

The Effect of Onion and Garlic Extracts on the Rancidity of Soyabean and Corn Oils

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Abstract: The abilities of Onion and Garlic extracts to inhibit lipid oxidation (Rancidity) have been investigated. The extracts were separately with each of Crude Soyabean and Corn Oil samples in the ratio of 7:3; Oil extract and left to stand in open containers for 10 weeks. Pure samples (without the extracts) of the oils were used as controls. The Free Fatty Acid (FFA) and the Peroxide Values (PV) of both the pure and mixed oil samples were determined bi-weekly. The FFA and PV of the pure samples of the oils increased as time progressed showing marked deterioration (rancidity) of the oils while the FFA and PV of the oil/extract samples decreased showing marked inhibition of lipid deterioration (rancidity) within the period of the experiment.

Key words: Rancidity, FFA, PV, onion, garlic, inhibition

INTRODUCTION

Rancidity is the oxidation (decomposition) primarily of unsaturated fatty acids resulting in disagreeable flavors and odors in fats and oils (Ensminger *et al.*, 1995). This process occurs slowly and spontaneously. Certain factors and substances such as light, high temperature and minerals, e.g. Copper, Iron, etc. (Macrae *et al.*, 1993). Catalyze or accelerate (pro-oxidants) lipid oxidation (rancidity) while some inhibit or prevent (anti-oxidants) it. Rancidity may be prevented by the addition of such synthetic anti-oxidants such as Butylated Hydroxyl Toluene (BHT), Butylated Hydroxyl Anisole (BHA), propyl gallate, etc.

However, some fats or oils are naturally protected from oxidation due to the presence of Vitamin E (Tocopherol), ascorbic acid, certain amino acids and proteins and other substances which may chelate metals (Ensminger *et al.*, 1995; Alais and Linden, 1999). Vitamin C and E are both natural proposed chain-breaking anti-oxidants that interrupt the process of oxidation and eliminate the by products from the body (Ingold and Burton, 1990).

Products of rancidity include Free fatty acids, peroxides, aldehydes, ketones, fatty alcohols, etc. The Free Fatty Acid (FFA) and the peroxide values are the most widely used tests for oxidative rancidity. Synthetic anti-oxidants are organic chemicals and have been widely applied in oil processing. But natural anti-oxidants are

certain natural components of some agricultural products, e.g., some plant species, herbs and spices. These plant species, herbs and spices are in abundance in Nigeria and can therefore be processed and employed in oil processing as anti-oxidants. This research is therefore, focused on the anti-oxidant properties of crude Onion and Garlic extracts.

MATERIALS AND METHODS

The soyabean (*Glycin max*) seeds, the corn kernels, onion and garlic samples used for the study were bought at the Umuahia central market, Abia State. The soyabean seeds and the corn kernels were dried in the oven at 65°C while the Onion and Garlic samples were cut into very tiny pieces and sun-dried. The dried soyabean, corn kernel, Onion and Garlic samples were separately milled and extracted with a mixture of 50:50 by volume of ethanol and n-hexane in a soxhlet extractor for 4 h to obtain the crude Soyabean and Corn Oils as well as the Onion and Garlic extracts.

The crude oils were then mixed with the extracts in the ratio of 7:3; oil extract. About 100 cm³ each of the unblended oil samples and the blended oil samples were left open in different containers for 10 weeks. The FFA (Firestone, 1990) and the peroxide values (Obboh *et al.*, 1987) were determined bi-weekly for 10 weeks. The average of three determinations for each parameter was recorded.

Sample labeling:

- CO-Pure Corn Oil
- CO/Onion-Corn oil/Onion extract mixture
- CO/Garlic-Corn oil/Garlic extract mixture
- SO-Pure Soyabean Oil
- SO/Onion = Soyabean Oil/Onion extract mixture
- SO/Garlic-Soyabean Oil/Garlic extract mixture

RESULTS AND DISCUSSION

The results of the FFA and Peroxide values of the pure and blended Corn Oil (CO) and Soyabean Oil (SO) samples for a period of 10 weeks are shown in Table 1 and 2, respectively. It will be observed that the FFA of the Pure Corn Oil (CO) sample increased from 0.56 in the 2nd week to 1.00 (an increase of 78.57%) in the 10th week. Its Peroxide Value also increased from 1.50 in the 2nd week to 2.10 (40%) in the 10th week (Table 1).

The FFA value of Pure Soyabean Oil (SO) increased from 0.70 in the 2nd week to 2.10 (200%) in the 10th week. Its Peroxide Value also increased from 1.30 in the 2nd week to 2.20 (69.23%) in the 10th week (Table 2). The continued increase in the FFA and the Peroxide Values is a clear indication of oxidation (Rancidity) of the oil samples as time progresses.

The development of FFA and Peroxides is more with Soyabean Oil (SO) than with Corn Oil (CO) (Table 1 and 2). Both Soyabean Oil and Corn Oil are unsaturated. Auto oxidation involves oxidation of methylene groups between the double bonds at the unsaturated side chains (Njoku, 2001). The unsaturation (or saturation), presence or absence of anti-oxidants and/or pro-oxidants have marked effect on the rancidity of oils. The graphs showing the development of peroxides in the pure and blended oil samples are shown in Fig. 1 and 2.

