



EVALUATION OF PEROXIDE VALUE IN VARIOUS FRESH AND REUSED EDIBLE OILS BY IODOMETRIC TITRATIONS

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ABSTRACT

Peroxides are the compounds containing an oxygen–oxygen single bond or the peroxide anion, O_2^{2-} . The O–O group is called the peroxide group or peroxy group. They are unstable, release oxygen when heated, and are powerful oxidizing agents. Peroxides are formed in oils when oxygen reacts with fat molecules. Exposure of oils to light, especially UV light, Exposure to aerial oxygen, Storage temperature, Metal ion residue from farming and processing are the circumstances which favor the formation of peroxides in oils. Peroxide value (PV) is a figure used for expressing peroxide content in oils. It is a qualitative criterion used for judging freshness of edible oils. High peroxide value indicates deterioration in oils and also decrease in nutritional value of oils. Use of rancid oils in cooking may cause diarrhea, nausea, head ache, abdominal pain fatigue, obesity, blood vessel blockage and may even cause cancer in humans. An attempt was made to show higher peroxide values in used edible oils compared to fresh edible oils by using iodometric titrations. Hence the present work suggests the usage of fresh edible oils to prevent rancidity of oils and other side effects.

KEYWORDS: Peroxides, Peroxide Value, iodometric titrations, rancidity.

1. INTRODUCTION

Oil oxidizes to form series of products like primary, secondary and tertiary oxidation products. Factors affecting rate of oxidation are temperature, light, availability of oxygen, and the presence of moisture and metals (such as iron).^[1] The type of oil also influences the rate of oxidation. Oxygen molecule reacts with oxygen to form peroxides. Peroxides are the compounds containing oxygen to oxygen single bond or peroxide anion O_2^{2-} .^[2]

Peroxides are intermediates in autoxidation reactions. Autoxidation is generally observed in oils with high degree of unsaturation, it is undesirable as it deteriorates and degrades the quality of oil. Peroxide value (PV) is used to determine autoxidation in oils. It is defined as concentration of peroxide present in oils which is used for assessing the quality of oil. Or it is the amount of peroxide oxygen present in 1 kilogram of oil. It is expressed in units of mill equivalents.^[3,4] In general fresh oils have a peroxide value of <10 mEq/Kg while peroxide values in the 30-40 mEq/Kg range are generally associated with a rancid taste.^[5]

edible oils are rich in triglycerides, sterol, tocoferol, carotenes and pigments. Reused edible oils are rich in free radicals and other cytotoxic agents which promote

undesirable effects like coronary heart diseases, obesity, abdominal pain, indigestion, cancer etc.^[6] Frying causes deterioration in quality of oils due to thermal-oxidation or lipid oxidation and hydrolytic reactions and the primary products of these reactions are hydroperoxides, which may later break down to produce lower molecular weight compounds, such as free fatty acids, alcohols, aldehydes, and ketones, eventually leading to a rancid product^[7] (Barthel and Grosch, 1974).

2. MATERIALS AND METHODS

2.1 Chemicals: Acetic acid, chloroform, potassium iodide, hypo and starch used for determining peroxide values of various fresh and used edible oils were of analytical grade.

2.2 Sample oils: Fresh oil samples like ground nut oil, sunflower oil, coconut oil, mustard oil, rice bran oil, castor oil, olive oil, cow ghee, buffalo ghee and vanaspati (fully or partially hydrogenated vegetable oil) used for study were purchased from local market. Reused oils like ground nut oil, sunflower oil, coconut oil, mustard oil, rice bran oil, castor oil, olive oil, cow ghee, buffalo ghee and vanaspati were collected from fast food centers and restaurants (reused for 3 - 4 times) located in and around banjarahills, Hyderabad, telangana, india.

