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Research article

Polish plants as raw materials for cosmetic purposes

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Abstract: *The cosmetics market is more and more demanding, and there is a constant request for new products. The aim of the study was to find plant materials occurring commonly in Poland that would have a multidirectional effect on the skin. Research focuses on plants with high content of saponins and polyphenols. Ability to create foam and ability to reduce the surface tension of water as a determinant of saponin content was checked. The Folin-Ciocalteu test was made to check the content of polyphenols. Fifty-seven raw materials were examined. To the most promising for cosmetic purposes belong goldenrods (Solidago), especially their leaves. Much better results were obtained for S. canadensis and S. gigantea, than S. virgaurea.*

Keywords: *saponins, polyphenols, cosmetics, herbs, screening.*

Introduction

In the 21st century, in a world full of technical novelties and synthetic products, popularity for products of natural origin is constantly increasing. This trend applies not only to food and drugs but also to the cosmetic market [1, 2]. Due to their functionality and various beneficial properties, herbs and spices have been used for centuries to produce cosmetics. Compared to synthetic cosmetics, their natural alternatives have many advantages: herbal products are mild, biodegradable, and they are just as effective – often even more than synthetics – in e.g., moisturizing, cleaning, and emulsifying. What is more, production and acquisition of natural cosmetics is often more ecological [1].

Traditionally, demand for many of natural cosmetic ingredients tends to be greater than the supply. Due to this fact, there is a huge need for gaining new highly efficient products possessing comprehensive properties and revealing beneficial effects on the skin. One of these kinds of products are botanical extracts. They are multifunctional cosmetics ingredients. They contain various kinds of compounds, which have desirable effects like moisturizing, anti-aging, photoprotective, anticellulite, astringent, anti-irritant, antioxidant or antimicrobial [1].

From the chemical point of view biologically active constituents from plants are divided into lipophilic and hydrophilic. Plant oils and essential oils are the most important lipophilic plant products used in cosmetic industry. The most

common hydrophylic botanical extracts comprise glycol (propylene or butylene) and glycerine, as well as water soluble dry extracts. These extracts contain mainly polyphenols and carbohydrates. When obtained from saponin reach raw materials, they contain also saponin.

At the same time, in addition to the strong trend towards natural cosmetic raw materials, the market is showing a tendency to return to familiar and local ingredients from individual producers. Poland belongs to the biggest producers of herbs in Europe. However, there is a lot of plants that are still undervalued as cosmetic raw materials.

There are many types of compounds found in plants that have a beneficial effect on the skin, hair and appendages of man. One of them are extremely well-known and very often used in cosmetics polyphenols, as well as saponins, which despite being slightly less known, can be an interesting cosmetic supplement, due to their diverse properties.

Saponins

Saponins belong to secondary non-volatile plant metabolites, that are surface-active compounds with a high molecular mass (600 to 2000 Da). Chemically, saponins belong to amphipathic compounds. They are glycosides containing hydrophobic part linked by O-glycosidic bond to hydrophilic part made up of sugar chains. Depending on the type of non-polar aglycone skeleton saponins are divided into two main groups: triterpene or steroidal type. Depending on the number of sugar chains, saponins are divided into mono-, bi- or tridesmosides.

Saponins are widely distributed in nature, occurring principally in higher plants. The most known sources of saponins are soapwort (*Saponaria officinalis*), soapbark tree (*Quillaja saponaria*), licorice (*Glycyrrhiza glabra*), yucca (*Yucca schidigera*), and ginseng (*Panax* genus) [3].

Saponins have a very wide range of properties. The most characteristic are their physicochemical properties, such as lowering the surface tension, foaming, emulsification, and solubilization [4]. Due to these abilities saponins are directly used in cosmetic production as biosurfactants. The use of saponins as washing or emulsifying agents could significantly reduce the number of synthetic detergents, especially in cosmetics production.

