MAJOR PIGMENTS IN DOUBLE - LOW RAPESEED OILS.

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ABSTRACT

Rapeseed lipids of the Polish variety Jantar analysed immediately after extraction under preservative conditions, contained chlorophyll A as a major component of chlorophyll pigments, while industrially produced oils - pheophityne A. Rapeseed oils from 1984 crops contained 92.8 ppm of chlorophylls /as chlorophyll A/, while from 1985 crops - 60.6 ppm. It has been established that lutein constituted a major component /ca 90%/ of carotenoids contained in Jantar variety rapeseed lipids, the rest being β-carotene. Industrially produced oils were characterized by similar carotenoid composition. Rapeseed oils from 1984 and 1985 crops contained 104.8 and 89.4 ppm of carotenoids /as lutein/, respectively. Proper absorption coefficients with respect to prevailing constituents of chlorophylls and carotenoids should be applied for quantitative spectrophotometric determination of pigments directly in oils.

INTRODUCTION

Xanthophylls, carotenes, chlorophylls are the main plant pigments. As they are unstable chemical compounds, they undergo changes during processing and storage of oil. Results reported in a few papers on Canola oils /Mag, 1983;

Taylor et al., 1984/ proved that double improved rapeseed oils are characterized by much higher content of chlorophylls and carotenoids compared to traditional varietes. Such results are consistent with our previous investigations on Polish varietes. High chlorophyll content makes rafination difficult and influences stability of oils /Endo et al., 1984, 1985/. Absorption measurement at a chosen analytical wavelength constitutes a most often used method of quantitative determination of pigments. Preliminary experiments proved that due to changes undergoing during extraction of oil from seeds and during storage the maximum absorption wavelength shifts. Hence, the method should have been polished up /a paper in print/. In this paper the contents of chlorophylls and carotenoids were determined taking into consideration the possibility of changes during processing.

MATERIALS AND METHODS.

Jantar variety rapeseed from 1984 and 1985 crops, as well as raw oils obtained industrially from the same rapeseed constituted the material for investigations. Laboratory extraction of lipids was carried out in a homogenizer using a hexane /ethanol mixture /3:1/. Miscellae filtration, as well as evaporation of solvent were carried out under preservative conditions. Carotenoids were determined in unsaponifiable matter extracted from oils after saponification at room temperature /Vogel, 1977/. Separation of carotenoids into xanthophyll and carotene fractions was carried out by TLC on Silica Gel G. A benzene/methanol /85:15/ mixture constituted the developing system. The

pigments were eluted with ethyl ether, the spectrum in hexane at the 400-500 nm spectral range being recorded using a Specord UV-VIS /Carl Zeiss/ spectrophotometer. Identification of spectra has been carried out on the basis of literature data /Vogel, 1977/ and spectrum of β-carotene standard. Chlorophylls were determined from absorption spectra of samples of oil dissolved in CCl_4 at the 500-700 nm spectral range. Identification of spectra has been carried out by comparison with spectrogram of the extract of parsley leaves pigments. Moreover, after pheophitynization with 9.2% HCl solution pheophityne spectrum has been recorded. Quantitative determinations of pigments calculated as a main component, have been carried out using absorption coefficients for solutions in CCl_4 determined previously /a paper in print/.

RESULTS AND DISCUSSION.

Total content of carotenoids in lipids isolated from seeds, as well as mutual proportions between xanthophylls and carotenes, are listed in Table 1.

Table 1. Carotenoids content of oils from Jantar variety rapeseed laboratory extracted, as well as percent share of xanthophylls and carotenes.

Seeds	Sum of carotenoids	Xanthophylls /as lutein/	Carotenes /as β-carotene/
1984 crop	104.8 ppm	90.1%	9.9%
1985 crop	89.4 ppm	90.0%	10.0%

Due to a prevailing share of xanthophylls, the content of carotenoids in oil should be calculated as lutein.

Maximum absorption wavelength /λ_{max}/ for lutein in hexane equalls 444 nm, while $E^{1\,cm}_{1\%} = 2160$. Lutein also constituted a main component of carotenoids from industrially obtained raw oils.

