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OXIDATION STABILITY OF SUNFLOWER OIL OF ALTERED SUNFLOWER AFTER SEED STORAGE

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SUMMARY

The main goal of these investigations was to study the changes in oxidative stability of oil after periods of seed storage (12 and 24 months after harvesting) held in room conditions (temperatures between 15-25°C). Investigations were carried out with samples of sunflower seed with high and normal linoleic acid contents. Samples were obtained from ongoing research at the Institute of Field and Vegetable Crops, Oil Crop Department, University of Novi Sad.Oil samples from high linoleic acid seed indicate a significantly shorter induction period (by Rancimat 617 apparatus at 100°C) as compared with oil samples with oleic acid content.

Key words: Oxidation, seed, sunflower, storage.

INTRODUCTION

A number of investigators have contributed to the development of sunflower hybrids with specific oleic and linoleic acid contents as compared with the normal ones (Soldatov, 1976; Vick, 1984; Urie, 1984). Oils with high oleic or linoleic acid content are especially interesting (Škorić, 1986). The upper limit of oleic acid content is approximately 85%, while linoleic acid is 72% (Škorić, 1987). Sunflower oil with high oleic acid content can be used for frying food, due to its increased oxidative stability (Turkulov, 1980). Purdy (1985) confirmed that the higher the oleic acid content, the better the oxidative stability. Investigations have been performed to improve the oxidative stability of polyunsaturated oils (soybean, canola) using high oleic oils (Frankel, 1994).

The objective of the present paper was to investigate the oxidative changes after prolonged storage (12 to 24 months) of sunflower seed oil (with high oleic and normal linoleic acid contents under ambient conditions, without possibility of selfheating).

MATERIALS AND METHODS

Four samples of sunflower seed were investigated: 12 months after harvesting - sample with normal linoleic acid content (NL-12), 12 months after harvesting - sample with high oleic acid content (HO-12), 24 months after harvesting - sample with high linoleic acid content (NL-24), 24 months after harvesting - sample with high oleic acid content (HO-24).

Peroxide value, free fatty acids (FFA) content and phosphatides in the oil were obtained using AOCS-methods. Oil content was determined by Soxhlet apparatus with extraction in petrolether. The composition of fatty acids was determined by gas chromatography (Hewlet Packard 5840 A). Pressed oil was obtained by cool pressing, using a laboratory press without thermal pretreatment. Oxidative stability of oil samples, extracted and pressed, was determined using a Rancimat apparatus.

RESULTS

The moisture and oil content of the samples are presented in Table 1. The moisture content is below 5%, so the storage conditions were favourable, avoiding many problems associated with storage at higher moisture contents.

Table 1: Sunflowerseed moisture and oil content

Sample	NL-12	HO-12	HL-24	HO-24
Moisture content (%)	4.20	5.00	4.50	4.80
Oil content (%)	48.19	41.40	46.71	36.81

The characteristics of pressed and extracted oil samples are presented in Table 2. The FFA content is lower in pressed than in extracted oil. The highest FFA content was found in extracted oil obtained from high oleic acid seed stored for 12 and 24 months as compared with extracted oils with normal linoleic acid content (NL-12 and NL-24). Regarding the phosphatides content, no significant difference was observed for the extracted oil samples. The phosphatides were present in the pressed oil only in traces.

Table 2: Characteristics of sunflower oil samples

Sample	Pressed oil				Extracted oil			
	NL-12	HO-12	NL-24	HO-24	NL-12	HO-12	NL-24	HO-24
Free fatty acids (%)	0.21	0.29	0.44	0.75	0.36	0.47	0.73	1.31
Phosphatides (%)	-	-	-	-	0.15	0.15	0.18	0.17
Peroxide value (mmol O_2/kg)	8.3	1.1	12.8	1.3	13.1	8.4	19.2	10.8

The hydroperoxides content of oil obtained from oleic types (HO-12 and HO-24) and normal linoleic acid content (NL-12 and NL-24) were different. After 12

and 24 months of storage, the peroxides content of pressed oleic type oil is very low: 1,2 and 1,3 mmol O_2/kg, respectively. On the contrary, the peroxide value of the normal linoleic acid oil was 8,3 and 12,8 mmol O_2/kg, respectively. A similar relationship of peroxides content was observed in extracted oil samples as well, however, higher peroxide values were observed also in the pressed oil.

