mg Of KOH)	FFA Value With Extract At 37°C (Mg Of KOH)	FFA Value With Extract At 20°C (Mg Of KOH)
1	Soybean Oil	1.68±0.03	0.56±0.06	0.17±0.04	0.21±0.03
2	Mustard Oil	1.80±0.04	1.34±0.03	0.68±0.05	0.54±0.02
3	Olive Oil	0.78±0.02	0.48±0.07	0.45±0.08	0.44±0.05
4	Rice Bran Oil	1.88±0.05	1.58±0.05	0.65±0.03	0.60±0.04

Table 3: Free Fatty Acid Values Of Water Extract Of Mixture Of Vetiveria Zizanioidesand Cynodondactylon

3.2.2 Analysis Of Free Fatty Acid Values Of The Oil Samples With Ethanol Extracts

The Effect Of Mixture Of Leaf Extracts Of Vetiveria Zizanioidesand Cynodondactylonin Ethanol On The Free Fatty Acid Content During Accelerated Storage Conditions (20^0C, 37^0C, 50^0C) Is Shown In Table 4. The Result Shows That The Antioxidant Activity Of Ethanol Extract Is Better Than Water Extract. The FFA Value Of Oil Samples With Ethanol Extract Has Shown Lower Values As Compared To FFA Values Without Extract. Here Also The FFA Values At Elevated Temperatures Have Shown Increased Values Which States That The Antioxidant Capacity Of The Extract Is Reduced By Increasing Temperature.

S.No.	Oil Sample	FFA Value Without Extract (Mg Of KOH)	FFA Value With Extract At 50°C (Mg Of KOH)	FFA Value With Extract At 37°C (Mg Of KOH)	FFA Value With Extract At 20°C (Mg Of KOH)
1	Soybean Oil	1.68±0.08	0.44±0.03	0.15±0.04	0.19±0.05
2	Mustard Oil	1.90±0.03	1.04±0.05	0.56±0.05	0.48±0.08
3	Olive Oil	0.76±0.05	0.31±0.07	0.22±0.03	0.24±0.06
4	Rice Bran Oil	1.88±0.02	1.01±0.02	0.49±0.06	0.52±0.03

Table 4: Free Fatty Acid Values Of Ethanol Extract Of Mixture Of Vetiveria Zizanioidesand Cynodondactylon

IV. STATISTICAL ANALYSIS

Peroxide Values And Free Fatty Acid Assays Were Performed In Triplicate. Mean Values For Different Parameters Were Calculated And Compared By Analysis Of Variance (One-Way ANOVA) Using Online Software. Moreover, Statistical Differences Between Mean Values Were Identified At Confidence Level $P<0.001$.

V. CONCLUSION

Oxidative Rancidity Is Mostly Determined By Peroxide Value Estimation. It Estimates The Concentration Of Peroxides And Hydro-Peroxides Produced In The Primary Stages Of Lipid Oxidation. The Two Main Factors That Promotes The Formation Of Peroxides Are Light And High Temperature. The Peroxides Produced During Oxidation Are Estimated By Titration Against Thio-Sulphate In The Presence Of Potassium Iodide. In This Starch Acts As An Indicator. In This Study The Level Of Oxidation Was Evaluated By Estimating Peroxide Value Of Different Oil Samples With Or Without Leaf Extracts Of Vetiveria Zizanioidesand Cynodondactylonin Two Different Solvents. Three Different Temperatures (20^0C, 37^0C, 50^0C) Were Selected For Accelerated Storage Conditions Studies. The Effect Of Antioxidant Property Of Water Extract On PV Is Shown In Table 1 And Figure 1, Whereas The Effect Of Ethanol Extract On PV Is Shown In Table 2 And Figure 2. The Studies Were Conducted For The Storage Period Of 30 Days. According To The Results The Peroxide Value Was Increased With Storage Time. The Peroxide Value Of Oil Sample Without Extract Showed The Maximum Value. This Showed Their Effect On Lowering The Peroxide Formation During The Lipid Oxidation.

