



# Chemistry

## Determination of nitrates in a water sample

### *Spectrophotometric method*

#### **Introduction**

Nitrates represent the last stadium of the oxidization of the nitrogen compounds coming from the biological decomposition of organic substrates. They can be present in traces in surface water, whereas they can reach relevant concentrations in groundwater. When their concentration in surface water increases, we can observe the excessive growth of plants. This phenomenon is termed eutrophication. For this reason effluents of treatment plants can hold up to 50 mg/L of nitric nitrogen. The amount of this analyte in water can be measured with a spectrophotometric method.

#### **Principle of the method**

The method is based on the reaction between nitrates and sodium salicylate in acid solution for sulfuric acid. The product of this reaction has yellow color when the pH is basic. We can determine concentration of this compound in solution by measuring its absorbance at the wavelength of 420 nm with a spectrophotometer.

#### **Apparatus**

Porcelain capsule  
10 mL calibrated pipette  
UV spectrophotometer  
Cells with 1 cm optical path.

#### **Reagents**

Sodium salicylate solution  
Sodium and potassium tartrate solution with sodium hydroxide  
Concentrated sulfuric acid (d=1,84)  
Deionized water

## Procedure

- Introduce 10 mL of the water sample inside an apposite porcelain capsule by using a 10 mL calibrated pipette.
- Pour 10 mL of deionized water into another porcelain capsule (for the blank analysis).
- Treat at the same way the content of both the two capsules.
- Evaporate completely the water by heating the capsule on a plate and leave to cool it.
- Add a tip of a spatula of sodium salycilate and dissolve all the residue with 2 mL of concentrated sulfuric acid by tilting and rolling the capsule.
- Allow the solution to stand for 10 minutes.
- Add 15 mL of deionized water and 15 mL of sodium and potassium tartrate solution with sodium hydroxide (ready). In these conditions the solution takes on a yellow color.
- Mix everything well with a glass rod.
- Take measurements of absorbance at the wavelength of 420 nm by using cuvettes with 1 cm optical path, working as follows:
  - set the wavelenght at 420 nm;
  - fill the two 1 cm cuvettes with the blank solution and insert them into the instrument;
  - reset the absorbance;
  - remove the cuvette close to the operator, empty it, rinse it 2 or 3 times with the sample solution and fill it with the sample;
  - Take note of the absorbance value measured by the instrument.

## Calculation

From the absorbance value of the sample, by using a calibration line, obtain the value of the nitric nitrogen (nitric-N) concentration in the water sample through the following relation:

$$\text{nitric-N (in mg/L)} = A \times K$$

in which A = absorbance of the sample; K = slope of the calibration line.