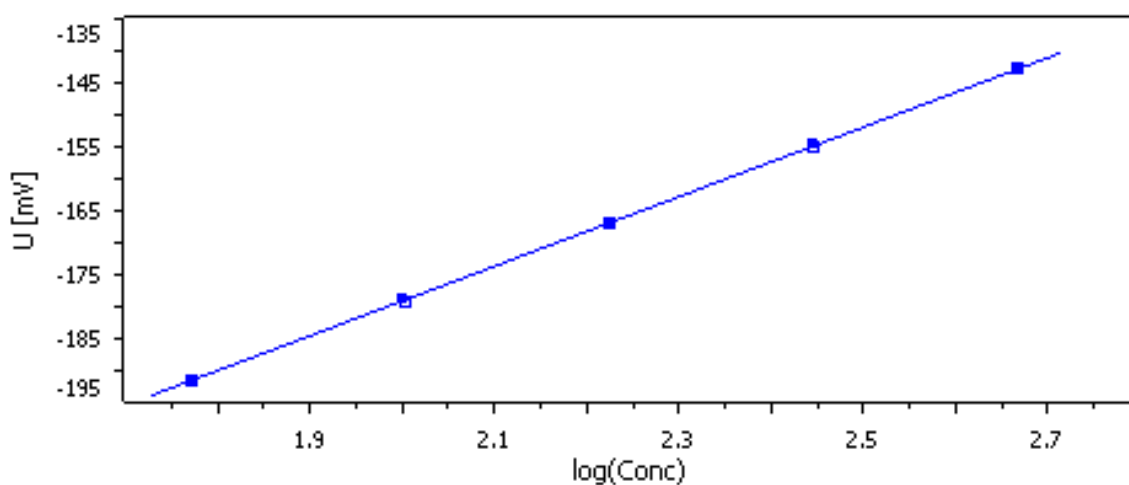


Potassium in liquid and solid NPK fertilizers

Fast and inexpensive determination using the ion-selective electrode



NPK fertilizers are mainly comprised of three primary nutrients required for a healthy plant growth (nitrogen, phosphorus, potassium). They are available as liquid, or granular form, whereof the last is the most common used one. Knowing the quality and content of a fertilizer allows an optimal utilization for a planned culture and optimizing the amount of used fertilizer. This helps to reduce costs and to improve plant growth and with it, a better harvest follows.

To assess potassium, several methods like flame photometry, titration, or ion measurement can be used. In this work, the potassium content is measured by standard addition which is a fast, inexpensive, and easy to use method.

Method description

Samples

Liquid and solid NPK fertilizers

Sample preparation

Approx. 5 g of liquid fertilizer or 2.5 g of solid fertilizer is weighed accurately into a 50 mL volumetric flask and filled up to the mark with $c(\text{NaOH}) = 2 \text{ mol/L}$. The solution is vigorously shaken and allowed to stand for about 1 hour to release ammonia.

Configuration

814 USB Sample Processor (1T/2P)	2.814.0020
Titration head, 3x SGJ 14	6.1458.040
Sample rack 22 x 120 mL	6.2041.470
Sample beakers plastic (PP), 120 mL, 250 pieces	6.1459.300
Propeller for 120 mL beaker	6.1909.050
802 Rod stirrer	2.802.0020
tiamo 2.5 full	6.6056.252
867 pH module	2.867.0010
800 Dosino, 3x	2.800.0010
Dosing unit, 50 mL	6.3032.250
Dosing unit, 10 mL, 2x	6.3032.210
Cable USB A- mini DIN 8 pin	6.2151.000
Electrode cable 2 m / F	6.2104.030
Electrode cable 2 m, 2 x 2 mm	6.2104.150
Combined K-ISE	6.0510.110
Temperature sensor Pt1000	6.1110.100

Solutions

Standard solution for additions	$\beta(\text{K}^+) = 10000 \text{ mg/L}$ 18.64 g dried potassium chloride is weighed into a 1 L volumetric flask and filled up to the mark with deion. water.
ISA	$c(\text{NaCl}) = 3 \text{ mol/L}$ 175.3 g sodium chloride is weighed into a 1 L volumetric flask and filled up to the mark with deion. water.
Sodium hydroxide	$c(\text{NaOH}) = 2 \text{ mol/L}$ 80 g sodium hydroxide is weighed into a 1 L volumetric flask and filled up to the mark with deion. water

Analysis of samples

1 mL of the prepared sample and 10 mL ISA are pipetted into the measurement vessel and diluted with deionized water to 50 mL. The standard addition is carried out with $\beta(\text{K}^+) = 10 \text{ g/L}$. In between each measurement the electrode is conditioned for 30 s in $c(\text{KCl}) = 0.1 \text{ mol/L}$ and then well rinsed with deionized water.

Parameters

Mode	STDADD auto
Number of additions	4
Volume auxiliary solution	49 mL
Stop volume	10 mL
Dosing rate	Medium
Delta U	12 mV
Signal drift	0.5 mV/min
Min. waiting time	10 s
Max. waiting time	300 s
Measuring interval	2.0 s
Stirring rate	8

Result

Sample	$\omega(\text{K}_2\text{O})$ in % (m/m)	$s_{\text{rel}} / \% (n = 5)$
Liquid NPK fertilizer 1	10.46	0.71
Liquid NPK fertilizer 2	6.87	1.05
Solid NPK fertilizer 1	32.4	1.1
Solid NPK fertilizer 2	24.1	1.3
Solid NPK fertilizer 3	9.3	2.1
Solid NPK fertilizer 4	14.3	2.6
Solid NPK fertilizer 5	10.04	1.19

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