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ANALYSIS OF POSSIBILITIES OF OBTAINING ESSENTIAL OILS FROM HERBACEOUS PLANTS WASTE

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ABSTRACT

The paper presents research results concerning the impact of the degree of crushing dried herbs on the content of essential oils. Herbaceous waste from lemon balm, garden sage and camomile was used for the research. Raw material was divided into fractions with the use of a laboratory pneumatic separator LPS 200 MC. Dried herbs, which stayed at the sieve of meshes provided below, was selected for analysis: 100 μm and 250μm. Determination of the content of essential oil in dried herbs was carried out according to the recommendations of a norm BN-88/8192-04. It was stated that the degree of crushing of herbs influences the content of essential oil. Higher values of essential oils were reported in a fraction of a lower degree of crushing. The results prove that the obtained herb waste may be used for further processing into essential oils.

Introduction

Herbs are the source of many valuable bioactive constituents as well as fragrance substances (Kowalski and Wawrzykowski 2009a; Raal et al., 2012). One of the main quality indicators of herbs and other spicy plants, which is one of the best descriptors of their organoleptic properties is essential oils retention (Rudy et al. 2011). These substances are mixtures of volatile organic chemical compounds which belong to carbohydrate aromatic, alcohols, aldehyde, ketone, esters and phenols (Klimek, 1957). Essential oils are valuable additives to food, beverages, cosmetics, cleaners and medical applications. (Seidler-Łożykowska et al. 2013; Argylopoulos and Műller, 2014). Antibacterial and antioxidant properties of these substances are highly rated. Essential oils have also free radical scavenging activities (Burt, 2004; Sacchetti et al. 2005).

The raw material is susceptible to disaggregation during harvest, drying process, transportation and storage. The significant percentage of herbs is then fractionated to very small particles. Crushing process causes disintegration of the internal structure of the material that influences chemical changes or lost of thermolabile compounds (Nowak and Syta 2009). One of these herbs is subjected to agglomeration, which creates new finely

crushed fractions of herbs (Kowalski and Wawrzykowski, 2009b). All of these fractions are treated as a waste, while they contain a significant volume of essential oils.

Objective of the paper

The objective of the paper was to estimate the essential oils content in different crushed fractions of lemon balm, sage and chamomile. The raw material used in the experiment was provided by courtesy of Herabapol Lublin Inc.

Materials and methods

Dried herbs of sage, lemon balm and camomile were used in the experiment (fig. 1).

Figure 1. Mixtures of specific material used for research: lemon balm, camomile and sage

The partition of specific mixtures into fractions was performed by the use of laboratory pneumatic separator LPS 200 MC, equipped with interchangeable screens (fig. 2). The screening enables material partition to the following fractions: 315 μm, 250 μm, 200 μm, 100 μm, 40 μm and smaller particles. For detailed studies dried herbs which stayed at the sieve of meshes provided below were selected for analysis 100 μm and 250 μm. An assessment of essential oils content in dried herbs was carried out according to the recommendations of standard BN-88/8192-04. Essential oils were analyzed by distillation with water vapour in Deryng apparatus. The principle of this method consists of two processing stages: a) essential oils distillation with water vapour, b) collecting distillate inside measuring apparatus and reading its volume. Oil content (X), expressed in ml per 100 g of raw material, was calculated as follows:

$$X = \frac{V}{m} \cdot 100 \tag{1}$$

where:

X – oil content, (ml·100 g^{-1})
V – oil volume, (ml)
m – mass of raw material used for distillation, (g)

The measurements were repeated 5 times. Factors that influences the efficiency of distillation were estimated by the use of Anova analysis and Tukey's test as additional statistical tool. The analysis was carried out at α=0.05 significance level by the use of Statistica 6.0 software.

Figure 2. Laboratory pneumatic separator LPS 200 MC

Results and discussion

The content of essential oils in the fraction of 250-315 μm particle size range was shown in fig. 3. The highest essential oils content was provided from sage whereas the lowest one was achieved from lemon balm. The yields of oils provided in the experiment are in accordance to the lowest levels in the standard range values of raw materials used in the experiment. Figure 4 illustrates essential oils content provided from the particle range of 100-200 μm.

The main factor that affected the yield of extracted essential oils was the particle size of crushed material. A detailed analysis of results obtained from the measurement of essential oils was shown in table 1. The oil content obtained from dried material of high reduction ratio was lower than that obtained from coarse-grained material. The yield disparity between particular herbs was statistically significant and was approximately of 40% for lemon balm, 24% for chamomile and 9.3% for sage. This phenomenon could be explained as follows. The greater size reduction is the more essential oils are evaporated from the crushed raw material, which is effected in the lower oil content. A significant dispersion of the oil content caused by the sieve effect for particular herbs is probably strictly related to the initial total oil content. For herbs of lower essential oils content (e.g. lemon balm) a minor loss of oils effects in a significant difference between the tested fractions.