The Second Most Frequently Method Used For Estimating Oxidative Rancidity Of Edible Oils Is Determination Of Free Fatty Acids Produced During Oxidation Of Lipids. The Generation Of Free Fatty Acid Is The Result Of Hydrolysis Of Triglycerides And Can Get Stimulated By Interaction Of Moisture With Oil. The Effect Of Mixture Of Leaf Extracts Of Vetiveria Zizanioidesand Cynodondactylonin Water And Ethanolon The Free Fatty Acid Content During Accelerated Storage Conditions (20^0C, 37^0C, 50^0C) Is Shown In Table 3 And 4 Respectively. After 30 Days Of Storage The Free Fatty Acid Content Of Control (Oil Samples Without Extract) Has Increased. The Oil Samples With Added Extract Have Shown A Reduction In Free Fatty Acid Content With Reference To Control. The Free Fatty Acid Content Was Reduced To A Larger Amount In Samples Kept At 37^0C When Compared To Samples Kept At 50^0C. This May Have Occurred Due To The Denaturation Of Antioxidants Compound At 50^0C.

REFERENCES

[1] Warner K, Eskin NAM, Methods To Assess Quality And Stability Of Oils And Fat-Containing Foods. Champaign: American Oil Chemists' Society 1995

[2] Man D Shelf Life. Ames: Blackwell Sciences Ltd. 2002, 113 P.

[3] Pike OA. Fat Characterization. In: Nielsen SS, Editor. Food Analysis.3rd Ed. New York City: Springer,2003, P 227-246.

[4] Merrill LI, Pike OA, Ogden LV, Dunn ML, Oxidative Stability Of Conventional And High-Oleic Vegetable Oils With Added Antioxidants. J Amer Oil Chemsoc 85, 2008, 771-776.

[5] Broadbent C.J., Pike O.A., Oil Stability Index Correlated With Sensory Determination Of Oxidative Stability In Canola Oil. JAOCS, 2003, 80, 59–63.

[6] Labuza TP, The Search For Shelf Life. Food Testing Analysis 6, 2000, 26-35.

[7] Warner K, Neff WE, Byrdwell WC, Gardner HW, Effect Of Oleic And Linoleic Acids On The Production Of Deep-Fried Odor In Heated Triolein And Trilinolein. J Agr Food Chem 49, 2001, 899-905.

[8] Labuza TP, Schmidl MK, Accelerated Shelf-Life Testing Of Foods.Food Technol-Chicago 39, 1985, 57-62, 64, 134.

[9] Nawar W, Lipids. In: Fennema O, Editor. Food Chemistry.3rd Ed. Boca Raton: CRC Press, 1996, P 225-319.
[10] Mcclements DJ, Decker EA, Lipids, In: Fennema, OR, Damodaran S, Parkin KL, Editors. Fennema's Food Chemistry,4th Ed. Boca Raton: CRC Press, 2008, P 155-216.
[11] Merrill L, Effect Of Oil Variety And Antioxidant Addition On Oxidative Stability Of Commercial Vegetable Oils [Msc Thesis], Provo, UT: Brigham Young Univ. 2007, 124 P. Available From: BYU Harold B. Lee Library, Provo, UT: Http://Www.Lib.Byu.Edu/.
[12] Nawar W, Biochemical Process: Lipid Instability, In: Taub IA, Singh RP, Editors. Food Storage Stability.Boca Raton: CRC Press, 1998, P 89-103.
[13] Addis P.B., Warner G.J., The Potential Health Aspects Of Lipid Oxidation Products In Food, Free Radicals And Food Additives (Eds. O.I. Auroma, B. Halliwell), Taylor And Francis, London,1991, Pp. 77–119.
[14] Brewer, M. S., Natural Antioxidants: Sources, Compounds, Mechanisms Of Action, And Potential Applications,Comprehensive Reviews In Food Science And Food Safety, 10(4), 2011, 221–247.
[15] 15.Marmesat S, Mancha M, Ruiz-Mendez MV, Dobarganes MC, Performance Of Sunflower Oil With High Levels Of Oleic And Palmitic Acids During Industrial Frying Almonds, Peanuts, And Sunflower Seeds, J Am Oil Chemsoc, 82, 2005, 505-510.
[16] Finley J.W., Given P., Technological Necessity Of Antioxidants In The Food Industry. Food Chem. Toxic, 1986, 24, 999–1006.
[17] De Deckere, E.A., Korver, O, Minor Constituents Of Rice Bran Oil As Functional Foods. Nutrition Review, 1996, 54, P120-126
[18] Gotoh N, Wada S., The Importance Of Peroxide Value In Assessing Food Quality And Food Safety. J Am Oil Chemsoc, 83, 2006, 473-474.

Garima Gupta "Effect of Antioxidant Property of Vetiveria Zizanioides and Cyanodondactylon Leaf Extract on Shelf Life of Various Edible Oils"International Journal of Engineering Research and Applications (IJERA) , vol. 8, no. 4, 2018, pp. 36-40