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Exploring the Consequences of Additives in Palm and Groundnut Oil

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Abstract:
The effects of mixing the additives like papaya, carrot, lime and dye to the palm and groundnut oil samples were examined by watching the variation in the fat constants measured from the oil samples before and after the mixing of additives. The investigation into additive's effect on either increasing or decreasing those values was carried out by standardized experimental methods and the consequences have shown the altered behavior of additives on the tested oil samples. From the study, use of suitable additives can improvise the quality and usability of oil.

Keywords*: Additives, Fat constants, Saponification, Peroxide, Acid, Iodine value*

1. Introduction

Fat or Oil analysis requires the collection of characteristic data for different oil types and such determination is accomplished by the Fat constants. All the oils prepared from the same source should exhibit relatively the same values. So, certain chemical constants like Iodine, Peroxide, Saponification and Acid numbers are widely considered by chemists as these values can be utilized for determining the extent of pureness or to detect possible adulteration[1]. Fat constants help in Qualitative analysis of certain properties, detection of rancidity and the presence of toxic hydroxyl fatty acids. Additionally, identification of biological value and natural characteristics of fat is likewise possible. However, the basic form of oil may lack some properties which limit its application or use for a specific purpose. This drawback can be overcome by adding a variety of substances to the oil for improving the performance and desired properties of oil. These chemical compounds, organic or natural content are usually termed as the Oil additives. Suitable oil additives are already applied in the fields of industry and domestic purposes. The major concentration of this paper is addressed towards the locally available natural additives like carrot, papaya, lime and dye. The finely grated additives are added to palm and groundnut oil for examining the changes in the numerical value of chemical constants[2]. Some constants vary slightly, whereas some exhibit a major change on mixing additives. By a proper scrutiny of the entire data and comparing each additive and oil type, a decision of choosing oil for desired purpose can be reached.

2. Materials and Methods

For the preparation of additives, Carrot and Papaya were finely grated; the juice extracted from lime and powdered dye was taken. Indicators and other solutions were prepared from AR grade chemicals available in the laboratory. The following procedures for fat constant determination are same for examining the palm and groundnut oil samples.

2.1. Estimation of Saponification value[3]

Ethanolic potash of 25ml is mixed with 2g of each oil sample and additive (separate flask for carrot, papaya, lime and dye) of 1gin a conical flask. Simultaneously, a blank test is executed without the oil sample. These flasks were boiled in a water bath for half an hour with regular shaking. Each flask is added with Phenolphthalein indicator of 2 drops and then titrated against 0.5M HCl. The volumes of HCl required for the test with oil sample and for the blank test were noted after obtaining the endpoint as 'V_1' and 'V_2'respectively. The Saponification value is calculated from the expression: (V_2-V_1) x Normality of KOH x Eq. wt. of KOH / Wt. of the oil sample.

2.2. Estimation of Peroxide Value

The method prescribed by AOAC is adopted to estimate the peroxide value in which 2g of oil along with Acetic acid and Chloroform in 3:2 ratios are mixed with 1g additive in a conical flask[4]. Saturated Potassium Iodide of 0.5ml is added to all flasks and after 5 minutes 15ml of distilled water is added. The setup is titrated using 0.1N Sodium thiosulfate ($Na_2S_2O_3$) until the yellowish color disappears. Finally, 0.5ml starch is added and the titration is continued till the solution becomes colorless. Note the values of volumes of $Na_2S_2O_3$utilized for oil sample and the blank test as 'V_1' and 'V_2'respectively. Now, the Peroxide value is determined from: 1000 x (V_2-V_1) x Normality of $Na_2S_2O_3$ / Mass of oil taken.