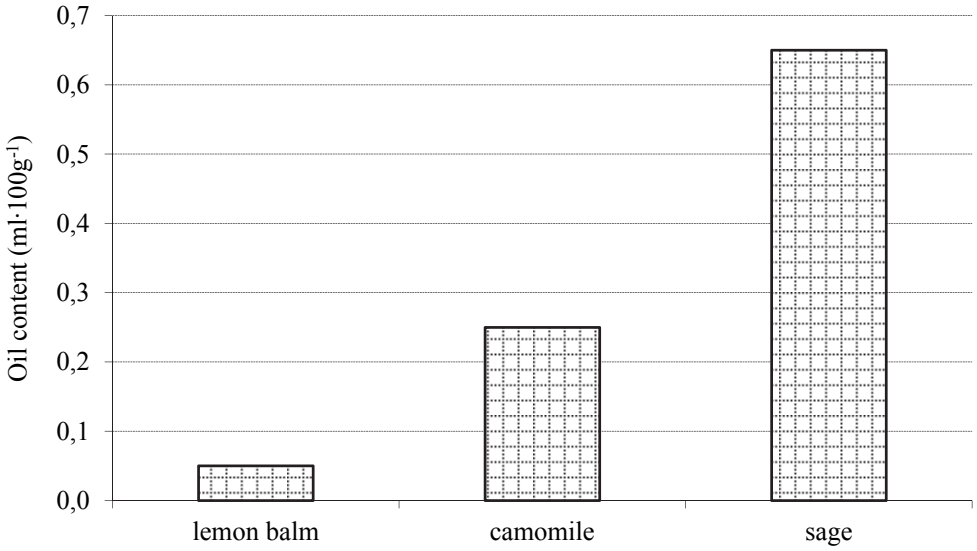

Figure 3. Content of essential oils in herbaceous waste which come from fraction of particles size within the scope of 250-315 μm

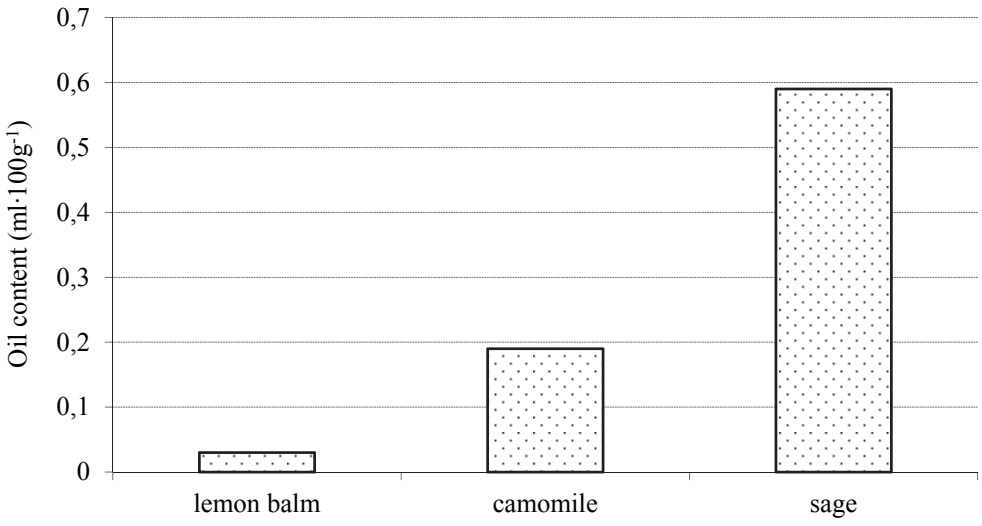

Figure 4. Content of essential oils in herbaceous waste which come from fraction of particle size within the scope of 100-200 μm

Table 1
Detailed analysis of results of measurement of the content of essential oils in lemon balm, camomile and sage

Raw material		Lemon balm		Camomile		Sage	
Parameter		Oil content (mean)	Homoge-neous groups	Oil content (mean)	Homoge-neous groups	Oil content (mean)	Homoge-neous groups
Grinding level	Fraction 100-200 μm	0.03	a	0.19	a	0.59	a
	Fraction 250-315 μm	0.05	b	0.25	b	0.65	b

Conclusions

1. Coarse graining results in higher essential oils content.
2. The yields of oils obtained in the process meets the requirements of lowest values in materials tested. Results obtained accentuates that waste of herbs used in the experiment can be employed as a valuable source of essential oils.
3. The research should be continued in order to create a new technology for effective recovering of essential oils from herbal waste as well as to extend this solution to other herbal plants.

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ANALIZA MOŻLIWOŚCI UZYSKANIA OLEJKÓW ETERYCZNYCH Z ODPADÓW ROŚLIN ZIELARSKICH

Streszczenie. W pracy przedstawiono wyniki badań dotyczące wpływu stopnia rozdrobnienia suszu zielarskiego na zawartość olejków eterycznych. Do badań użyto odpady zielarskie pochodzące z następujących roślin: melisy lekarskiej, szałwii lekarskiej i rumianku. Surowiec podzielono na frakcje wykorzystując laboratoryjny separator pneumatyczny LPS 200 MC. Do analiz wybrano susz, który zatrzymał się na sitach o wielkości oczek: 100 μm i 250μm. Oznaczenie zawartości olejku eterycznego w suszu wykonano zgodnie z zaleceniami normy BN-88/8192-04. Stwierdzono, że stopień rozdrobnienia ziół ma wpływ na zawartość olejku eterycznego. Większe wartości olejków zaobserwowano we frakcji o mniejszym stopniu rozdrobnienia. Otrzymane wyniki wskazują, że pozyskany odpad zielarski może być użyty do dalszego przerobu na olejki eteryczne.

Słowa kluczowe: melisa, szałwia, rumianek, olejki eteryczne, odpady zielarskie