Besides special physicochemical properties, saponins have a wide range of biological and medical properties, which also find a variety of possible application, including increasing the attractiveness as well as the functionality of cosmetics. In addition to their analgesic, antioxidant, anti-diabetic, and anti-obesity properties, which are used in drugs, they also have antibacterial, antifungal, and anti-inflammatory properties, what can be used in many ways, not only in e.g., anti-dandruff, antifungal shampoos and products for skin with acne problems, but also in anti-aging products and those dedicated to sensitive skin or affected by rosacea or varicose veins [5]. What is more, the use of saponin additive may reduce the amount of preservatives used in cosmetics, which are perceived as controversial ingredients. Important to mention is also the fact that

more and more often it is noticeable that saponins, due to their cytotoxicity, can be used as potential antitumor agents, which in future could also be their advantage, even in the cosmetic industry [6].

Polyphenols

Polyphenols, which are secondary plant metabolites, are omnipresent in the plant kingdom. In terms of structure, polyphenols are a fairly diverse group of compounds. Their common feature is more than one phenolic hydroxyl group bonded to one or more benzene ring systems. In general, phenolic acids, flavonoids, stilbenes, lignans, coumarins, and tannins are classified to the group of polyphenols [7-9]. Polyphenols often occur in the form of glycosides. In cosmetology and dermatology, the most important polyphenols are flavonoids and phenolic acids [10]

Polyphenols are found in many parts of plants, mainly in their fruits like grapes, acerola or pomegranate, but also in leaves, e.g., green tea (*Camellia sinensis*) which is one of the best sources of polyphenols, wood or bark [8, 11]. It is worth mentioning that one of the best sources of polyphenols are wastes and by-products from food production [11].

The popularity of polyphenols in cosmetic industry is mainly connected with their anti-inflammatory properties and antioxidant activity. Polyphenols are used in cosmetic formulations for another reasons as well: they reveal anti-ageing, astringent, and photoprotective effects, slowdown skin darkening and improve skin tone properties [8, 9, 11, 12, 13]. Another advantage of using polyphenols in cosmetics is the fact that they have antimicrobial properties, also in relation to microorganisms that are associated with the production of cosmetics, e.g., *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, and *Pseudomonas aeruginosa*. The use of products that are rich in polyphenolic compounds in cosmetics production can increase the safety of cosmetics, especially against their secondary infection [8].

The purpose of the research is to assess herbs that are commercially available in Poland, as the possible plant raw materials to produce hydrophilic extracts for cosmetic purposes. The chosen materials were screened by simple tests for the content of both saponins and polyphenols.

Experimental

Materials

The material for the study were herb's parts (root, rhizome, bark, herb, leaves, flower, inflorescence, seed or fruits) supplied by Zakład Zielarski „KAWON – HURT" Nowak sp.j. (KAWON), "NANGA" Przemysław Figura (Magiczny Ogród) or collected in summer 2017 from a natural state in Łódź and dried at room temperature (Table 1). Samples were stored at room temperature, without air or light access, and powdered directly before analysis.

