The Antioxidant Property of *Aframomum danelli* Spice in Oils

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Abstract

A study was carried out on the antioxidant property of *Aframomum danelli* extract in palm oil and soybean oil. The activity of *A. danielli* extract was compared with those of other antioxidants of other plant sources, rosemary extract and d-tocopherol, at different concentrations. *A. danielli* was as active as rosemary plant extract in reducing rate of peroxide formation in soybean oil at concentrations of 200 ppm and 300 ppm . *A danielli* was much more effective than tocopherol in reducing peroxidation in soybean oil and palm oil at the higher concentrations except at 50 ppm.

Keywords: Antioxidant activity, *Aframomum danielli* spice, oils.

Introduction

Preservatives used in the food industries are coming under increasing scutiny and re-appraisal. Synthetic antioxidants are effective oil stabilisers but concern about their possible adverse effects on consumption is increasing. Some have been reported to have carcinogenic and mutagenic activity (Ito *et al* 1985 VanEsh, 1986).

The potent sources of natural antioxidants are spices and herbs. Spices have been known to impact flavour but it is now recognised that they fulfill more than this one function in food systems. Shelef (1980) reported that certain spices prolong the shelf life of foods by their bacteriostatic activity. Spices such as red chili, cinammon leaf, clove , rosemary, sage, have been reported to have antioxidant properties (Chipault and Lumberg, 1962).

According to Pokorny, (1991) when natural antioxidant are compared with synthetic ones, natural antioxidants have the following advantages; they are readily acceptable by consumers as they are considered to be safer, no safety tests are required by legislation for they belong to a component of food that is generally regarded as safe.

Aframomum danielli is a spice belonging to the genus *Aframomum* and the family Zingiberaceae. This spice has been found to have preservative property in some food systems (Adegoke and Skura, 1994). This paper describes the effect of A. *danielli* as an antioxidant on some oil systems. Its activity in oil was compared with other natural antioxidants.

Materials and Methodology

The spice *A. danielli* was obtained from Bodija market, Ibadan. Fresh palm oil was from Okiti-pupa oil mill, and the soybean oil was from Jof Ideal Ltd. Rosemary antioxidant and d-tocopherol was from Waco Pure Chemicals Osaka, Japan.

Spice treatment

The seeds were removed from the pod of A. *danielli* fruit and it was cleaned of all extraneous materials and adhering particles. The seeds were air-dried at 25°C for 2 days due to its low moisture of 10.9% (determined by AOAC 1990). The seeds were pulverized into a fine powdery form after drying in a hammer mill (Philips model) and it was stored at 4°C until it was used.

Solvent extraction of spice

This was determined by the method described by Chang *et al* (1977) One hundred grains of finely ground *A. danielli* spice was extracted with 240ml of diethyl ether under refluxing condition for 24hr. The mixture was filtered and the residue was extracted again with fresh extract. The filtrate was freed of. solvent to recover the extract by evaporation of the solvent. The filtrate, which the spice extracts, was packaged at 4°C until it was used.

Antioxidant incorporation

The spice was incorporated into soybean oil (initial .PV, 0.56meq/ kg) and palm oil (initial PV, 0.51 meq/ kg) by direct addition into the oils using the method of Smith (1991). The different concentrations of adding the extract into the oils were 50, 100, 200 and 300 ppm respectively.

Storage test for treated oils

Shaal oven storage test as described by Smith (1991) was used. 100g of oil with A. *da,,elli* extract added (based on the concentrations indicated above) were put in uncovered 250m1 pyrex glass beakers. The oils were stored in an oven (THELCO model 28) at 63°C. The same procedure was repeated for rosemary extract and d-tocopherol. Control samples without the extracts were also placed under the same storage condition. Oxidative stability of the oils was measured by monitoring Peroxide value (PV) for 28 days. PV was determined by the method of Egans, *et. al.* (1991).

Statistical analysis

Result of antioxidant activity of the extract in oils were tested for significant difference by ANOVA (Analysis of variance) and separation of means was by SAS, 1995.

Result and discussion

The effect of *A. danielli* in comparison with rosemary extract and d -tocopherol in oils are shown in **Tables 1** and **2**. The decrease in the rate of formation of peroxides in the oils was used as the measure of antioxidant activity. Generally, rate of peroxidation in the oils decreased with increase in concentration of extracts. Chang *et al* (1977) also observed a decrease in peroxide value for lard preserved with rosemary extract. Peroxide value of the control samples for the oils increased steadily in the early heating periods and later gradually.

