

Student experiment
(10th - 13th grade)

Photometric determination of citric acid

🕒 Time: 30 min.

Safety:

safety glasses



Instruments:

- photometer
- cuvettes
- pipettes
- 7 beakers (50 ml)
- measuring pipettes (10 ml)
- watch
- millimeter-lined paper
- ruler

Chemicals:

- citric acid (monohydrate; H: 318; P: 305+351+338-311)
- iron(III)-chloride (H: 302-315-318-290; P: 280-302+352-305+351+338-313)
- hydrochloric acid (c = 0,01 mol/l)
- distilled water,
- sample containing citric acid (e.g. lemon juice, bathroom cleaner, decalcifying agent, etc.)

Preparation:

- Dissolve 0,7g of citric acid monohydrate in a little distilled water and dilute to 1l using more distilled water (**= 0,64 g citric acid/liter**).
- Dissolve 1g of iron(III)-chloride in a little hydrochloric acid. After it cools, add enough hydrochloric acid to bring the total volume to 1l.

Experiment:

- Dilute 5ml of the iron(III)-chloride solution with 5ml of distilled water and measure the extinction point (total absorption) using the photometer and light with a wavelength of $\lambda = 380\text{nm}$. Record this value as the zero reference value, E_0 .
- Dilute the citric acid with distilled water as shown in the accompanying table. These samples will be mixed according to the table with iron(III)-chloride solution and measured for their extinction point, E , after approximately 5 minutes using the photometer.
- Calculate the value of E minus E_0 for each sample. Graph the difference against the citric acid concentration and calculate the calibration line.

Nr.	ml citric acid	ml Water	ml FeCl_3	E	$E-E_0$	Citric acid g/l
1	4	2	6			
2	3	3	6			
3	2	4	6			
4	2	6	8			
5	2	8	10			
6	1	7	8			

- Dilute 1ml of sample with distilled water to a volume of 10ml. Add 10ml of iron(III) chloride solution. Determine the extinction point after 5 minutes. Using the calibration line, calculate the citric acid concentration in the sample.

Observations:

When iron(III) ions are added to citric acid, the color of the yellowish iron salt solution deepens.

Results:

This reaction builds a complex, in which iron(III) ions are bound into a dicitrate complex.

