Electrical conductivity is considered to be one of the best parameters for analysing and authenticating honey, and differentiating between honey made from nectar (“blossom” or “flower honey”) and honey made from honeydew (“forest honey”). It is the origin that determines the composition of the honey – and hence its electrical conductivity.

According to the guidelines of the International Honey Commission (IHC), the electrical conductivity of honey is defined as that of a 20 % weight in volume (w/v) solution in distilled water at 20 °C, where the 20% refers to honey dry matter (dry matter basis). The result is expressed in microSiemens per centimetre (µS/cm).

Honeys with an electrical conductivity of more than 800 µS/cm are labelled honeydew or forest honeys. The electrical conductivity values of mixtures of forest and flower honeys range between 600 and 800 µS/cm. Pure flower honeys show electrical conductivity values between 350 and 600 µS/cm. If the electric conductivity value is below 250 µS/cm, this might indicate that the bees have been artificially fed with sugar and such honey is banned by Departments of Health and Food Safety in many countries.

## Task

### Sample weight determination

1. Calculate the mass of the dry matter in gram (= g DMref) from the water content (= g moisture content) of the sample (see experiment “Determination of the water content of honey”).
2. Now, applying the rule of three, calculate the sample weight (= g sample weight) from the refractometric dry matter (= g DMref) determined above and the “target dry matter” (= g DMtarget) of 20 g.
3. Weigh the honey sample and dissolve it in 100 ml distilled water.

### Experiment

Equipment: Scales (accuracy of 0.1 g), beaker (50 ml), graduated cylinder (100 ml), conductivity meter, funnel, glass stirring rod

Chemicals: distilled water, various honey samples

Dangers: no dangers

1. Weigh the calculated honey sample in a 50 ml beaker, add some distilled water, and thoroughly mix with a glass stirring rod until dissolved.
2. After dissolving the honey, place the funnel into the 100 ml graduated cylinder, and carefully pour the honey solution into it.
3. Fill the measuring cylinder with distilled water to its top graduation. Shake well to mix the solution thoroughly.
4. Rinse the 50 ml beaker with distilled water and pour enough honey solution into it to fully immerse the conductivity cell.
5. Now measure the electrical conductivity.
6. Do not forget to clean the conductivity cell between and after the measurements with distilled water.

### Measured values / observations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Honey sample | Water content (gram) | Dry  matter (gram) | Sample weight (gram) | Electrical Conductivity (µS*/*cm) | Colour of the  Honey |
| Flower honey 1 |  |  |  |  |  |
| Flower honey 2 |  |  |  |  |  |
| Forest honey 1 |  |  |  |  |  |
| Forest honey 2 |  |  |  |  |  |
| eHive Honey |  |  |  |  |  |
| Artificial Honey |  |  |  |  |  |

### Analysis

1. Suggest a hypothesis to explain the differences you may observe between the measured values.
2. Explain why it is necessary to calculate the dry matter. Why is it not possible to simply use a 20 g honey sample for determining the conductivity?
3. Discuss how electrical conductivity tests can be used to identify artificially adulterated honey.
4. Discuss the results with your neighbour and write them down.

For the quicker pupils

1. Read the following text:

„Honey comes in a variety of colours, flavours and fragrances. While some are amber, others are red, brown, or yellow. Have you ever wondered why honeys made by the same bees have different colours?

The answer is simple. Honey is made from nectar. Different flowers have different kinds of nectar, all of which have different colours. While rape honey is usually very light in colour, the amber colour comes from poplar or magnolia plants. The colour of honey changes over the year which is, of course, to be explained by the different flower seasons. In general, spring honeys are light in colour while summer honeys are darker the later the year.

Forest honey is not made from nectar but from honeydew. It is usually very dark in colour and remains liquid for a long time.“

http://www.honig-schmidt.de/honig-blog/honig/unterschiede-zwischen-blutenhonig-und-waldhonig/  
(last accessed on 24 August 2016, translated & adapted)

http://www.pitara.com/science-for-kids/planet-earth-for-kids/different-colours-of-honey/  
(last accessed on 21 February 2017, adapted)

1. Compare the colours of the honey samples you have analysed. Use the information above to explain the relationship between honey colour and electrical conductivity.

## Literature

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