DETERMINATION OF THE CHEMICAL COMPOSITION OF THE PLANT CALENDULA OFFICINALIS

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Abstract

Calendula officinalis (Calendula), Asteraceae to his family, usually known as English Marigold or Pot Marigold fragrant grass is traditional medicine in the system for ulcers, stomach ulcers, herpes, scars, skin injury, cold and the cold in treatment is used blood cleaning. Its different biological activities because of analgesic, diabetes, wound and inflammation against diseases treatment is used. It is also gastrointestinal, gynaecological, and eye diseases of skin damage and some burns in cases used. Calendula was considered a symbol of constancy in love, so grooms gave bouquets of sunny baskets to their lovers, these flowers decorated wedding celebrations, and girls wove wreaths from calendula on birthdays. In this study we studied protein and micro and macro element constituents of Calendula officinalis, and results have shown it contains ample amount of protein and elements.

Keywords: *Protein, Calendula officinalis, elements, treatment, fragrant, medicine, micro and macro, inflammation, flavonoids.*

Introduction

Calendula officinalis (Calendula), Asteraceae to his family, usually known as English Marigold or Pot Marigold fragrant grass is traditional medicine in the system for ulcers, stomach ulcers, herpes, scars, skin injury, cold and the cold in treatment is used blood cleaning. Its different biological activities because of analgesic, diabetes, wound and inflammation against diseases treatment is used. It is also gastrointestinal, gynaecological, and eye diseases of skin damage and some burns in cases used [1]. Even the ancient Romans noticed that bright yellow flowers, similar to the sun, turn after it, opening their petals, like the hands on a clock dial, and in the shade the flower collects its petals in a heap [2,9].This is why calendula has been called the “flower of the sun”, the “sun dial” and the “bride of summer”. It was also noted that the plant announces the beginning of day and night, like a kind of calendar, hence the name calendae, which in Latin means “the first day of the month.” Calendula was especially loved in medieval France. It was the favourite flower of the Queen of Navarre, Margaret of Valois. In the Luxembourg Gardens in Paris, you can see her statue holding a calendula flower [3]. Calendula was considered a symbol of constancy in love, so grooms gave bouquets of sunny baskets to their lovers, these flowers decorated wedding celebrations, and girls wove wreaths from calendula on birthdays. She was also popular in love rituals. And in Russia, they gave it its name - marigold. It is connected with the legend of a folk healer, destroyed by an evil sorceress, whose nail sprouted a beautiful golden flower, which continues to this day to heal people from various diseases [4]

It was in Ancient Rome, and then Greece, that the unique medicinal properties of calendula were recognized. Later her fame spread everywhere. In Russia, calendula began to be grown as a medicinal and ornamental plant from the 12th century [5]. Traditional healers

of the Middle Ages assured that both the sight of a yellow flower, which gives energy and charges with optimism, and its aroma have a beneficial effect on people, relieving them of headaches. The juice was made from calendula flowers, believing that it eliminates tinnitus and relieves inflammation of the eyes. Calendula was called a stomach-healing herb and was considered the best remedy for treating skin diseases. Our distant ancestors were sure that calendula calms the heart, strengthens the spirit and protects against infectious diseases, so garlands of it were hung on doors and ceilings. Scientists have also recognized calendula. This happened in the 1st century AD. The ancient Greek physician and philosopher Dioscorides noted that an infusion from this plant had a beneficial effect on the liver [6,8]. In the 6th century, Aesculapian wrote a book about the medicinal properties of plants, "The Dream of Health," which is still relevant today. In it, calendula is credited with the properties of stopping bleeding and disinfecting wounds. The famous physician Avicenna, who lived in the 11th century, confirmed the wide capabilities of calendula in treating not only the digestive system, but also the nervous, endocrine, and joint diseases. Over time, new healing properties of calendula were discovered. Thus, already in the 12th century, diseases of the female reproductive system were treated with ground leaves and flowers. In addition, it was recommended to make jam from fresh calendula flowers to improve mood, and also use it as a spice [7]. Since ancient times, calendula has been used to tint dishes yellow, giving food a tart taste and replacing the more expensive spice – saffron. Calendula is still used in cooking today: the dye found in its petals is used to tint some types of cheeses, butter, and meat dishes.

Materials and methods: Determination of the amount of total protein

The method consists of determining nitrogen using the Kjeldahl method, followed by conversion to protein. The essence of the method is the decomposition of the organic matter of the sample with boiling concentrated sulfuric acid with the formation of ammonium salts, the conversion of ammonium into ammonia, its distillation into an acid solution, the quantitative accounting of ammonia by the titrimetric method and the calculation of the nitrogen content in the material under study.

From an average crushed homogeneous sample of the studied low-fat cotton seed meal, an accurate sample was weighed in a test tube for analysis, with an error of no more than 0.1%. The sample was quantitatively transferred to a Kjeldahl flask. Further experiments were carried out according to the methodological instructions [10].

