Quality of Edible Nonrefined Sunflower Oil with Different Fatty Acid Composition

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Introduction

The edible nonrefined oils are becoming more and more important lately. Besides the olive oil, other nonrefined oils obtained from pumpkin seed, sesam, almond, walnut etc. are enjoying an upsurge in popularity These oils are specific ones and they taste like the source. They are known as so-called gourmet or pungent oils and are used for salads, dressings etc. (1).
The production of edible nonrefined oils started in Yugoslavia lately, especially of sunflower oil, which is obtained by pressing and as such used in the nutrition.
The aim of this work was to investeigate the quality, biological value and stability of sunflower oil with different fatty acid composition (high oleic and high-linoleic type) obtained by pressure on the hydraulic and screw presses.

Key words: edible nonrefined sunflower oil, quality, stability, fatty acid composition

Materials and methods

The sunflower oil samples were prepared according to the given scheeme (Figure 1).

Figure 1

The dehulled material going to the hydraulic presses was treated in two ways (scheeme), while the screw pressed oil was obtained from non-treated dehulled seed.
The ISO methods were used for quality and oxidative state determination. The oxidative stability of the oil samples was determined using the Rancimat apparatus, at 120°C (2).

Results and discussion

The oil samples were obtained from different types of sunflowerseed, as it is obvious from Table 1, presenting the fatty acid compositon. The biggest differences

were in the linoleic e.g. oleic acid content, while the total content of saturated fatty acids is rather similar, ca 9%.

Table 1

Quality and biological value of all samples obtained are presented in Table 2.

Table 2

The results obtained confirme that all oil samples are of very good quality and biological value. It is interesting that the sensory characteristics of the oils were graded very high scores and accepted from a greater number of investigators. It has to be emphasized that the flavour of oils is specific and typical for sunflowerseed. The highest scores were given the samples obtained from fried kernel (L_1 and O_1). This means that the frying of material contributed to the formation of more typical flavour of the oils.
The oil colour is attractive yellow, and of oils obtained on the hydraulic presses from the fried material (L_1 and O_1) the colour is somewhat darker, with reddish nuances.
The content of unsaponifiable matters, including important minor components from the standpoint of nutrition (3), is somewhat higher in linoleic-type oils. The crude oils contain a higher amount of different pigments, compared to the refined oils. The importance of carotenoides is increasing, besides vitamin E, due to their act as antioxidants in vivo (4). The total tocopherols content is high in samples investigated, more than 65 mg/kg (with the exception of sample L), and similar in all samples, nevertheless the kind of oil and way of obtaining.
The pretreatment of the material and the kind of pressing is especially influencing the phosphatides content. Namely, the highest phosphatides content was found in oils obtained on the hydraulic press from the hydro-thermally treated material. The phosphatides are valuable components of vegetable oils, having an important role in the organism. The presence of phosphatides in these oils increases their biological value. In case of usual edible oils the phosphatides are removed completely during the refining process.
The most important thing is that the stability of oleic-type oil is more than three times higher than of the linoleic-type oil. The kind of pressure also affects the stability of the oil. The best stability was found in oils obtained on the hydraulic press, after the hydrothermal treatment of the material. The present phosphatides contribute also the high stability of these oils, as they act like sinergists (7). The stability e.g. the induction period of refined linoleic-type sunflower oil is, according to the literature data, about 2,5 hours at 120°C (8).
The hydrothermal treatment and heating during the pressing process have a negative effect on the oxidative stability (higher specific absorbances $A^{1\%}_{232}$ and $_{270\ nm}$). However, the oil obtained in this way contains more phosphatides (Table 2) and this justifies this kind of seed pretreatment.
The results presented in Table 4 also favor the extremely good oil stability. It has to be emphasized that the stability was determined after 6 months of keeping at room temperature (20-25°C), in dark, in the same samples which were used for initial quality investigation.

