Annals of the University of Craiova
**The Chemistry Series**
Volume L, No. 2 (2024) 54-59
homepage: chimie.ucv.ro/anale/

# Comparative analysis for three types of honey. Determination of glucose by the Auerbach-Bodlander method

*Larisa-Marina-Elisabeth Chirigiu[1], Elena Morosan[2]*•, *Anca Gănescu[3], Rodica-Geanina Chirigiu[4]*

[1] University of Medicie and Pharmacy of Craiova, Faculty of Pharmacy, Petru Rares 4, Craiova, Romania

[2] University of Medicie and Pharmacy Carol Davila București, Faculty of Pharmacy, Bulevardul Eroii Sanitari 8, București, Romania

[3] University of Craiova, Faculty of Sciences, Department of Chemistry, Calea București 107 I, Craiova, Romania

[4] Elena Cuza National College, 12 Mihai Viteazul Sreeet, Craiova, Romania

* E-mail: l.chirigiu@gmail.com

*Received: 17.11.2024 / Accepted: 26.11.2024 / Published: 20.12.2024*

**Abstract:**
In this paper, a comparative analysis of three types of honey from the Oltenia area was carried out. The conclusions obtained led to a qualitative classification of the three types of honey according to their glucose content. We also performed a microscopic analysis of the pollen content and determined that the richest pollen content is found in linden honey, which is why it is not recommended for patients suffering from pollen allergies.

**Keywords:** linden honey, polyfloral honey, acacia honey, pollen, glucose

## 1. INTRODUCTION

Over the centuries, honey has been the main sweetener used by our people. In our country, the craft of beekeeping has been practiced since ancient times. It is also since then that interest in the analysis and characterization of honey production has emerged.

Various proposals were made for the selection of analysis methods and finally the use of the Auerbach-Bodlander metho was established. [1, 2]

Among the components of honey, we mention the influence on its properties of the action of carbohydrates that give honey its sweet taste, water responsible for fluidity, and the remaining components are responsible for the other properties: color, smell and taste.

One of the analyzes performed on honey was the determination of the glucose content. In the present work, we tried and succeeded in determining the glucose content in honey by the Auerbach-Bodlander method.

## 2. MATERIALS AND METHODS

### *2.1. Principle of the method*

Aldehyde groups in glucose are oxidized with iodine in alkaline medium, but not ketone groups in fructose. [3]

$$C_6H_{12}O_6 + I_2 + H_2O \rightarrow C_6H_{12}O_7 + 2\ HI$$

### *2.2. Reagents and solutions*

- distilled water;
- iodine solution 0.1 N;
- sodium thiosulfate solution 0.1 N;
- starch solution 1 %;
- $Na_2CO_3$ solution 0.2 M;
- $NaHCO_3$ 0.2 M;
- $H_2SO_4$ 25 %.

### *2.3. Instruments and apparatus*

- 100 mL volumetric flasks;
- 250 mL Erlenmeyer flasks equipped with ground-in stoppers;
- graduated burette.

*2.2. Analysis methods*

1 g of honey is placed in a 100 mL volumetric flask and made up to the mark with distilled water.

In an Erlenmeyer flask fitted with a ground stopper, 20 mL of honey solution prepared as above, 50 mL of sodium bicarbonate solution, 50 mL of sodium carbonate solution and 20 mL of iodine solution are placed. Shake well, secure the ground stopper and leave in the dark for 2 hours. Add 12 mL of sulfuric acid and titrate the unreacted iodine with sodium thiosulfate solution in the presence of starch as an indicator.

Prepare a blank sample by replacing the 20 mL of honey solution with 20 mL of distilled water. Titrate the blank sample with sodium thiosulfate in the presence of starch as an indicator.

## 3. RESULTS AND DISCUSSION

The percentage glucose content is expressed using the formula:

$$\text{Glucose } \% = \frac{9{,}005 \cdot (V - V_1) \cdot 5}{m \cdot 1000} \cdot 100$$

where:

9.005 = glucose (mg) corresponding to 1 mL of 0.1 N iodine solution;

V = volume of iodine consumed in the honey sample (difference between the volume of iodine solution added and the volume of sodium thiosulfate consumed during titration), (mL);

$V_1$ = volume of iodine consumed in the control sample (difference between the volume of iodine solution added and the volume of sodium thiosulfate consumed during titration), (mL);

5 = ratio between the volume of the volumetric flask (100 mL) and the volume taken in the work, (20 mL);

m = mass of honey taken in the work, (g);

1000 = conversion factor mg to grams.

Our research was done on three varieties of honey:

1. Acacia honey

It is a very light pale honey, almost colorless.

In this variety of honey, the ratio between glucose and fructose is shifted in favor of fructose, which makes it very difficult to crystallize. In it we practically find only very rare traces of pollen, which is why it is recommended for patients allergic to pollen. It is also recommended for calming coughs, being very assimilable.

In folk medicine it was indicated for many conditions: nervous asthenia, gastritis and ulcers, heart and liver tonic, insomnia, cancer, pneumonia and TB. [4]

It is used as a sweetener because it does not change the taste of sweetened foods.