The fatty acid composition of oil obtained from oleic type seed and from normal linoleic acid content type seed after 24 months storage time is presented in Table 3. The oleic type is characterized by very low content of linoleic acid.

Table 3: Fatty acids composition of oleic and linoleic type of sunflower oil

Sample	Fatty acids			
	C 16:0	C 18:0	C 18:1	C 18:2
HO-12	3.06	4.44	87.65	4.06
NL-24	5.36	5.90	15.97	72.42
HO-24	2.97	3.31	89.35	3.63
NL-24	6.86	5.02	24.05	63.65

The greatest differences between the two kinds of oils were observed for oxidative stability (Rancimat 617). The induction period of extracted normal linoleic acid oil samples (NL-12 and NL-24) (Figure 1) is significantly lower than for oleic type oils. In the case of oleic type seed oils, the change of oxidative state is obvious as seen after one-two years of seed storage.

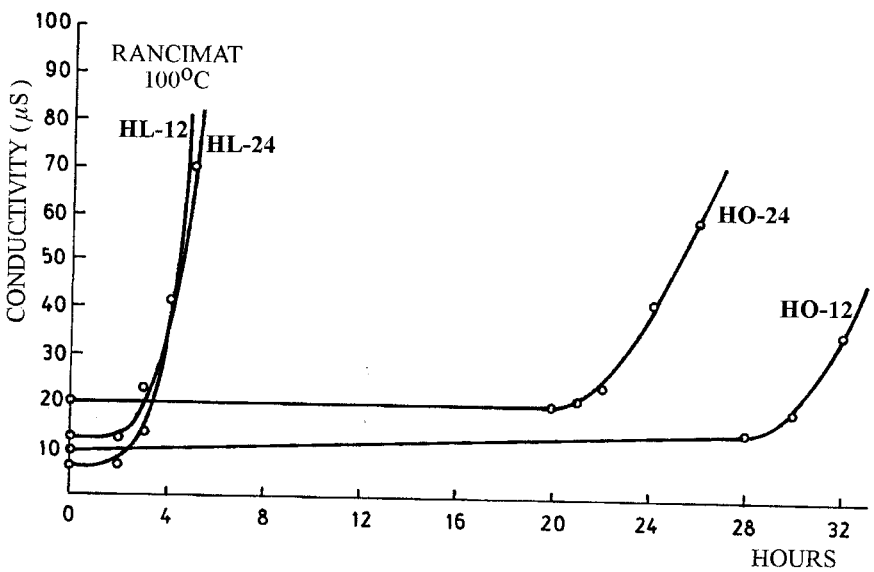

Figure 1. Shelf life of extracted oil samples determined by Rancimat 617, at 100°C

