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Electrochemical profiles and water content in different honey varieties from Western Balkan countries

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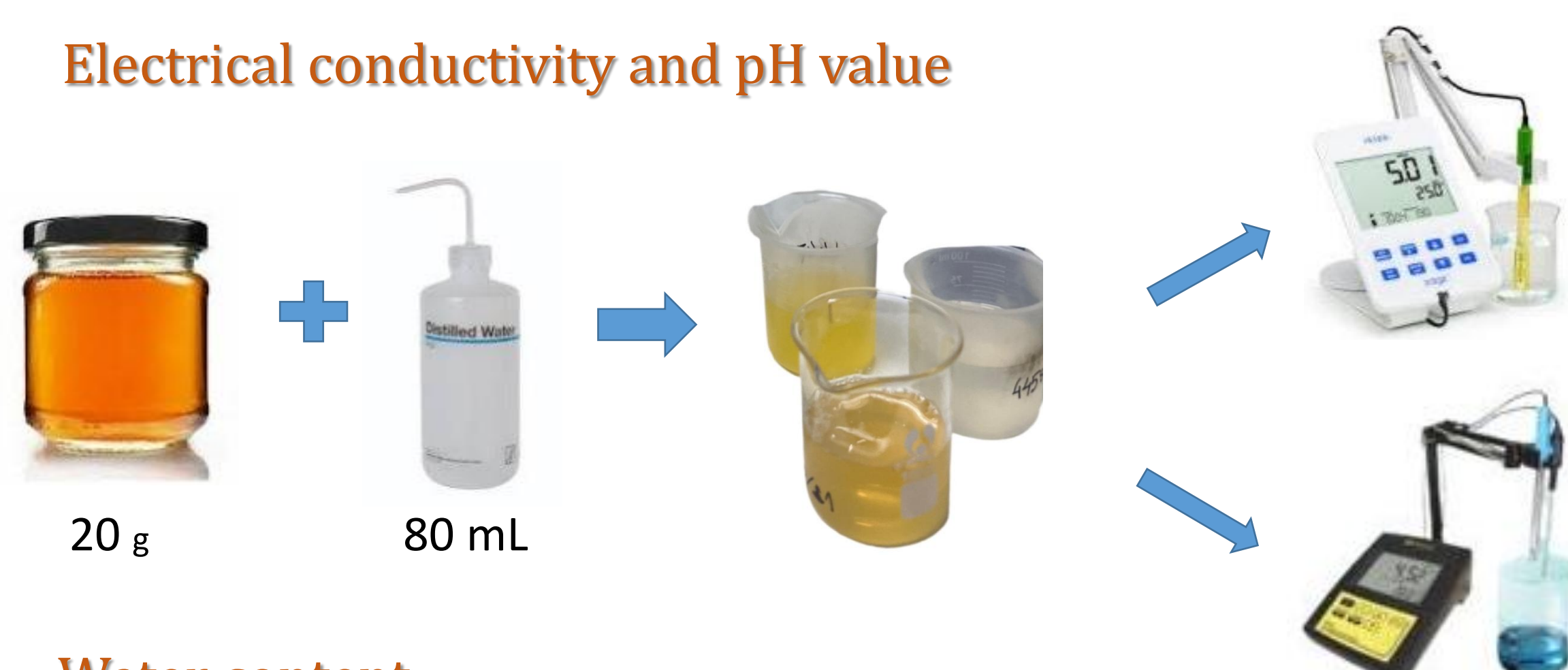
Abstract: Honey, as a sweet and nutritionally rich substance, occupies a special place in agricultural production. From a chemical point of view, it contains over 200 important compounds for the normal functioning of metabolic processes, which together make up the dry matter of honey (e.g., minerals, organic acids, phenolic compounds, vitamins such as niacin, riboflavin, pyridoxine, etc.). In addition to dry matter, honey also contains a certain percentage of water. Honey has multiple important aspects: It is used in medicine and pharmacy due to its therapeutic and antibacterial properties and is additionally recommended for inclusion in the daily diet. Therefore, special attention should be paid to quality control and microbiological safety. Electrical conductivity, measured with a conductometer, represents the content of mineral substances and indirectly indicates the botanical and geographical origin of honey, as well as its clarity. This parameter is among the standard measures used in honey quality control, owing to the fact that honey beside the amount of different compounds, contains minerals that can dissociate into ions in aqueous solution and thus conduct electrical energy. Through the use of a pH meter, the pH value of the samples was also determined, which is correlated with the organic acids in honey. The water content is also one of the major parameters that indicates its microbiological stability and affects its viscosity. Its value is not constant, but varies depending on the storage conditions (air humidity). Water content was determined using a refractometer whose principle of operation is based on the refraction of light that passes through a sample of honey, which is applied to the appropriate tile on the instrument. Among the samples analyzed, rapeseed honey showed an average conductivity of 160.67 $\mu\text{S}/\text{cm}$, a pH of 4.09, and a water content of 18.13%. Meadow honey had higher conductivity at 532.37 $\mu\text{S}/\text{cm}$, a pH of 4.03, and 16.17% water content. Linden honey had the highest conductivity at 636.75 $\mu\text{S}/\text{cm}$, with a pH of 4.11 and 16.78% water. Acacia honey displayed the lowest conductivity 146.23 $\mu\text{S}/\text{cm}$, a pH of 4.04, and a water content of 16.15%. These results show the importance of electrochemical profiling in differentiating types of honey and ensuring quality standards.

