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Short Paper

Effect of seed moisture on phenolic acids in rapeseed oil cake

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RESUMEN

Efecto de la humedad de la semilla sobre los ácidos fenólicos en torta de semilla de colza.

Semillas de colza de 6'5, 8'2, 9'9 y 12'65% de humedad se prensaron para la obtención del aceite. A las dos semanas se obtuvieron los extractos metanólicos de los compuestos fenólicos a partir de la torta. Los análisis revelaron que no hubo efecto de la humedad de la semilla sobre el contenido de los compuestos fenólicos totales en los extractos y sobre la actividad antioxidativa de los mismos. Tampoco hubo diferencias significativas en los espectros UV o en los diagramas de los derivados 2 y 4 entre los extractos.

PALABRAS-CLAVE: Acido fenólico — Semilla (humedad) — Torta de semilla de colza.

SUMMARY

Effect of seed moisture on phenolic acids in rapeseed oil cake

Rapeseeds of 6.5, 8.2, 9.9 and 12.65% moisture were pressed to obtain oil. After two weeks methanol extract of phenolic compounds was obtained from the oil cake. Analysis reveal that there was not effect of seed moisture on the content of total phenolic compounds in extracts and on antioxidative activity of extracts. There were no significant differences in UV spectra or diagrams of derivatives 2 and 4 between the extracts.

KEY-WORDS: Phenolic acid — Rapeseed oil cake — Seed (moisture).

1. INTRODUCTION

Phenolic acids make the main group of phenolics in rapeseeds and canola seeds (1)(2)(3). Strong antioxidative activity of these compounds was demonstrated in model experiments (4)(5). Phenolic acid extracts from rapeseeds also inhibit the growth of many bacteria (6). Derivatives of benzoic and cinnamic acids are inhibitors of lipase and lipooxigenase (7)(8). Phenolic acids can also form complexes with rapeseed proteins (9).

The objective of the study was to establish the effect of moisture of stored rapeseed oil cake on phenolic compounds considering their antioxidative properties.

2. MATERIALS AND METHODS

Commercial rapeseeds were used for investigations. 60 kg rapeseed batches were moistured to 6.5, 8.1, 9.9 and 12.6%. and conditioned for 24 h at 15°C. Next, they were pressed using a complete "Bispomasz" technological line (pressing yield 100 kg seeds/h). Samples of the oil cake obtained of 8.1, 9.9, 11.4 and 14.4% moisture were stored for 2 weeks at 15°C +1°C at relative air humidity 78%. After this time the oil cake was additionally defatted with petroleum ether in Soxhlet apparatus. From this obtained material, phenolic acids were cold-extracted with 80% ethanol (1). The non-pressed rapeseeds, defatted with petroleum ether, were additionally extracted.

Following concentration to dryness in a rotary evaporator at 45°C, total phenolics were determined colorimetrically in the extracts using Folin-Ciocalteus reagent (10), applying sinapic acid as standard.

Antioxidative properties of the extracts obtained were analysed in β-carotene-linoleate model system (11), adding 0.2 ml methanol solution containing 2 mg extracts to 5 ml linoleate and carotene emulsion. Sample were incubated in water bath at 50°C for 120 min measuring absorbance every 15 min at 470 nm.

Additional measurements were made for sample with 0.2 ml of methanol without extract (control) and sample containing 0.15 mg buthylated hydroxyanisole (BHA).

UV spectra and derivatives 2 and 4 of the extracts dissolved in methanol were recorded using Beckman DU-7500 diode array spectrophotometer.

3. RESULTS AND DISCUSSION

Total phenolics content in the extracts obtained generally did not depend on the oil cake moisture and ranged from 76 to 78 mg/g (Fig.1). In the extract obtained from non-pressed rapeseeds a similar (77 mg/g) content of phenolics was found.

All the extracts had high antioxidative activity (Fig. 2). The extract obtained from the oil cake of 11.4% moisture was slightly more active than the others. Considering the content of phenolics in the extracts analysed, it can be stated that their antioxidative properties were similar or higher than the values obtained for canola (5), white mustard (12), linseed (13) or green tea (14) extracts or fractions. High antioxidative activity of phenolics from rapeseeds was reported by Nowak et al.(6).

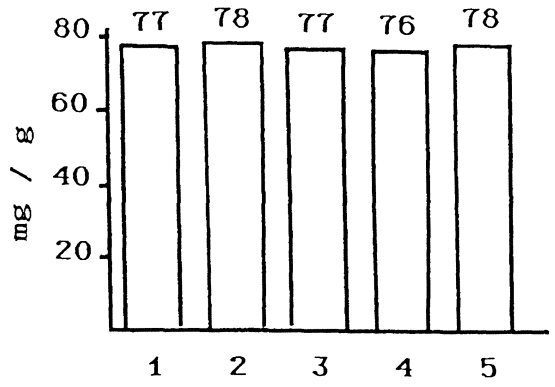

Fig. 1
Phenolic acids content in extracts from rapeseed oil cake (1 - extract from non-pressed rapeseeds, 2-5 - extracts from rapeseed oil cake obtained from seeds of 6.5, 8.1, 9.9 and 12.6% moisture, respectively).

