

# Principle of mass spectroscopy

Mass spectroscopy is a method for determining the mass of atoms, ions or the isotopic composition of a certain element. The device we use for this method is a **mass spectrograph**, which works on the basis of the fact that the trajectory of a charged particle is dependent on its mass.

First, we have to convert the monitored isotopes into ions with charge  $q$ .

$$E = \frac{1}{2} \cdot m \cdot v^2 = q \cdot U$$

( $q$ = charge of the ion,  $U$ =voltage... the product is the total energy of the accelerated ions)

After this step the accelerated ions enter the **mag. field** and a mag. power acts on them with a size of :

$$F_{mag} = q \cdot v \cdot B$$

The path of the ions then curves and *'describes a circle with radius  $r$ '* in the magnetic field, which we can determine from the equality of magnetic and centrifugal forces:  $\frac{M \cdot v^2}{r} = q \cdot v \cdot B \quad r = \frac{M \cdot v}{q \cdot B}$

For speed we substitute from the first formula:

$$r = \frac{\sqrt{2 \cdot U}}{B} \cdot \sqrt{\frac{M}{q}} = A \cdot \left(\frac{q}{M}\right)^{-1/2},$$

where  $A$  does not depend on the mass, but only on the charge. For this reason, ions with the same charge and different masses will move in different circles. It follows that we will later use detectors to distinguish individual isotopes from each other.

## Mass spectroscopy procedure

1. The sample is placed in the instrument and undergoes evaporation.
2. We ionize the sample and ions are formed.
3. The ions are separated according to the  $m/Q$  ratio in the analyzer elmag. field.
4. There is a quantitative detection of ions by the device.
5. After detection, the device processes the ions.

## Links

### Source

- KUBATOVA, Senta. *Biofot* [online]. [cit. 2011-01-31]. <<https://uloz.to/!CM6zAi6z/biofot-doc>>.