Table 4

A certain peroxides content increase was found during this period, however, all samples still fulfill the demands given in our quality rule book (9) for the peroxide value (below 8 mmol/kg).
The stability expressed by the induction period of linoleic-type oil was somewhat lower, but in oleic-type it was almost the same.

Conclusions

1. The pressed edible nonrefined sunflower oil is of very good quality and can be classified in the category of oils called "gourmet oils".
2. The oils obtained by hydraulic pressingm are somewhat better than the screw pressed.
3. The biological value of these oils is of especial importance since they contain phosphatides besides vitamin E. However, the phosphatides content depends on the pretreatment of material before pressing (temperature, moisture, time).
4. The stability of edible nonrefined oils is very good. The phosphatides contribute to the stability also. The high-oleic sunflower oil obtained by hydraulic pressing (O_1) is of exceptionally high stability.
5. The keeping of oil in "open" packaging for 6 months at room temperature hasn't result in more pronounced change of oxidative stability parameters. As far as the stability of oleic-type oil is concerned, it is almost the same in the initial oil and after 6 months of keeping.

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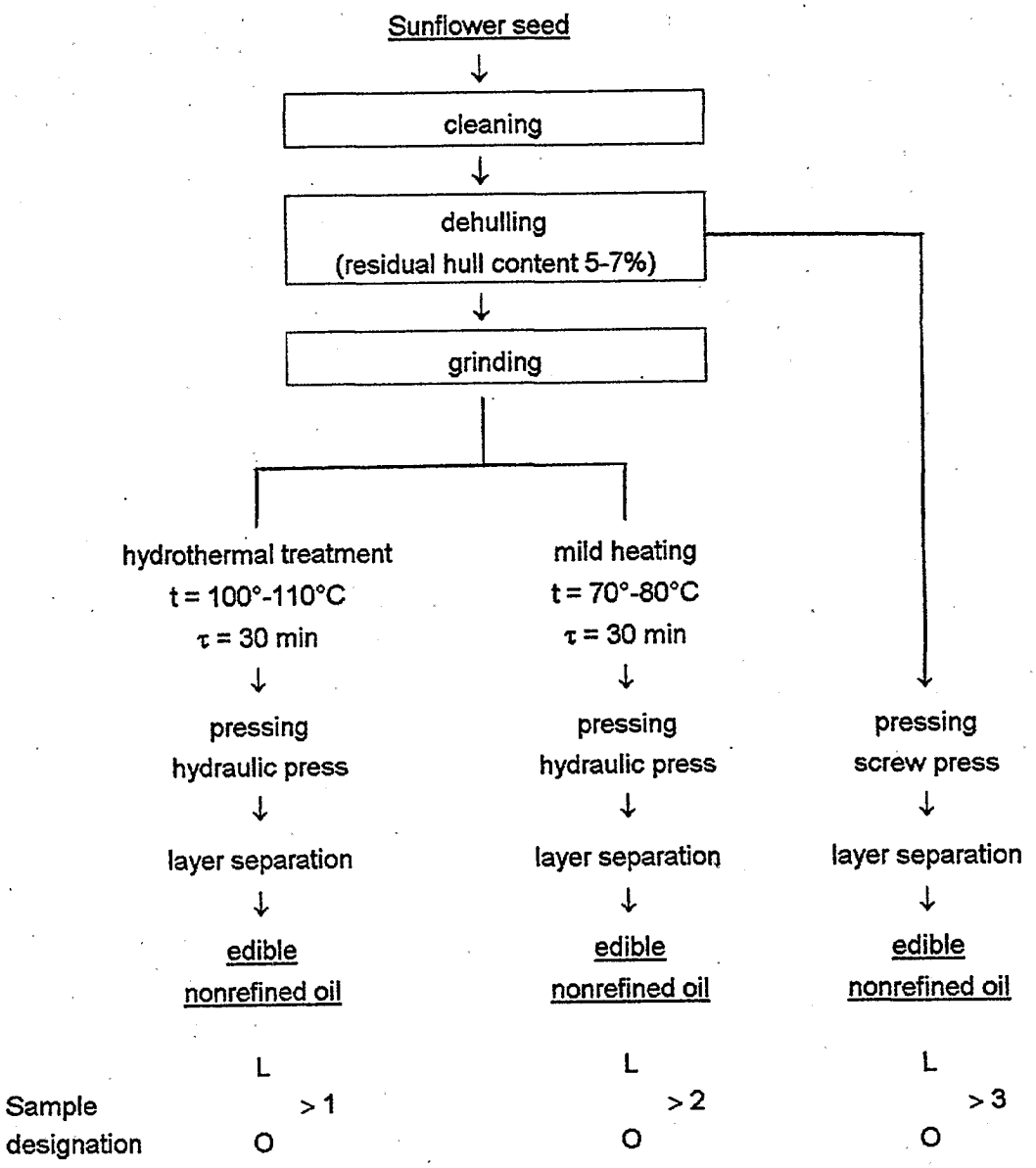