Table 1. Herbal raw materials used in the study

No	Scientific name	Common name	Family	Plant part	Source
1	*Achillea millefolium* L.	common yarrow	Asteraceae	herb	K
2	*Acorus calamus* L.	sweet flag	Acoraceae	rhizome	MO
3	*Anthyllis vulneraria* L.	woundwort	Fabaceae	flower	MO
4	*Arctium lappa* L.	greater burdock	Asteraceae	root	K
5	*Arnica montana* L.	mountain arnica	Asteraceae	inflorescence	K
6	*Bellis perennis*L.	common daisy	Asteraceae	flower	MO
7	*Betula pendula* Roth	silver birch	Betulaceae	leaf	K
8	*Betula pendula* Roth	silver birch	Betulaceae	bark	MO
9	*Betula pendula* Roth	silver birch	Betulaceae	buds	MO
10	*Calendula officinalis* L.	common marigold	Asteraceae	inflorescence	K
11	*Capsella bursa-pastoris* (L.) Medik.	shepherd's purse	Brassicaceae	herb	MO
12	*Carum carvi* L.	caraway	Apiaceae	fruit	K
13	*Chelidonium majus* L.	greater celandine	Papaveraceae	herb	MO
14	*Crataegus* L.[1]	hawthorn	Rosaceae	inflorescence	K
15	*Elymus repens* L.	common couch	Poaceae	rhizome	K
16	*Equisetum arvense* L.	common horsetail	Equisetaceae	herb	K
17	*Frangula alnus* Mill.	alder buckthorn	Rhamnaceae	bark	K
18	*Galega officinalis* L.	galega	Fabaceae	herb	MO
19	*Galium verum* L.	yellow bedstraw	Rubiaceae	herb	MO
20	*Glechoma hederacea* L.	greater celandine	Lamiaceae	herb	MO
21	*Hypericum perforatum* L.	St. John's-wort.	Hypericaceae	herb	K
22	*Leonurus cardiaca* L.	motherwort	Lamiaceae	herb	K
23	*Marrubium vulgare* L.	common horehound	Lamiaceae	herb	MO
24	*Medicago sativa* L.	lucerne	Fabaceae	herb	MO
25	*Melilotus officinalis* L.	common melilot	Fabaceae	herb	K
26	*Mentha* × *piperita* L.	peppermint	Lamiaceae	herb	K
27	*Mentha spicata* L.	spearmint	Lamiaceae	herb	MO
28	*Nigella sativa* L.	black cumin	Ranunculaceae	seeds	MO
29	*Ononis spinosa* L.	spiny restharrow	Fabaceae	root	K
30	*Plantago lanceolata* L.	ribwort plantain	Plantaginaceae	leaf	K
31	*Polygonum aviculare* L.	common knot grass	Polygonaceae	herb	K
32	*Potentilla erecta* L.	common tormentil	Rosaceae	rhizome	K
33	*Pulmonaria officinalis L.*	common lungwort	Boraginaceae	herb	MO
34	*Rosmarinus officinalis* L.	rosemary	Lamiaceae	leaf	K
35	*Saponaria officinalis* L.	common soapwort	Caryophyllaceae	root	MO
36	*Solanum dulcamara* L.	fellenwort	Solanaceae	herb	MO
37	*Solidago canadensis* L.	canadian goldenrod	Asteraceae	leaf	NH
38	*Solidago canadensis* L.	canadian goldenrod	Asteraceae	flower	NH
39	*Solidago gigantea* Aiton	giant goldenrod	Asteraceae	leaf	NH
40	*Solidago gigantea* Aiton	giant goldenrod	Asteraceae	flower	NH
41	*Solidago virgaurea* L.	common goldenrod	Asteraceae	leaf	NH
42	*Solidago virgaurea* L.	common goldenrod	Asteraceae	flower	NH
43	*Solidago virgaurea* L.	common goldenrod	Asteraceae	herb	K
44	*Symphoricarpos albus* L.	common snowberry	Caprifoliaceae	leaf	NH
45	*Symphoricarpos albus*L.	common snowberry	Caprifoliaceae	fruits	NH
46	*Symphytum officinale* L.	common comfrey	Boraginaceae	root	MO
47	*Taraxacum officinale* F.H. Wigg.	common dandelion	Asteraceae	root	K
48	*Thymus serpyllum* L.	breckland thyme	Lamiaceae	herb	K
49	*Thymus vulgaris* L.	common thyme	Lamiaceae	herb	K
50	*Tilia* L.[2]	linden	Malvaceae	inflorescence	K

Table 1. continued

No.	Scientific name	Common name	Family	Plant part	Source
51	*Trigonella foenum-graecum* L.	fenugreek	Fabaceae	seed	K
52	*Tussilago farfara* L.	coltsfoot	Asteraceae	leaf	K
53	*Urtica dioica* L.	nettle	Urticaceae	leaf	K
54	*Verbascum* L.[3]	mullein	Scrophulariaceae	flower	K
55	*Veronica officinalis* L.	gypsyweed	Plantaginaceae	herb	MO
56	*Viburnum opulus* L.	guelder-rose	Adoxaceae	bark	MO
57	*Viola tricolor* L.	viola tricolor	Violaceae	herb	K

