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INULIN CONTENT IN DIFFERENT PLANTS AND OBTAINING ENDOINULASE ENZYME FROM DANDELION

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Inulin containing plants (chicory (*Chicorium intybus*), burdock (*Arctium appa*), dandelion (*Taraxacum officinale*), artichokes (*Helianthus tuberosus*)) are widely spread in Syunik province. From the point of inulin content, the highest criterion has burdock. Inulin content in above mentioned plants varies during all vegetation and generation processes and takes a maximal amount during sprout emergence acceleration and flowering. Fructose/glucose relation undergoes changes as well. It was revealed that burdock possesses also endoinulase (EC 3.2.1.7., 2,1 – fructan fructanohydrolase) enzyme, the activity of which exceeds the activity of endoinulase enzyme obtained from microorganisms.

Inulin content – endoinulase – different plants – dandelion

Ինուլին պարունակող բույսերը, (եղերդակը (*Cichorium intybus*), կռատուկը (*Arctium appa*), խատուտիկը (*Taraxacum officinale*), գետնախնձորը (*Helianthus tuberosus*)), լայնորեն տարածված են Սյունիքի մարզում: Այս բույսերից, ինուլինի պարունակության տեսակետից, ամենաբարձր ցուցանիշն ունի կռատուկը: Ինուլինի պարունակությունը վերը նշված բույսերում տատանվում է ամբողջ վեգետացիայի և գեներացիայի ընթացքում և մաքսիմալ քանակության է հասնում ծաղկաբողբոջների արագացման և ծաղկման շրջանում: Փոփոխության է ենթարկվում նաև ֆրուկտոզ/գլյուկոզ հարաբերությունը: Պարզվել է, որ կռատուկն օժտված է նաև Էնդոինուլազ (EC 3.2.1.7., 2,1 – fructan fructanohydrolase) ֆերմենտով, որի ակտիվությունը գերազանցում է միկրոօրգանիզմներից ստացված Էնդոինուլազ ֆերմենտի ակտիվությանը:

Ինուլինի պարունակություն – Էնդոինուլազ – տարբեր բույսեր – խատուտիկ

Растения, содержащие инулин (цикорий (*Cichorium intybus*), лопух (*Arctium appa*), одуванчик (*Taraxacum officinale*), артишоки (*Helianthus tuberosus*)) широко распространены в провинции Сьюник. С точки зрения содержания инулина самый высокий критерий имеет лопух. Содержание инулина в вышеупомянутых растениях варьирует в течение всей вегетации и генерации и достигает максимума во время акселерации образования побегов и цветения. Изменяется также соотношение фруктоза-глюкоза. Выявлено, что лопух обладает ферментом эндоинулаза (EC 3.2.1.7., 2,1 – fructan fructanohydrolase), активность которого превышает активность фермента эндоинулазы полученного от микроорганизмов.

Содержание инулина – эндоинулаза – различные растения – одуванчик

At present obtaining inulin from plant organisms and their properties are not studied sufficiently. This question are being discussed intensively. Plants belonging to Compositae family such as artichokes, dandelion et al., are enriched by inulin [3,9,14,18]. Inulin is fructose polymer that is widely investigated and used as a fructose syrup which is obtained from enzymatic hydrolysis. Syrup is obtained by inulin enzymatic as well as acidic hydrolysis. Enzyme which hydrolyzes inulin is exoinulase (EC 3.2.1.80; -D-fructan fructohydrolase) or endoinulase (EC 3.2.1.7., 2.1 – fructan fructanohydrolase) [6,14,20]. Among the mentioned plants the most inulin enriched ones are chicory, artichokes and dahlia [3,9,18]. In production of inulin chicory is widely spread. This plant is also important because its harvest does not vary significantly [8]. To obtain inulin from these plants bacterial endoinulase system is used [7].

From the mentioned plants chicory, dahlia, asparagus and dandelion are spread in Zangezur. But biochemical peculiarities of these plants are not studied in details. The goal of present work is to study inulin content dynamics during vegetation and after harvest during preservation.

Materials and methods. Artichokes, chicory, dahlia, dandelion and asparagus that are spread in Synik province have been used as investigation objects. These plants have also pharmacological and agrarian importance. For example, artichokes which comprises 16-18% inulin is used as high valued forage and has an industrial value as well. This plant comprises also vitamins C and B. In 1 ha space 100-150 tone tubers and almost 120 tone ground stem are obtained that are used as forage.

Inulin content was determined as described in [1]. Fructose and glucose content obtained from inulin was determined by Colthoff method [1].

Results and Discussion. Artichokes (*Helanthus tuberosus*), asparagus (*Asparagus officinalis*), burdock (*Arctium appa*), dandelion (*Taraxacum officinale*) and chicory (*Cichorium inthibus*) have been studied in present work. The results are presented in tab. 1.

Table 1. Inulin content in roots of plants

Plant name	Inulin, %	Fructose, mmol/l	Glucose, mmol/l	Fructose amount, %	Glucose amount, %
Burdock	24	61.2	2.98	95.2	4.8
Chicory	18	53	1.8	96.6	3.4
Artichokes	20	46.8	3.8	91.9	8.1
Dandelion	16	40.3	1.92	95.3	4.7
Asparagus	14	32.5	2.3	93	7.0

It is shown from presented results that the highest criterion from the point of inulin content was revealed in burdock roots (24%), the least amount – in asparagus roots (14%), in artichokes it reaches 20%. Artichokes has a big practical importance due to its high harvest. As it is shown from table data fructose amount varies from 91.9% up to 97%, glucose amount – from 3.4% up to 8.1% that coincide with literature data [15].