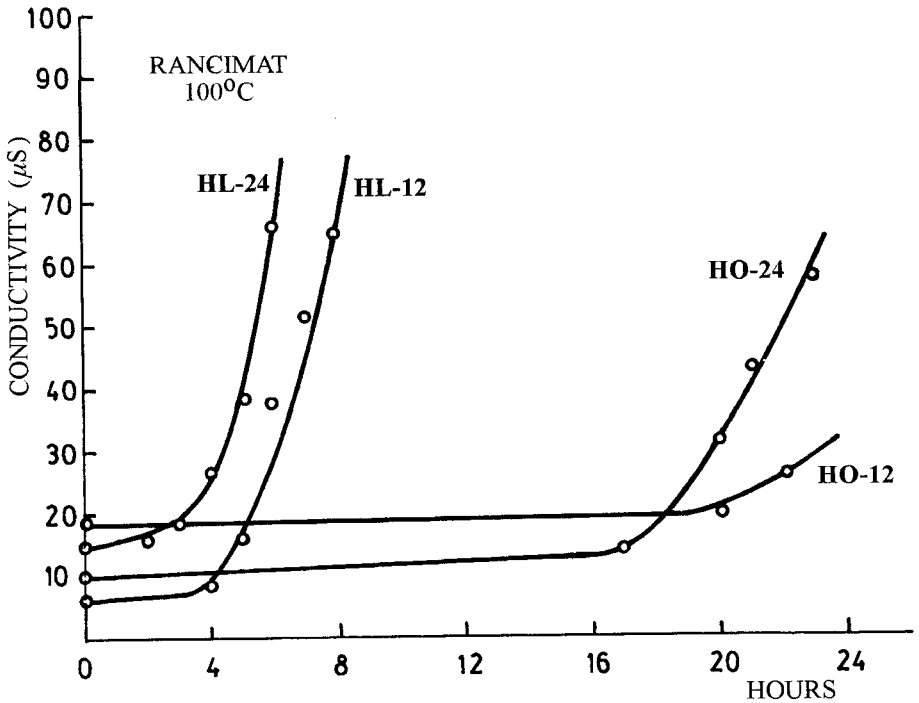

Figure 2. Shelf life of pressed oil samples determined by Rancimat 617, at 100°C

The oxidative stability of pressed oil samples was also determined at 100°C (Rancimat 617). The induction period of extracted high oleic and linoleic oil samples is significantly shorter as compared with pressed oils. The oxidative stability of oils obtained from seed stored for 24 months was worse in both cases (Figure 2).

CONCLUSIONS

The oxidative changes of oil were determined after storage period of 12 and 24 months of sunflowerseed with high and low oleic acid contents. The oil samples were obtained by pressing and by hexane extraction. Significant differences were found in hydroperoxides content, which was lower in pressed oil samples and oil obtained from oleic type seed. High differences were expressed during the oxidation of sunflowerseed oil at 100°C (Rancimat 617 apparatus). The induction period of oleic oil is approximately 5 times greater (even after 24 months of storage) than of normal linoleic acid oil. This would indicate that different fatty acid compositions are more significant for the oxidative stability of the oil than the storage time (12 or 24 months) for the high oleic and normal linoleic seed samples in this study.

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ESTABILIDAD OXIDATIVA DEL ACEITE DE GIRASOL DESPUÉS DE UN LARGO ALMACENAMIENTO DE LA SEMILLA

RESUMEN

Las investigaciones fueron llevadas a cabo con muestras de semillas de girasol con contenido alto o estándar de ácido linoleíco. Las muestras fueron cultivadas en el campo de investigaciones del Institute of Field and Vegetable Crops, Departamento de Oleaginosas, Universidad de Novi Sad. El objetivo principal de estas investigaciones fué estudiar los combios de la estabilidad oxidativa del aceite después de un período largo de almacenamiento de semilla a temperatura ambiente (12 y 24 meses después de la recolección). De acuerdo con los resultados, las muestras de aceite de la semilla de girasol con alto contenido de ácido linoleíco indician un perído de inducción más corto (mediante un aparato Rancimat 617 a 1000C) en relación a las muestras de aceite con incremento del contenido de ácido oleíco.

STABILITÉ DE L'HUILE DE TOURNESOL À L'OXYDATION APRÈS UNE LONGUE PÉRIODE DE STOCKAGE DE LA GRAINE

RÉSUMÉ

Des recherches ont été menées sur des échantillons de graines de tournesol standard ou à haute teneur en acide linoléique. Les échantillons ont été cultivés dans le cadre des recherches conduites à l' "Institute of Field and Vegetable Crops", Département des plantes oléagineuses, Université de Novi Sad. L'objectif principal de ces travaux était d'étudier les modifications de stabilité de l'huile vis à vis de l'oxydation, aprés une longue période de stockage des graines à température ambiante (12 et 24 mois aprés la récolte). D'aprés les résultats, les échantillons d'huile de graines de tournesol à haute teneur en acide linoléique montrent une période d'induction significativement plus courte (Appareil Rancimat 617, à 100°C) comparativement à celle échantillons d'huile à teneur élevée en acide oléique.