[1] *Crataegus monogyna* Jacq. (Lindm.), *C. laevigata* (Poir.) DC, *C. pentagyna* Waldst. et Kit. ex Willd., *C. nigra* Waldst. et Kit. and/or *C. azarolus* L.
[2] *Tilia cordata* Miller and/or *Tilia platyphyllos* Scop.
[3] *Verbascum thapsus* L, *V. densiflorum* Bertol. (*V. thapsiforme* Schrad) and *V. phlomides* L.
K – KAWON, MO – Magiczny Ogród, NH – collected from natural habitat.

Methods

Foam test for saponins

To check the ability to foam, the shake foam test was performed [14, 15]. To the powdered plant material (0.5 g) placed in a calibrated cylinder, 10 ml of boiling water was added, and then it was allowed to cool down. Then, the cylinder was shaken vigorously for about 10 s. The foam height generated was measured immediately after generation, after 10 min, and after the addition of several drops of 2 N hydrochloric acid, respectively. The results were presented as the height of the foam layer.

Ability to reduce surface tension

For measuring the surface tension of water extracts, 5 g of the powdered plant material was placed in glass bottle, 100 ml of boiling distilled water was added. The bottle was screwed, shaken vigorously and allowed to cool down. After cooling, the infusion was filtered on the Büchner funnel to remove parts of the plant. The obtained extract was tested using the drop counting method [16].

The Traube's stalagmometer (volume V = 4.7 ml, radius of the dripping tip r = 0.57 cm) was rinsed three times with distilled water and with the tested extract. The stalagmometer was filled up with the extract. Next, the number of extracts drops flowing from the stalagmometer was measured. Surface tension of the extract was calculated, according to the formula (1) including the correction factor (2) [17, 18]. Surface tension of water was calculated according to formula (3) and it was 0.0716 [N/m]. Then the percentage of extracts ability to lower the surface tension of water was calculated.

$$\gamma_r = \gamma_{H_2O} \frac{\overline{n}_{H_2O}}{\overline{n}_r} \cdot \frac{f_{H_2O}}{f_r} \quad (1)$$

where: γ_r, γ_{H_2O} – surface tension of the tested extract or distilled water [N/m]

$\overline{n}_r$, $\overline{n}_{H_2O}$ – averaged number of extract or waters drops flowing from the stalagmometer

f_r, f_{H_2O} – correction factors for extract or water depending on the parameters of the stalagmometer; data for the dependence of $\overline{\left(\frac{V}{n}\right)^{\frac{1}{3}}}^{r}$ (2) [18].

$$\gamma_{H_2O} = \left[75,623 - 0,1394 \cdot t - 0,0003 \cdot t^2\right] \cdot 10^{-3} \quad (3)$$

where: t – temperature [°C].

The measurement was made five times, at the temperature 27°C.

Content of polyphenols

Preparation of extracts

To 0.5 g of powdered plant material placed in Erlenmayer flask, 10 ml of 80% methanol was added. The flask was covered with a stopper, left at room temperature for 30 minutes, and shaken gently every 5 minutes. The extract was filtered and poured into 25 ml volumetric flask. To the raw material again 10 ml of 80% methanol was added. The flask was left overnight at room temperature. The extract was filtered and added to the previous one. Raw material leftovers were washed with 5 ml of 80% methanol. Volumetric flask was filled up with 80% methanol and left at room temperature.

Folin-Ciocalteu test

The content of polyphenols was checked spectrophotometrically using Folin-Ciocalteu reagent, according to modified method proposed by Singleton [19]. Into a 25 ml volumetric flask 0.5 ml of methanol plant extract was transferred, then 0.25 ml of Folin-Ciocalteu reagent was added, and mixed gently. Next 2.5 ml of 20% sodium carbonate was added and filled up to volume with distilled water. The flask content was mixed thoroughly and left in a dark place in room temperature for 30 minutes. The measurement was made at the wavelength 750 nm using Spectrophotometer VIS-7220G. A blank test was methanol 80%. Gallic acid (25-1000 mg/L) was used as standard and the results were expressed as mg gallic acid equivalents per 100 g of raw material (mg GAE/100 g).