Instruments and utensils used: ISPMSNEXION-2000 or similar mass spectrometer,

microwave digestion device (Germany) or similar Teflon autoclaves volumetric flasks

Reagents used: multi-element standard No. 3 (29 elements for MS)

standard for –Hg (mercury) nitric acid (chemical/h) hydrogen peroxide (chemical/h)

double-distilled water argon (gas purity 99.995%)

Results: Processing of results: The mass fraction of nitrogen (X) in the test sample as a percentage of its mass during the distillation of ammonia into sulfuric acid was calculated using the formula

$$X = \frac{(V_1 - V_0) \times K \times 0.0014 \times 100}{M}$$

Vo – volume of 0.1 mol/l sodium hydroxide solution consumed for titration of 0.05 mol/l sulfuric acid in the control experiment, ml. V1 – volume of 0.1 mol/l sodium hydroxide

solution consumed for titration of sulfuric acid in the test solution, ml; K – correction to the titer of 0.1 mol/l sodium hydroxide solution;
0.0014 – amount of nitrogen equivalent to 1 ml of 0.05 mol/l sulfuric acid solution;
M is the mass of the sample, g. The arithmetic mean of the results of five parallel tests was taken as the final test result. Results were calculated to the third decimal place and rounded to the second decimal place.
The mass fraction of nitrogen in terms of dry matter of the product (X3), in per cent, was calculated using the formula:

$$X_3 = \frac{X_1 \times 100}{100 - W}$$

X1 – mass fraction of nitrogen in the test sample, %; W – humidity of the test sample, %.
The mass fraction of protein (Y) as a percentage was calculated using the formula: Y = K XX, where K is the conversion factor of nitrogen to protein: with moderate lipid content - 6.38;

Table 1

Protein content of Calendula officinalis

№	Sample	Nitrogen(%)	Protein(%)
1.	Calendula officinalis	2,532	15,426

Method for quantitative determination of micro and macroelements using inductively coupled plasma mass spectrometry (ICP-MS)

An accurate sample of 0.0500-0.5000 g of the test substance is weighed on an analytical balance and transferred to Teflon autoclaves. Then the autoclaves are filled with the appropriate amount of purified concentrated mineral acids (nitric acid (h/h) and hydrogen peroxide (h/h)). The autoclaves are closed and placed on a Berghofc microwave digestion device using the MWS-3+ software or a similar type of microwave digestion device. Determine the decomposition program based on the type of substance under study, indicate the degree of decomposition and the number of autoclaves (up to 12 pcs). After decomposition, the contents in autoclaves are quantitatively transferred into 50 or 100 ml volumetric flasks and the volume is adjusted to the mark with 0.5% nitric acid. The determination of the substance under study is carried out using an ISPMS device or a similar optical emission spectrometer device with inductively coupled argon plasma. In the determination method, the optimal wavelength of the micro or macroelements being determined is indicated, at which they have maximum emission. When constructing a sequence of tests, indicate the amount in mg and the degree of its dilution in ml. After receiving the data, the true quantitative content of the substance in the test sample is automatically calculated by the device and entered in the form of mg/kg or μg/g with error limits - RSD in%.

table 2

Quantitative determination of micro content and macroelements using the ISPMS method

№	Element	**Quantitative content mg/kg**	**№**	Element	**Quantitative content mg/kg**
1	Silver, Ag	**0,013**	**17**	Magnesium, Mg	**8465,52**

2	Aluminium, Al	**0,552**	**18**	Sodium, Na	**9125,056**
3	Arsenic, As	**0,035**	**19**	Manganese, Mn	**53,63**
4	Barium, Ba	**65,2**	**20**	Nickel, Ni	**0,001**
5	Beryllium, Be	**0,022**	**21**	Rubidium, Rb	**2,65**
6	Bismuth, Bi	**0,004**	**22**	Selenium, Se	**0,253**
7	Calcium, Ca	**3065,8**	**23**	Strontium, Sr	**69,678**
8	Cadmium, Cd	**0,021**	**24**	Thallium, Tl	**0,001**
9	Cobalt, Co	**0,075**	**25**	Uranus, U	**0,001**
10	Chromium, Cr	**2,45**	**26**	Vanadium, V	**0,123**
11	Copper, Cu	**6,78**	**27**	Zinc, Zn	**9,23**
12	Iron, Fe	**145,6**	**28**	Lead, Pb	**0,013**
13	Gallium, Ga	**0,82**	**29**	Cesium, Cs	**0,003**
14	Indium, In	**0**	**30**	Mercury, Hg	**9,122**
15	Potassium, K	**7952,08**	**31**	Phosphorus, P	**11978,6**
16	Lithium, Li	**0,755**	**32**	Bor V	**8,78**

Discussion: Based on the obtained results the plant Calendula officinalis has right amount of proteins as well as some micro and macro elements such as Calcium, Potassium and magnesium which help for different part of body to digest and work properly. And this material can be used for future medicinal usage because of its chemical contents.

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