Figure 1. Obtaining of edible nonrefined sunflower oil samples

Table 1. The fatty acid composition of sunflower oil

Fatty acid (%)		Linoleic sunflower oil (L)	Oleic sunflower oil (O)
palmitic	$C_{16:0}$	5,50	3,93
stearic	$C_{18:0}$	3,33	3,88
oleic	$C_{18:1}$	32,31	83,67
linoleic	$C_{18:2}$	57,97	7,29
behenic	$C_{20:0}$	0,89	1,23

Table 2. Quality and biological value of edible nonrefined sunflower oil

Characteristic	Kind of oil					
	Linoleic type (L)			Oleic type (O)		
	pressing kind					
	hydraulic		screw	hydraulic		screw
	1	2	3	1	2	3
Sensory evaluation* (points)	20	19,08	19,28	20	18,86	18,68
Colour (% $T_{455\ nm}$)		49	53	41	52	54
Moisture content (%)	0,12	0,11	0,12	0,08	0,09	0,10
FFA (% oleic acid.)	0,72	0,59	0,62	0,35	0,39	0,34
Unsaponifiable matters (%)	1,04	1,03	0,98	0,69	0,73	0,56
Total phosphatides (%)	0,41	0,20	traces	0,30	0,13	traces
Total tocopherols(mg/100 g) (expressed as α-tocopherol)	52	69	67	67	65	68

*maximal point count is 20

Table 3. Oxidative state and stability of freshly obtained samples of edible nonrefined sunflower oil

Characteristic	Kind of oil					
	Linoleic type (L)			Oleic type (O)		
	pressing kind					
	hydraulic		screw	hydraulic		screw
	1	2	3	1	2	3
Peroxide value (mmol/kg)	1,40	1,18	0,90	0,66	1,02	0,51
$A^{1\%}_{232\ nm}$	1,72	0,81	0,64	0,57	0,51	0,27
$A^{1\%}_{270\ nm}$	0,96	0,15	0,06	0,13	0,08	0,02
R-value	2	6	10	4	7	12
Stability Induction period at 120°C (hours)	4,85	3,90	2,00	>14	6,80	8,60

Table 4. Stability of edible nonrefined sunflower oil samples after the obtaining and after keeping for 6 months

Characteristic	Kind of oil					
	Linoleic type (L)			Oleic type (O)		
	pressing kind					
	hydraulic		screw	hydraulic		screw
	1	2	3	1	2	3
Peroxide value (mmol/kg)						
fresh oil	1,40	1,18	0,90	0,66	1,02	0,51
after 6 months	4,68	3,00	2,16	4,22	2,97	0,75
Stability - Rancimat test						
Induction period at 120°C(hours)						
fresh oil	4,85	3,90	2,00	>14	6,80	8,60
after 6 months	4,60	2,45	1,90	>14	6,75	8,50