Results and discussion

To screen the possible content of saponins two indirect methods were used, namely, shake foam test and test for reduce the surface tension. Foam test is one of the simplest methods to detect saponins – its negative result indicates the lack of saponins in the tested sample, while the positive result does not unambiguously confirm the presence of these compounds. The ability to reduce the surface tension of water is elemental and universal property of all saponins. However, it should be mentioned that other plant constituents also reveal surface activity, e.g., proteins, phospholipids.

Foaming properties are classified according to the foam height measured immediately after shaking (0 minutes) and presented as follows: no foam = negative, foam less than 10 mm high = weakly positive, foam 12-20 mm = positive, and

foam greater than 20 mm high = strongly positive [14]. According to these rules, sixteen plant samples showed strongly positive and three positive result of foam test. It was assumed that these plant materials and/or materials that revealed at least 25% reduction of surface tension (16 samples) deserve attention as biosurfactants. Taking into account both tests, altogether 30 plant materials were pointed that gave positive foam test and/or surface tension test and were considered as potential saponin sources. The most known source of saponins in Polish flora common soapwort (*Saponaria officinalis*, 35) was included in the research as a standard. Relation between foam height in 0 minute and reduction of surface tension of these 30 samples is illustrated in Figure 1.

Table 2. Results of surface activity tests and polyphenol content

No.	Plant name	Plant part	Foam hight [mm]			Ability to reduce the surface tension [%]	Polyphenols content [mg GAE/100g]
			0 min	10 min	addition 2N HCl		
1	*A. millefolium*	herb	3	1	0	11.73	1000
2	*A. calamus*	rhizome	0	0	0	22.77	350
3	*A. vulneraria*	flower	2	0	0	**27.63**	900
4	*A. lappa*	root	0	0	0	18.13	1175
5	*A. montana*	inflorescence	0	0	0	24.47	1700
6	*B. perennis*	flower	**59**	2	2	**40.48**	1550
7	*B. pendula*	leaf	3	0	0	**31.20**	**2925**
8	*B. pendula*	bark	**23**	**12**	5	11.16	**2625**
9	*B. pendula*	buds	**43**	7	7	**25.29**	**7050**
10	*C. officinalis*	inflorescence	0	0	0	**33.76**	450
11	*C. bursa-pastoris*	herb	0	0	0	20.05	375
12	*C. carvi*	fruit	2	0	0	**30.51**	50
13	*C. majus*	herb	0	0	0	18.13	350
14	*Crataegus*	inflorescence	0	0	0	20.52	**3200**
15	*E. repens*	rhizome	7	1	0	11.16	150
16	*E. arvense*	herb	1	0	0	18.13	425
17	*F. alnu.*	bark	12	3	0	23.63	1325
18	*G. officinalis*	herb	5	0	0	23.63	800
19	*G. verum*	herb	0	0	0	16.11	625
20	*G. hederacea*	herb	0	0	0	23.20	600
21	*H. perforatum*	herb	0	0	0	21.43	**3600**
22	*L. cardiaca*	herb	3	0	0	19.10	975
23	*M. vulgare*	herb	1	0	0	23.63	875
24	*M. sativa*	herb	7	0	0	20.98	225
25	*M. officinalis*	herb	7	0	0	20.98	825
26	*M. × piperita*	herb	12	0	0	**27.63**	**2950**
27	*M. spicata*	herb	5	0	0	22.77	1250
28	*N. sativa*	seeds	10	5	5	**46.01**	75
29	*O. spinosa*	root	**40**	9	4	21.88	500
30	*P. lanceolata*	leaf	2	0	0	19.10	1175