Fig. 1 presents spectrograms of oil extracted laboratory under preservative conditions and one of the samples of industrially obtained oil, as well as the spectrum of green pigments of parsley leaves. The spectrum recorded after pheophitynization is also illustrated.

On the basis of a detailed analysis of spectra it has been established that chlorophyll A constitutes a major component of oil extracted from seeds under preservative conditions. It has been calculated that rapeseed oil from 1984 crops containded 92.8 ppm of chlorophylls /as chlorophyll A/, while from 1985 crops 60.6 ppm.

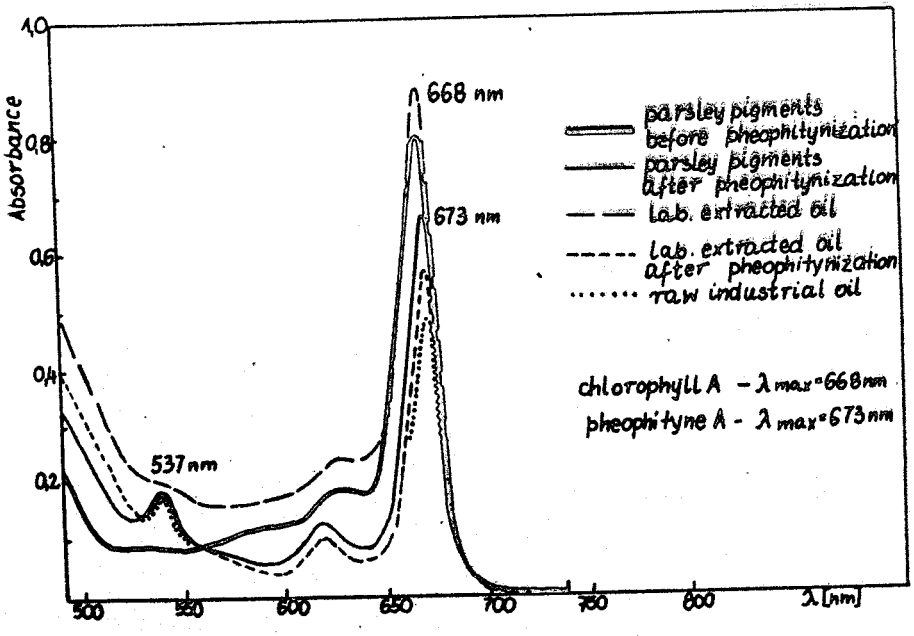

Fig.1. A comparison of spectra of rapeseed oils laboratory and industrially extracted with spectra of the extract of parsley leaves pigments.

It follows from Fig.1 that a conversion of chlorophylls into pheophityns is accompanied by a development of a peak at 537 nm and a 5 nm shift of λ_{max} towards longer wavelength. Position of λ_{max} and the ratio of peaks height at λ_{max} and $\lambda_{537\ nm}$ denoted as Q /Johansson et al., 1984/ allow to evaluate, whether an oil contains chlorophylls /Q ≈ 50/ or pheophityns /Q ≈ 9/. Table 2 illustrates these relationships.

Table 2. Chlorophylls and pheophityns content of oils from Jantar variety rapeseed.

Type of oil	λ_{max} /CCl_4/	Q	Major component of chlorophylls	Content of the major component of chlorophylls
lab.extracted	668 nm	59.0	chlorophyll A	92.8 ppm
lab.extracted after pheophityniza-tion	673 nm	9.0	pheophityne A	91.2 ppm
raw industrial	672-673 nm	9-15.0	pheophityne A	ca 90.0 ppm

It means that in case of industrially obtained oils the prevailing pigment should be qualitatively determined, and a proper absorption coefficient should be used for calculations.

The results of this research confirm that oils from Jantar variety double improved rapeseed contain much more chlorophylls compared to traditional varietes. This phenomenon should be taken into regard during technological evaluation of raw material due to difficulties connected with removal of chlorophylls during rafination.

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