The rate of production of FFA and Peroxides by Corn oil is smooth and slow until the 6th week but very sharp between the 6th and the 8th week (Fig. 1). In the same vein, the rate with Soyabean oil is very sharp between the 2nd and 4th week but smooth and gradual from the 4th week and up to the 10th week (Fig. 2).

Oils composed of more of saturated fatty acids are more stable to oxidative rancidity than oils composed of more of unsaturated fatty acids. This will therefore, imply that among the oils composed of unsaturated fatty acids, those composed of more of the unsaturated fatty acids will be less stable than those composed of less of the unsaturated fatty acids. Corn oil is composed of 86% unsaturated fatty acids (more unsaturated) while Soyabean oil is composed of 83% unsaturated fatty acids (Ononogbo, 2002) yet Corn oil has better stability with longer induction period than Soyabean Oil.

This observation can be explained as a result of the presence of anti-oxidants naturally in the crude oil samples. It has been reported that Corn oil has a total Vitamin E (Tocopherol) content of 62.04% comprising of 11.28% of α -tocopherol and 50.76% of γ -tocopherol while soyabean has a total tocopherol content of 60.73% comprising of 10.23% of α -tocopherol and 50.48% of γ -tocopherol (Dupont *et al.*, 1990). Thus, the higher presence of tocopherol (an anti-oxidant) in Corn oil in spite of its higher composition of unsaturated fatty acids than Soyabean oil has necessitated its higher stability to lipid oxidation than Soyabean oil (Fig. 1 and 2). The increase in the FFA and Peroxide Values of the blended oils in the 2nd week may be as a result of the free fatty acid contribution of the onion and garlic extracts. The blended oil samples showed marked decreases in the FFA and Peroxide Values. The reduction in the FFA and Peroxide Values of the blended oil samples show good anti-oxidant activities of Onion and Garlic extracts.

The FFA and Peroxide Values of the Corn oil samples at the 10th week represent 40 and 32% inhibition of the

Table 1: The FFA and peroxide values of pure and blended Corn Oil (CO) samples

Weeks	CO		CO/Onion		CO/Garlic	
	FFA	P.V	FFA	P.V	FFA	P.V
2nd	0.56	1.50	0.58	1.54	0.60	1.54
4th	0.65	1.70	0.60	1.56	0.63	1.58
6th	0.70	1.80	0.60	1.57	0.64	1.59
8th	0.90	2.10	0.60	1.57	0.65	1.59
10th	1.00	2.10	0.60	1.58	0.68	1.59

Table 2: The FFA and peroxide values of pure and blended Soyabean Oil (SO) samples

Weeks	SO		SO/Onion		SO/Garlic	
	FFA	P.V	FFA	P.V	FFA	P.V
2nd	0.70	1.30	0.75	1.60	0.78	1.65
4th	0.80	1.80	0.75	1.60	0.78	1.65
6th	0.90	1.90	0.75	1.60	0.79	1.65
8th	2.05	2.15	0.78	1.60	0.82	1.68
10th	2.10	2.20	0.80	1.65	0.84	1.71

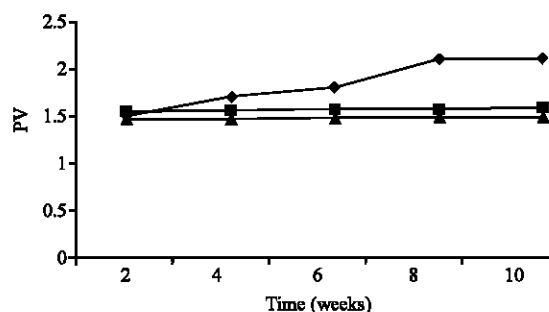


Fig. 1: A plot of PV against time (weeks) for pure and blended CO samples

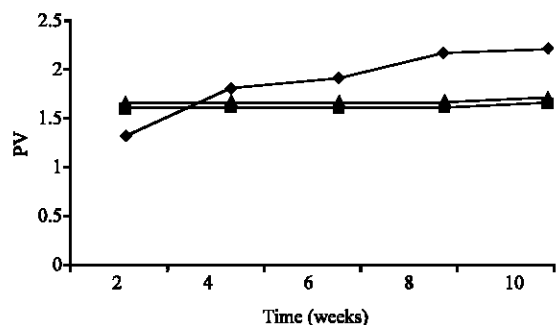


Fig. 2: A plot of PV against time (weeks) for pure and blended SO samples

development of FFA and also 24.76 and 24.29% inhibition of the development of peroxides by the Onion and Garlic extracts, respectively.

In the same vein, the FFA and Peroxide Values of the Soyabean oil samples at the 10th week also represent 61.90 and 60% inhibition of the development of FFA and also 26.36 and 23.18% inhibition of the development of peroxides by the Onion and Garlic extracts, respectively.

CONCLUSION

The anti-oxidant properties of the extracts is as a result of the presence of Vitamin A, C, E as well as such phytochemicals as terpenes, flavonoids, saponins, carotenoids and allyl sulphides in the crops and which are known to possess anti-oxidant properties (<http://en.wikipedia.org>).

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