Table 2. continued

No.	Plant name	Plant part	Foam hight [mm]			Ability to reduce the surface tension [%]	Polyphenols content [mg GAE/100g]
			0 min	10 min	addition 2N HCl		
31	*P. aviculare*	herb	2	0	0	16.11	975
32	*P. erecta*	rhizome	**37**	8	5	15.59	**6125**
33	*P. officinalis*	herb	0	0	0	13.43	**2550**
34	*R. officinalis*	leaf	**23**	4	3	**28.01**	**2575**
35	*S. officinalis*	root	**63**	**58**	**27**	24.47	325
36	*S. dulcamara*	herb	5	0	0	20.52	825
37	*S. canadensis*	leaf	**110**	5	5	**37.48**	**4850**
38	*S. canadensis*	flower	**62**	**22**	**7**	**31.19**	**2575**
39	*S. gigantea*	leaf	**100**	5	5	**38.77**	**4475**
40	*S. gigantea*	flower	**52**	**22**	**22**	23.63	**3575**
41	*S. virgaurea*	leaf	**55**	5	5	**36.11**	**4850**
42	*S. virgaurea*	flower	**40**	**27**	**23**	**26.87**	**2550**
43	*S. virgaurea*	herb	**65**	**32**	5	**34.96**	825
44	*S. albus*	leaf	2	0	0	13.43	2100
45	*S. albus*	fruits	2	0	0	22.33	975
46	*S. officinale*	root	5	5	5	9.37	1800
47	*T. officinale*	root	10	0	0	16.11	300
48	*T. serpyllum*	herb	2	0	0	21.43	1625
49	*T. vulgaris*	herb	1	0	0	24.88	**2600**
50	*Tilia*	inflorescence	0	0	0	6.23	1825
51	*T. foenum-graecum*	seed	5	4	2	24.47	300
52	*T. farfara*	leaf	0	0	0	19.10	**2925**
53	*U. dioica*	leaf	0	0	0	24.88	700
54	*Verbascum*	flower	**19**	**12**	**12**	**33.76**	600
55	*V. officinalis*	herb	**20**	0	0	20.52	**3700**
56	*V. opulus*	bark	15	5	5	18.13	400
57	*V. tricolor*	herb	0	0	0	20.52	625

As can be seen in Table 2 and Figure 1 only in small part of samples positive correlation between foam height and ability to reduce surface tension of water is visible. Samples that shown the best results in both tests were leaves and flowers of three *Solidago* species (37-42) and flowers of *Bellis perenis* (6). It should be stressed that with the exception of giant goldenrod flowers (40), these samples revealed better surface activity than soapwort. Results of foam test shown an interesting differences between the foam of goldenrod leaves and flowers, especially *S. canadensis* and *S. gigantea* – the leaves are able to produce a higher foam (110 and 100 mm vs. 62 and 52 mm, respectively), while the foam created by the flowers is more stable (22 and 22 mm vs 5 mm after 10 min). Foam formed by *S. virgaurea* was lower, however, it also was stable. Our research is in accordance with Dobjanschi *et al.* [20] who assessed the saponin content by gravimetric method in three mentioned goldenrod species as 8.0-9.4%.

The next raw material deserved attention due to high saponin content is *B. perennis* flower [21]. Foam obtained directly after shaking its infusion was high (59 mm), although quite unstable (2 mm after 10 min). On the other side,

ability to reduce the surface tension of water was one of the highest 40.48%. Only *N. sativa* seeds (28) revealed better ability (46.01%) while foam high was low (10 mm). *B. pendula* buds (9) and bark (8), *Ononis spinosa* root (29), *Potentilla erecta* rhizome (32), *Rosmarinus officinalis* leaves (34) and *Veronica officinalis* herb (55) can be also consider as biosurfactants.