2.3 Methodology: Determination of peroxide value was carried out using the method described by Pearson (1981) and Ranken (1988). unless otherwise directed, about 2 grams of oil sample ,accurately weighed was taken in a 250ml conical flask fitted with glass stopper, 10 ml of mixture of glacial acetic acid and chloroform (3:2) ,0.5ml of saturated potassium iodide solution was added to conical flask and was shaken

vigorously for 1 minute then it was kept in dark for 5 minutes to complete the liberation of iodine and to avoid photochemical reaction of iodine , then it was taken out from dark spray washed the walls of flask with about 10ml of distilled then titrated against 0.01N hypo until yellow color was discharged at this stage 5ml of freshly prepared starch was added to conical flask and continued titration until blue color was discharged. Blank titre Value was obtained by following the same procedure omitting oil. A peroxide value for reused oils was also determined by using same procedure. Peroxide value is calculated using the equation below:

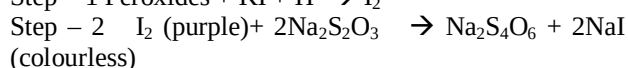
$$\text{Peroxide value} = \frac{2(a-b)}{\text{Weight of oil sample used}}$$

Where a = sample titre value b = blank titre value

3. RESULTS AND DISCUSSIONS

The peroxide value method is referenced in both the American Oil's Chemist Society

(AOCS) and the Association of Analytical Chemists (AOAC) as methods 965.33 (AOAC) or Cd-8b (AOCS).The theory and science behind the method involves measurement of iodine liberated from potassium iodide by a peroxide present in oil sample, using sodium thiosulfate solution as the titrant. In the presence of acetic acid. mechanism can be represented as follows.



In the present study peroxide values of various fresh and reused edible oils were evaluated (Table -1). Peroxide value of fresh and reused coconut oil was found to be same where as peroxide values of reused hydrogenated vegetable oils is much higher than its fresh sample. There is a significant increase in peroxide oils in almost all reused oil samples than their fresh samples. (Figure – 1)

Table -1 Peroxide values of fresh and reused edible oils

S.No	Name of oil sample	Peroxide value of fresh oil (meq/kg)	Peroxide values of reused oils (meq/kg)
1	Ground nut oil	1.6	1.8
2	Sunflower oil	2.0	2.5
3	Coconut oil	1.2	1.2
4	Mustard oil	2.8	3.1
5	Rice bran oil	1.7	2.6
6	Castor oil	2.0	2.8
7	Olive oil	1.5	1.8
8	Vanaspati /hydrogenated vegetable oil	3.5	4.3
9	Buffalo ghee	0.5	3.0
10	Cow ghee	0.6	1.8

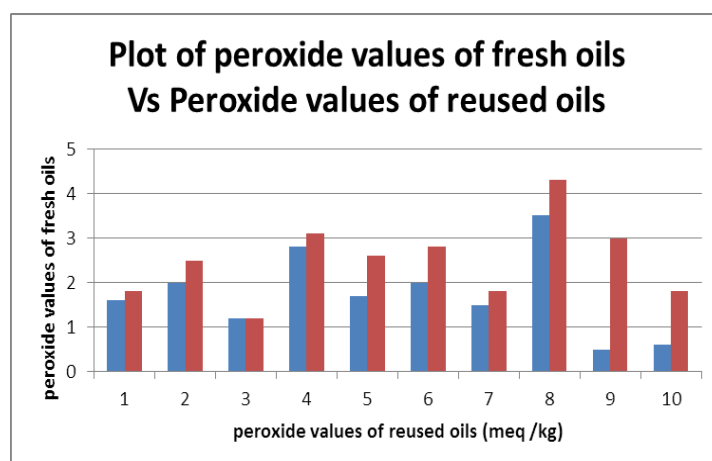


Figure -1 Plot of peroxide value of fresh oils vs peroxide values of reused oils

4. CONCLUSION

Peroxide values of fresh edible oils are in the order buffalo ghee < cow ghee < coconut oil < olive oil < groundnut oil < rice bran oil < sunflower oil = castor oil < mustard oil < vanaspati and peroxide values of reused edible oils are in the order vanaspati > buffalo ghee > mustard oil > castor oil > rice bran oil > sunflower oil > groundnut oil = olive oil = cow ghee > coconut oil. This order also indicates rancidity or deterioration in oils. Oils containing monounsaturated fats minimize artery blockage, supports the health of brain, heart and other organs and minimizes risk of diet-related ailments. Coconut oils are rich in monounsaturated fat,⁽⁸⁾ which helps to reduce cholesterol and triglyceride levels. The "Ceylon Medical Journal" notes that coconut fats do not contain artery-clogging trans fats, making coconut oil a healthy choice for those with heart problems.

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