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Evaluation of selected quality parameters of freshly extracted and commercial walnut oil

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INTRODUCTION & AIM

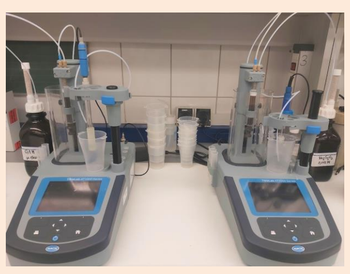
Walnuts (*Juglans regia*) are a source of fat (oil) known for its distinctive nutty flavour, and it is a versatile ingredient in culinary applications. Walnut oil (WO), rich in mono- and polyunsaturated fatty acids (MUFAs and PUFAs), undergoes oxidation reactions and produces undesirable flavours when exposed to light and air. Commercially available WO is stored in glass bottles and kept under ambient temperature and fluorescent light conditions. The shelf life for walnut oil under such conditions is relatively short. This study compares the properties of oil that has been freshly extracted from mature kernels with commercial walnut oil just before its expiration date.

METHODS

Walnut oil (cold pressed) and walnut kernels were purchased from a local store in Poland. Oil from nuts was extracted using the Soxhlet apparatus with hexane as a solvent. The fatty acid compositions were determined by gas chromatographic (GC) analysis of fatty acid methyl esters. Acid and peroxide values were determined by potentiometric and iodometric titrations of oil samples. The total phenolic content in the sample was quantified using the UV/VIS spectrophotometric method with Folin-Ciocalteu's reagent and the results were expressed as milligrams of gallic acid equivalent (GAE) per gram of oil. Thermal analysis of WO was performed using pressure differential scanning calorimetry (PDSC). The samples were oxidized at constant temperatures (100 - 130°C) under 1400 kPa pressure of oxygen. The activation energy was calculated from the equation:

$$E_a = 2.19 \times R \times \frac{d \log \tau_{max}}{dT^{-1}}$$

and τ_{max} found from calorimetry curves.



CONCLUSION

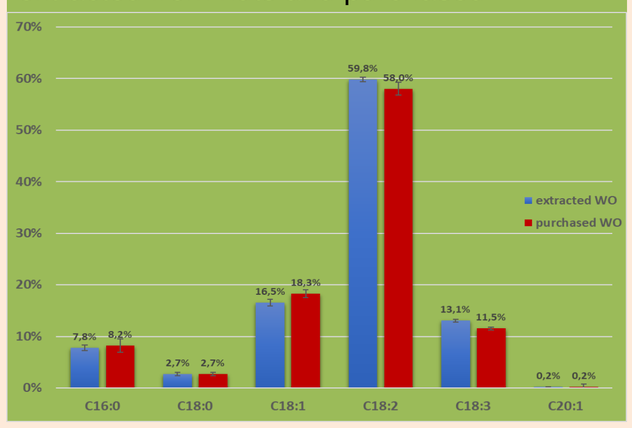
A comparison of the data obtained for freshly extracted and commercial walnut oil does not show significant changes, proving that the cold-pressed oil purchased and used before the expiration date meets the requirements and maintains the quality after a few months of storage on the shelf.

RESULTS & DISCUSSION

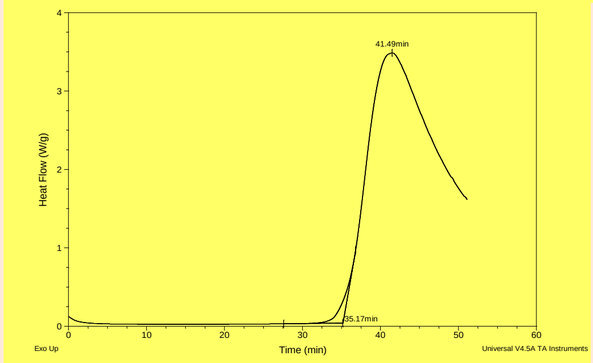
Selected quality parameters of walnut oil

	extracted WO	purchased WO
acid value (AV) [mg KOH/g]	2,24 ± 0,04	2,85 ± 0,03
peroxide value (PV) [mmol O_2/g]	6,21 ± 0,02	6,36 ± 0,00
phenolic content [mg GAE/g]	3,07 ± 0,2	3,16 ± 0,2
activation energy of thermooxidative decomposition [kJ / mol]	94,68	93,04

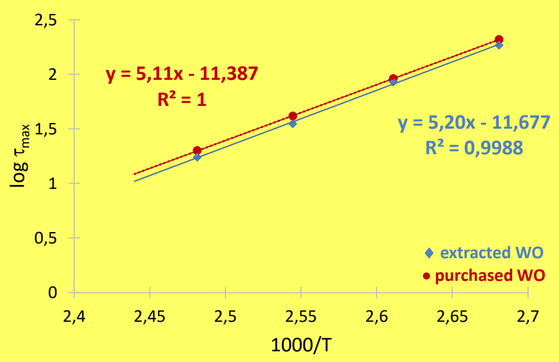
Fatty acid composition of walnut oils extracted from nuts and purchased



Oxidation PDSC curve for WO at 120°C



A graph of the relationship between the logarithm of maximum oxidation time for WO (τmax) vs. inverse of the measurement temperaturę



Investigated nuts contained 69 % of fat. The GC measurements for both: extracted and commercially available walnut oils showed the content of saturated fatty acids (SFA) close to 10%, monounsaturated fatty acids (MUFA) 17-18%, and polyunsaturated fatty acids (PUVA) ~70%. Acid and peroxide values are important for evaluating oils' freshness and quality as they indicate hydrolytic and oxidative changes in fat. The AV and PV were slightly higher for the commercial than the extracted oil.

On the other hand, the investigation of the oxidative stability of WO using PDSC has shown a slightly higher maximum oxidation time at a given temperature for purchased WO compared to extracted one.

Oxidative decomposition of fats can be prevented (slowed down) by antioxidants. The total phenolic content in both WO samples was almost the same.