Total content of polyphenols was assessed by Folin-Ciocalteu method and the results were expressed as mg gallic acid equivalents per 100 g of raw material (mg GAE/100 g). The content of polyphenols varied in broad range from 50 mg/100 g in *C. carvi* fruit to 7050 mg/100 g in *B. pendula* buds. According to review paper on 100 richest dietary sources of polyphenols the amount of these compounds estimated by Folin-Ciocalteu assay varied from 100 to 9070 mg/100 g with the exception of clove (16000 mg/100 g) [22]. Authors of this paper reported polyphenols in *Mentha x piperita* (980 mg/100 g), *M. spicata* (6575 mg/100 g), and *R. officinalis* (2519 mg/100 g). Only the latter revealed in our research similar polyphenol content.

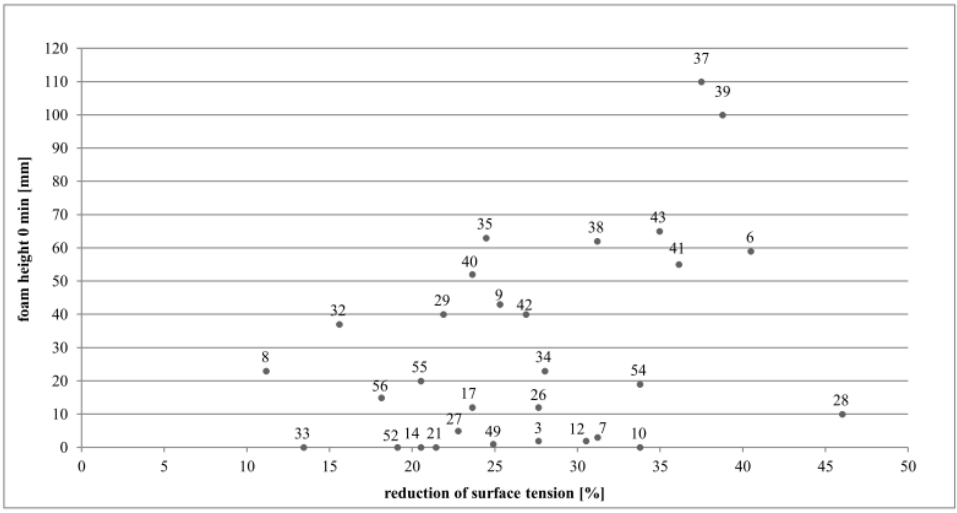

Figure 1. Relation between foam height and reduction of surface tension

The highest content of polyphenol was determined in *B. pendula* buds (7050 mg/100 g), *P. erecta* rhizomes (6125 mg/100 g), and three goldenrod leaves (4475-4850 mg/100 g) and flowers (2550-3575 mg/100 g). What is important these samples showed also good surface activity.

In many cases raw materials potentially rich in saponins have quite low content of polyphenols and vice versa. On the other hand, there are also several plant samples which achieved satisfactory results in both issues. In Figures 2 and 3 the relation between polyphenol content and foam test as well as surface tension test, respectively was presented. It is obvious that beside previously mentioned other plant materials deserve more attention as sources of both

saponins and polyphenols, namely herb of *V. officinalis*, *H. perforatum*, *T. vulgaris*, *R. officinalis*, bark of *B. pendula*, and inflorescence of *Crataegus*.