• Introduction

Honey as a substance containing large amounts of vitamins, minerals and organic acids has multiple uses. When it comes to quality parameters, electrical conductivity, pH value and water content are always determined in biochemical analyses. Those three parameters indicate some of the main properties of honey (transparency, content of organic acids, viscosity, etc.)

• Material and method

Electrical conductivity and pH value



Water content



• Results and discussions

Honey type	Electrical conductivity $\mu\text{S}/\text{cm}$	pH	Water, %
Acacia honey	111.2	4.17	15.1
	149.1	4.05	16.5
	140	4.05	14.9
	171.4	4.04	16.1
	138.9	3.73	17.4
	150.9	3.76	16
	128	4.14	17.1
	164.9	4.27	14.9
	201	4.09	17.2
	203	3.95	16
	158.1	4.05	14.9
	150.2	3.97	15.2
	124.9	3.87	16.4
	68.8	4.11	17.1
	133.1	4.35	17.5
Xsr	146.23	4.04	16.15
STDEV	33.45	0.17	0.97
RSD, %	22.88	4.18	6.02

Honey type	Electrical conductivity $\mu\text{S}/\text{cm}$	pH	Water, %
Meadow honey	202	4.09	16.6
	272	4.02	16.4
	664	4.38	15.9
	387	3.65	16.8
	463	4.04	16
	524	3.84	16.8
	634	4.32	16.3
	465	3.88	16.1
	276	3.57	15.6
	556	4.04	17.01
	472	3.55	16.4
	328	3.57	16.4
	679	4.12	16
	747	4.5	15.9
	753	4.33	15
Xsr	532.37	4.03	16.17
STDEV	181.92	0.33	0.62
RSD, %	34.17	8.08	3.84

Type of honey	Electrical conductivity $\mu\text{S}/\text{cm}$	pH	Water, %
Rapeseed honey	140.5	4.27	19.8
	202	4.03	17.8
	139.5	3.97	16.8
Xsr	160.67	4.09	18.13
STDEV	35.80	0.16	1.53
RSD, %	22.28	3.88	8.42

Honey type	Electrical conductivity $\mu\text{S}/\text{cm}$	pH	Water, %
Linden honey	664	4.02	18.4
	658	4.48	16.8
	637	4.05	14.9
	588	3.9	17
Xsr	636.75	4.11	16.78
STDEV	34.50	0.25	1.44
RSD, %	5.42	6.16	8.58

• Conclusions

Different samples of honey have different values of the investigated parameters (depending on geographical, botanical and other factors). All samples have good electrochemical properties and each of them is within the range of prescribed values.

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