2. Linden honey

It is a light yellow honey that sometimes acquires slightly greenish reflexes. It is a honey with a very intense aroma, with a high content of pollen grains, forbidden to those with allergies. On the other hand, it is very rich in vitamin B1. It has a calming effect on coughs and in folk medicine it is recommended for treating nervous system diseases, treating insomnia, and fevers. It is also indicated for improving migraines. [5]

On the respiratory system, linden honey acts by improving pneumonia, bronchial asthma and TB.

3. Polyfloral honey

It is a honey with a dark yellow to reddish yellow color. Being obtained from a mixture of plants, it has the ability to manifest the curative properties of the plants from which it comes. The properties of polyfloral honey are not stable, they change from one beekeeping season to another. In addition to the changing curative effects, polyfloral honey has an effect that it continuously maintains – its excellent cosmetic action. [6, 7]

The determinations were carried out in the analytical chemistry and sanitary chemistry laboratories at variable temperatures between 20 – 27°C, a temperature range in which the systematic analysis errors introduced due to the dilution index were calculated and established within the limit of 3 %. These errors insignificantly influence the results of the determinations carried out on the three honey varieties.

The analyzed honey comes from the area of Dolj – Olt counties and was harvested in the spring – autumn of 2023.

The results of the determinations are presented in Table 1, being approximated to 2 decimal places.

Table 1. Determination of glucose content in honey
by the Auerbach – Bodlander method

| Sample No. | V | $V_1$ | $(V - V_1)$ | m | Glucose % |
|---|---|---|---|---|---|
| Acacia honey | | | | | |
| 1 | 8,8 | 1,0 | 7,8 | 1,0231 | 34,32 |
| 2 | 8,8 | 1,0 | 7,8 | 1,0043 | 34,96 |
| 3 | 8,5 | 1,0 | 7,5 | 0,9982 | 33,82 |
| 4 | 9,3 | 1,0 | 8,3 | 1,1023 | 33,90 |
| 5 | 8,6 | 1,0 | 7,6 | 1,0002 | 34,21 |
| Average of determinations | | | | | 34,24 |
| Linden honey | | | | | |
| 1 | 8,0 | 0,9 | 7,1 | 1,1004 | 31,84 |
| 2 | 7,9 | 0,9 | 7,0 | 1,0435 | 30,20 |
| 3 | 8,1 | 0,9 | 7,2 | 1,0298 | 31,47 |
| 4 | 7,9 | 0,9 | 7,0 | 0,9892 | 31,86 |
| 5 | 7. 8 | 0,9 | 6,9 | 1,0021 | 30,42 |
| Average of determinations | | | | | 31,16 |
| Polyfloral honey | | | | | |
| 1 | 7,4 | 0,6 | 6,8 | 0,9978 | 30,68 |
| 2 | 7. 5 | 0,6 | 6,9 | 0,9732 | 31,92 |
| 3 | 7,5 | 0,6 | 6,9 | 1,0076 | 30,83 |
| 4 | 7,6 | 0,6 | 7,0 | 1,1428 | 27,58 |
| 5 | 7,4 | 0,6 | 6,8 | 1. 1297 | 27,10 |
| Average of determinations | | | | | 29,62 |

## 4. CONCLUSION

1. Honey is a food component of the greatest importance.

2. Honey has different quality and properties depending on the variety, the harvest period, the area where it was produced, the type and species of flowers existing in that area.

3. The therapeutic capacities of honey differ depending on the variety of honey and natural factors, some varieties having different therapeutic capacities compared to other varieties in certain diseases.

4. We analyzed three different varieties of honey: acacia honey, linden honey and polyfloral honey, honey harvested from the Oltenia area, more precisely from the Dolj and Olt counties, for which we determined the glucose content.

5. Following the analyzes performed, we reached the following results:

6. Acacia honey is the honey with the richest glucose content 34.24%.

7. Linden honey has an intermediate content between acacia honey (34.24%) and polyfloral honey (29.62%), which is (31.16%).

8. We performed a microscopic analysis of the pollen content and determined that the richest pollen content is in linden honey, which is why it is not recommended for patients suffering from pollen allergies.

## REFERENCES


[1] I. Palarie, M.C. Varut, L.M.E. Chirigiu, *Rev. Chim Buc.* 70, **(2019)**, p. 140-142.

[2] L. Chirigiu, M.V. Bubulica, L.M.E. Averis, *Revista de Chimie, Bucharesti*, 63, **(2012)**, p. 764-767

[3] Analiza chimică a alimentelor, L. Chirigiu, M. V. Bubulică, L. Radu, Editura Sitech, Craiova, **(2010)**, p. 131-145.

[4] Addis Getu and Malede Birhan, *Academic Journal of Nutrition* 3 (1) **(2014)** 06-14.

[5] Ana Pascual-Maté, Sandra M Osés, Miguel A Fernández-Muiño, M Teresa Sancho, *Journal of Apicultural Research* Volume 57, **(2018)** Pages 38-74.

[6] Priscila Missio da Silva, Cony Gauche, Luciano Valdemiro Gonzaga, Ana Carolina Oliveira Costa, Roseane FettA.Shukla, *Food Chemistry*, Volume 196, **(2016)**, Pages 309-323.

[7] Keith H. Steinkraus, Roger A. Morse, Hoang Van Minh, Beatriz V. Mendoza, F. M. Laigo, *Bee World*, Volume 52, **(2015)**, p. 122-127.