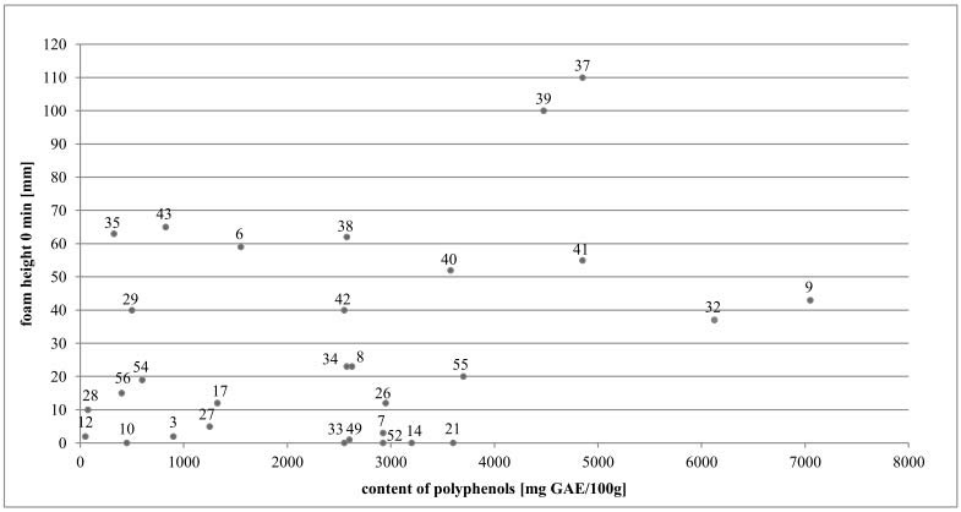

Figure 2. Relation between foam height and content of polyphenols

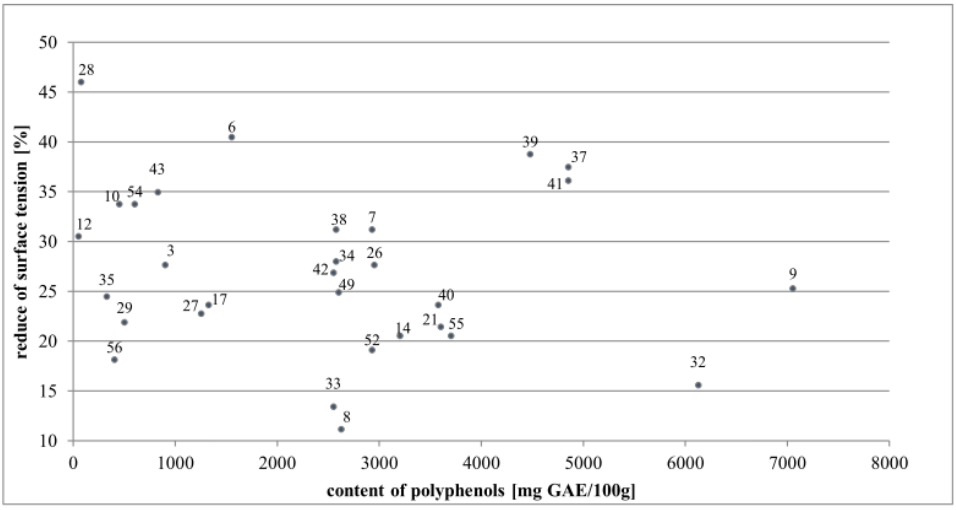

Figure 3. Relation between reduction of surface tension and content of polyphenols

Conclusions

Despite the variety of cosmetics raw materials available on the market, there is a sustainable need for new ones. It is also worth checking the currently used raw materials in terms of the content of less popular compounds, as well as researching new possibilities of their use in cosmetics formulations. Conducted tests have made it possible to find out whether raw materials available on the Polish market are rich in polyphenols, as well as abundant in saponins. Tests

carried out have shown that to these raw materials could be included various goldenrod growing popularly in Poland – *Solidago virgaurea*, *Solidago canadensis* and *Solidago gigantea* species. Admittedly in industry goldenrods are already applied, but the most commonly used is *Solidago virgaurea* L., while the results in following research show that the content of both polyphenols and saponins is much higher for *Solidago canadensis* L. and *Solidago gigantea* Antion than in the aforementioned variety.

The more interesting it is for the reason that both species are widely found in the Polish flora, and thanks to their difficult to control spread and invasiveness they are treated as weeds and are often combated. Therefore, it is worth paying attention to them, due to their domestic popularity, low cultivation requirements or resistance to external factors what can favour of gaining the raw material, which is a potentially good source for cosmetics use. However, it is important to handle the right part of the plant, because results are quite different for extracts obtained from leaves and flowers. Especially leaves seem to be the best source for polyphenols and saponins. Nevertheless, there is need to carried our more detailed researches to make sure about their possibilities of use in the cosmetics industry.

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