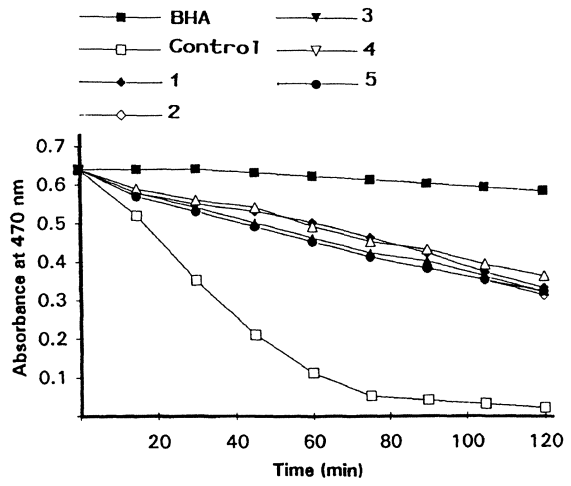

Fig. 2
Antioxidative activity of extracts from rapeseed oil cake (BHA - sample containing buthylated hydroxyanisole, control-sample without extract, 1 - sample with extract from non-pressed rapeseeds, 2-5 - extracts from rapeseed oil cakes obtained from seeds of 6.5, 8.1, 9.9 and 12.6% moisture, respectively).

UV spectra of the extracts studied were very similar (Table I and Figure 3). Maximum absorbance of the extract from non-pressed seeds and from rapeseeds of 11.4% and 14.1% moisture, was at 330 nm, while for the extracts from the oil cake of 8.1 and 9.9% moisture it was at 332 nm. Diagrams of derivative 2 were almost the same, whereas those of derivative 4 from the extracts from the oil cake of 8.1 and 9.9% moisture, there were found extra maxima at 328 nm (moisture 8.1%) and 330 nm (moisture 9.9%). The maxima were shifted by few nm towards longer waves compared with the spectra of pure phenolic acids (1) (15). The shift was due to the occurrence of phenolic acids in the form of esters, glycosides and complexes with proteins (1) in rapeseeds.

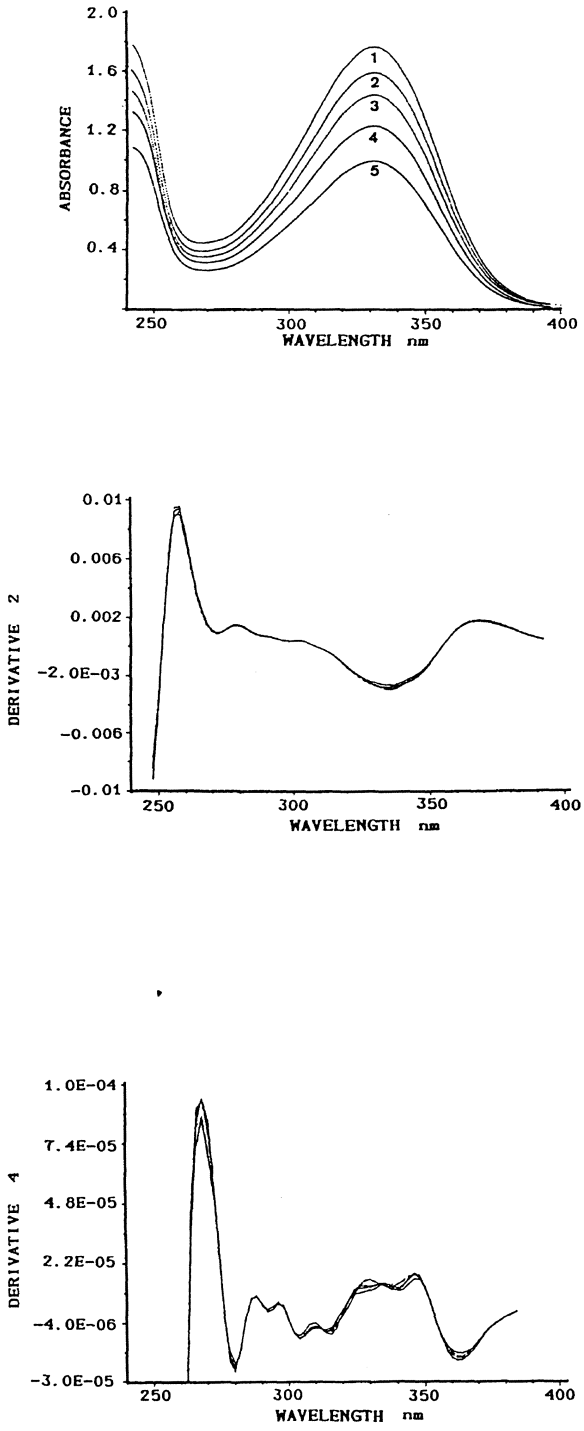

Fig. 3
UV spectra and plots of derivatives 2 and 4 of obtained extracts (1 - extract from non-pressed rapeseeds, 2-5 extracts from rapeseed oil cakes obtained from seeds of 6.5, 8.1, 9.9 and 12.6% moisture, respectively).

Table I
Spectral data (nm) of rapeseed phenolic extracts

No	λmax of absorbance	λmax of derivative 2	λmax of derivative 4
1	330	258, 280, 302, 368	268, 288, 296, 310, 334, 346
2	332	258, 280, 302, 368	268, 288, 296, 310, 328, 336, 348
3	332	258, 280, 302, 368	268, 288, 296, 310, 330, 346
4	330	258, 280, 302, 368	268, 288, 296, 310, 334, 346
5	330	258, 280, 302, 368	268, 288, 296, 310, 336, 346

To sum up, it should be stated that pressing and 2-week storage of the oil cake of diversified moisture do not affect significantly phenolic compounds in the oil cake. From the practical point of view it is especially important that after 2 weeks this group of phenolic compounds preserves antioxidative properties. Since in practise obtained rapeseed oil cake is used by farmers as a valuable addition to fodder. Maintained antioxidative properties of phenolic compounds can restrain the oxidative changes of fat left in oil cake, thus they can keep high nutritive quality of the oil cake.

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