2.3. Estimation of Iodine Value[5]

0.5g of oil sample, 50ml of Chloroform, 15ml Hanus solution and additive measuring 1g are taken in a corked conical flask; undisturbed for 30minutes in darkness. Later, 10ml each of 10% Potassium Iodide and distilled water are added, followed by a titration with 0.1N Sodium thiosulfate until a straw yellow color is observed. Again, 2ml starch indicator is added and titrated till the solution loses blue color. The readings for volumes of $Na_2S_2O_3$ used for blank test and oil sample test are noted as 'V_1' and 'V_2' respectively. Iodine value is calculated from the formula: 12.69 x (V_2-V_1) x Normality of $Na_2S_2O_3$ / Wt. of oil sample.

2.4. Estimation of Acid Value[6]

2g oil sample, 1g of additive and 25ml of Carbon tetrachloride are taken in a conical flask. To this, Phenolphthalein indicator of 2 drops is added and titrated against 0.1N alcoholic potash until the change in color is observed. Note the values of volume of alcoholic potash for blank test and the oil sample as 'V_1' and 'V_2' respectively. Acid value is obtained from the following expression: 56.1 x (V_2-V_1) x Normality of alcoholic potash / Wt. of the oil sample.

3. Results

The experimental values of fat constants for the palm and groundnut oils were provided in Table – 1 and Table – 2 respectively.

Chemical Constants	**Without Additives**	**With Additives**			
		Carrot	**Papaya**	**Lime**	**Dye**
Saponification Value (mg KOH/1g of oil)	298.790	301.000	307.271	307.271	313.542
Peroxide Value (meq/kg of oil)	25	40	45	35	35
Iodine Value (g of I_2/100g of oil)	54.313	54.821	56.851	53.044	54.059
Acid Value (mg KOH/1g of oil)	1.122	1.402	1.963	1.122	1.402

Table 1: Computed Fat constants for Palm oil

Chemical Constants	**Without Additives**	**With Additives**			
		Carrot	**Papaya**	**Lime**	**Dye**
Saponification Value (mg KOH/1g of oil)	206.938	213.209	219.479	219.479	232.021
Peroxide Value (meq/kg of oil)	5	10	15	15	10
Iodine Value (g of I_2/100g of oil)	87.561	81.216	81.470	80.708	80.962
Acid Value (mg KOH/1g of oil)	2.805	3.085	3.366	3.646	3.366

Table 2: Computed Fat constants for Groundnut oil

4. Discussion

The Saponification value or number is the amount of KOH required to emulsify 1g of oil and can be stated to be in an inverse relationship to the molar mass or chain length of the fatty acids in the oil[7]. The data from the columns of saponification value in the Table – 1 and Table – 2 indicates a slight increase in value owing to the addition of additives which account for reducing the fatty acid weight or the chain length. It can be put forward that for both the oils in the case of Saponification value, Papaya and Lime exhibit the same effect;whereas Carrot has the least and Dye has a greater impressionas additives.

Peroxide value, as observed from the tabular forms in the results, can be clearly seen to have increased with the presence of additives. Usually, the count of peroxides may also include some natural constituents (additives) present in the oil and this explains the reason for the increase in the peroxide value in the oil samples[8]. Moreover, many researchers have confirmed that the peroxide values are unstable owing to higher temperatures that usually occur in cooking these oils[9].

The Iodine value changes as observed in the palm oil are almost negligible; whereas significant decrease noted in groundnut oil with additives is considered as a potential diminution in the unsaturation of the fatty acids present in the oil. This may not be accountable for the conjugated double bonds or the double bonds near the carboxyl groups[10].

From the calculated fat constants, it is observed that adding lime does not alter the acid value of palm oil. Carrot and dye have shown identical acid values in palm oil. Similar results were identified in case of papaya and dye added in groundnut oil. Overall, the increment in acid value can be accounted for increase of moisture content present in the additives.

5. Conclusion

Variation in the Fat constants for the oils can be achieved by proper selection of the additive either to alter the chemical parameter or to increase the quantity without altering the parameter. However, such a change is appreciable for a specific scientific application purpose rather than to improve the quality or quantity of low grade oil.Technical restrictions may be enforced to limit the usage of additives in the edible oils for the sake of society.

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7. References

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