At 50 ppm concentration of extracts in soybean oil, rosemary extract showed the highest activity in reducing the rate of peroxide formation followed by *A. danielli*. but the activity of *A. danielli* was not significantly different from that of d-tocopherol by the 28th day of storage at $p<0.05$. In soybean oil at 100ppm, *A.danielli* was not significanay different from rosemary extract at 200ppm. Both *A. danielli* and rosemary were not significantly different in their activity. Also at 300ppm, rosemary was initially most active but its activity was not significantly different from *A. danielli* by the 28th day of storage at $p<0.05$ (**Tables 1**). d-tocopherol showed the least activity but it is significantly different from the control samples at the different concentrations of use. In palm oil, at 50, 200 and 300ppm, rosemary extract was still the most effective but at 100 ppm, activity of *A.danielli* was similar with that of rosemary at about 28th day of storage (**Table 2**). Generally, tocopherol had the least activity when compared with *A. danielli* and rosemary extracts especially in palm oil. Smith (1991) observed that addition of tocopherol to vegetable oils that are already rich in tocopherol does not have any significant effect in the stability of such oils. He also reported that tocopherols are readily oxidized into tocoquinones. Reduced activity of tocopherol in palm oil could be due to these reasons. Yosida *et al* (1993) attributed the activity of tocopherols to the ability to break chain reactions by reacting with free fatty radicals.

Soybean oil had higher rate of peroxide formation than palm oil. This could be due to more of unsaturated fatty acids present in the soybean oil which are readily susceptible to oxidation unlike palm oil with more of saturated fatty acids. Aurand *et al* (1987) reported that unsaturated fatty acids are more reactive than saturated fatty acids.

Table 1. Change in preoxide value of soybean oil during storage

		PV at 63°C during storage of oil			
Extract (ppm)	**Extracts**	0	7	14	28 (days)
50	A danielli	0.56	24.29 cd	62.08 g	156.93*l*
	rosemary	0.56	20.78 cd	47.72f	130.60k
	d-tocopherol	0.56	38.28e	78.80h	159.78*l*
100	A danielli	0.56	16.23ab	24.48cd	98.13ij
	rosemary	0.56	14.84a	22.05cd	77.55h
	d-tocopherol	0.56	20.59cd	73.30gh	138.39k
200	A danielli	0.56	20.22cd	40.69e	51.22f
	rosemary	0.56	15.35ab	34.95e	49.25f
	d-tocopherol	0.56	32.82d	44.86ef	101.74j
300	A danielli	0.56	18.83c	21.01cd	36.21e
	rosemary	0.56	13.74a	20.15cd	28.39cde
	d-tocopherol	0.56	20.96cd	39.98e	79.69gh
	Control	0.56	49.22f	90.20i	200.45m

Means not followed by the same letter are different at $P<0.05$

Table 2. Changes in peroxide value of palm oil during storage

		PV at 63°C during storage of oil			
Extract (pm)	**Extracts**	0	7	14	28 (days)
50	A danielli	0.51	29.79e	52.69gh	97.65m
	Rosemary	0.51	10.65b	58.71h	81.10*l*
	d-tocopherol	0.51	30.41ef	65.86j	99.49m
100	A danielli	0.51	13.69b	25.97de	35.92f
	Rosemary	0.51	25.97de	31.87ef	31.12ef
	d-tocopherol	0.51	24.87de	36.34f	59.08h
200	A danielli	0.51	13.80b	15.79c	25.22d
	Rosemary	0.51	9.78ab	10.61b	15.84c
	d-tocopherol	0.51	16.25c	20.57d	72.01k
300	A danielli	0.51	11.87b	14.92bc	16.13c
	Rosemary	0.51	7.87a	7.83a	13.10b
	d-tocopherol	0.51	25.15de	48.26g	61.07i
	Control	0.51	32.86ef	60.86i	102.50n

Means not followed by the same letter are different at $P<0.05$

Conclusion

Based on these observations, antioxidant activities of *A. danielli* extract compares favourably with rosemary. If it could be effective in its crude form, it is suggested for use in the food industries in its purified form.

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