In the next series of experiments inulase enzyme activity in dandelion roots has been studied. This enzyme possesses high activity. The enzymatic activity was revealed during emergence and flowering of sprouts in dandelion roots. This enzyme was used for obtaining glucose and fructose from inulin in artichokes tubers. Comparison with results obtained from acidic hydrolysis was carried out. The obtained results are presented in tab. 2.

The presented results show that enzymatic hydrolysis has a big advantage compared with acidic hydrolysis. During enzymatic hydrolysis sufficient big results have been obtained. Thus if during acidic hydrolysis in artichokes fructose amount was 46.8 mmol/l, during enzymatic hydrolysis it was equal to 52.8 mmol/l. It means that at acidic hydrolysis

fructose amount decreases by 6 units. Quantitative comparison of inulases being in dandelion roots in different media was carried out. In dandelion roots gathered from leas inulase amount was equal to 64.3 mmol/l, in the case of gathering from forests it was equal to 60.1 mmol/l.

Table 2. Fructose and glucose amounts obtained from inulin enzymatic hydrolysis and their comparison with acidic hydrolysis results

Plant name	Inulin, %	Fructose mmol/l enz.hyd.	Glucose mmol/l enz.hyd.	Fructose mmol/l acid.hyd.	Glucose mmol/l acid.hyd.	Fructose amount,% enz.hyd.	Glucose amount,% enz.hyd.	Fructose amount,% acid.hyd.	Glucose amount,% acid.hyd.
Burdock	24	66.3	1.2	61.2	2.98	98.2	1.8	95.2	4.8
Artichokes	20	52.8	0.5	46.8	3.8	99.0	0.94	91.9	8.1
Asparagus	14	36.7	0.8	32.5	2.3	97.9	2.1	93.0	7.0

In the next step of experiments inulin changing dynamics in artichokes tubers was studied with month preservation time. The obtained results are presented in tab. 3.

Table 3. Inulin changing dynamics in artichokes tubers after harvest during the preservation

	Analyses with months	Inulin, %	Fructose mmol/l	Glucose mmol/l	Fructose percent relation	Glucose percent relation
1	November (start)	31.1	90.0	6.0	93.75	6.25
2	November (end)	24.6	68.0	8.0	89.5	10.5
3	December	14.4	36.8	7.8	82.5	17.5
4	January	13.0	31.3	9.1	77.5	22.5
5	February	10.7	30.0	3.2	90.4	9.6

The presented data show that if inulin amount in the beginning of November month was 31.2% the same amount during November decreases and in the end of month it was 24.6%. This tendency continued in December, January and February and in the end of February it was 10.7%. Then starting from March inulin amount increases and it is obvious from fig. 1.

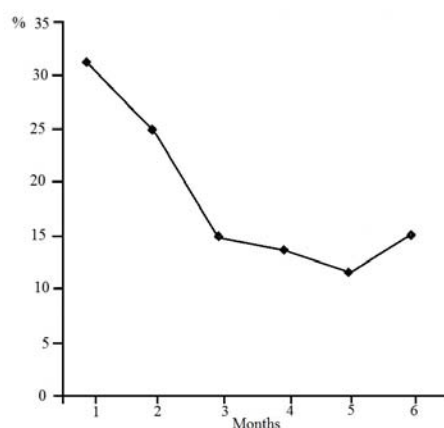


Fig. 1. The Inulin changing dynamics with months.

The next series of experiments are devoted to inulin changing dynamics of artichokes. Data are presented in tab. 4.

Table 4. Inulin emerging dynamics during artichokes vegetation and generation

Months	Inulin, %
April	0.0
May	0.2
June	0.65
July	1.25
August	2.6
September (beginning)	12.6
September (end)	15.2
October (beginning)	20
October (end)	24

In the next series of experiments inulin cleavage to fructose and glucose has been investigated at pH different values. Obtained results are presented in tab. 5.

Table 5. Enzymatic hydrolysis at pH different values

N	pH value	Inulin, %	Fructose, mmol/l	Glucose, mmol/l	Fructose percent relation	Glucose percent relation
1	5.4	10.7	300	2.2	99.3	0.7
2	5.8	10.7	307.7	1.1	99.6	0.4
3	6.2	10.7	362	1.3	99.6	0.4
4	6.6	10.7	263	1.6	99.4	0.6
5	7.0	10.7	286	3.3	98.8	1.2
6	7.4	10.7	233	2.4	99.0	1.0

If we compare our results with literature data we may conclude that the enzymatic hydrolysis has an advantage and consequently the enzymatic preparations are important to use in production. The most important point is that in glucose-fructose syrup the amount of fructose is higher. Summarizing our results we can conclude.

Inulin amount in artichokes tubers changes and gains to maximal value (24%) during sprout emerging and flowering. Inulin amount changes after harvest as well during the preservation (31.1-10.7%). If in November in tubers it was 31.1%, and then gradually decreased and in the end of February it was 10%. In March it increased certainly. During experiments glucose-fructose content changes, moreover the enzymatic hydrolysis gives higher results than the acidic hydrolysis. Optimal functioning pH for inulase from dandelion is in 5.8-6.2 interval. Activations of inulases from dandelion growing in different conditions differ. Inulase from dandelion roots grown in leas shows the bigger activity. The enzymes from plant organisms show bigger activity during cleavage to glucose and fructose than the enzymes from microorganisms.

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