

## Measurement of potassium in soil

LAQUAtwin is a series of compact water quality testers. Using Ion Specific Electrode (ISE) technology, they are available for Conductivity, Calcium ion, Nitrate ion, Potassium ion, Sodium ion and pH measurement. Using just a single drop of sample, the LAQUAtwin proprietary flat sensors can quickly and accurately measure the values of the chemical parameters for quality check of food in production lines.



## Introduction

Typically, Atomic Absorption (AA) or Inductivity Coupled Plasma-Optical Emission Spectrometry (ICP-OES) is used to measure potassium ion, by first extracting the potassium ion from sample soils by 1 mol/L ammonium acetate ( $\text{CH}_3\text{COONH}_4$ ). These are the methods performed in laboratories.

A simpler method for a rapid measurement of potassium ion in soil uses the LAQUAtwin potassium ion meter B-731. The extraction method is the same as the lab method. The following procedure explains how you can measure  $\text{K}^+$  with good correlation to analytical lab tests.

## Method

- Put 1g each of air-dried soils (four samples) in 100mL glass beakers, two beakers per soil sample.
- Prepare two kinds of extraction per soil sample, one by adding 20 ml of 1mol/L  $\text{CH}_3\text{COONH}_4$  to one beaker, and 20ml of 0.01mol/L  $\text{CH}_3\text{COONH}_4$  to another beaker.
- Shake the beakers around 1 hour to extract  $\text{K}^+$  from the soil using a bench top shaker.
- Calibrate LAQUAtwin B-731 with 150mg/L and 2000mg/L  $\text{K}^+$  standard solutions included in the product.
- Measure potassium ion concentration of the filtrated solution with calibrated B-731 and with ICP-OES (e.g. HORIBA Jobin Yvon. Model ULTIMA2).
- Perform this measurement with 4 different samples.

## Results and Benefits

The Laqua Twin B-731 allows for a simple on site determination of potassium which provides accuracy close to laboratory techniques.

<sup>1</sup>Table 1 shows the results from ICP-OES and LAQUAtwin  $\text{K}^+$  extracted with 1 mol/L and 0.01 mol/L  $\text{CH}_3\text{COONH}_4$ .

<sup>1</sup> Internal study by HORIBA labs, 2013

\*Extraction efficiencies will vary amongst soil samples.

Table 1 :  $\text{K}^+$  concentrations measured by ICP-OES and LAQUAtwin extracted with 1 mol/L  $\text{CH}_3\text{COONH}_4$  and 0.01 mol/L  $\text{CH}_3\text{COONH}_4$ .

(Unit : mg/L)

Kind of soil	Extracted by the use of 1 mol/L $\text{CH}_3\text{COONH}_4$		Extracted by the use of 0.01 mol/L $\text{CH}_3\text{COONH}_4$	
	ICP-OES	LAQUAtwin $\text{K}^+$	ICP-OES	LAQUAtwin $\text{K}^+$
For vegetables (in house)	35	120	27	25
For Chinese cabbage (field)	16	76	14	14
For turnip leaf (Komatsuna)(field)	25	130	18	19
For potherb mustard (field)	21	93	17	16

Based on table 1, higher value against ICP-OES is detected by LAQUAtwin  $\text{K}^+$  with 1 mol/L  $\text{CH}_3\text{COONH}_4$  extraction, due to strong interference by  $\text{NH}_4^+$  of  $\text{CH}_3\text{COONH}_4$ . However, with 0.01 mol/L  $\text{CH}_3\text{COONH}_4$  extraction, although the extraction efficiency is reduced by approximately 80%\* (Figure 1), very good correlation ( $R=0.981$ ,  $R^2=0.962$ ) is obtained between ICP-OES and LAQUAtwin (Figure 2).

Figure 1 shows the potassium extraction efficiency measured with ICP-OES. Setting 1 mol/L  $\text{CH}_3\text{COONH}_4$  extraction as 100%, efficiency trend is plotted depending on different  $\text{CH}_3\text{COONH}_4$  concentration.

Figure 2 shows the correlation between ICP-OES and LAQUAtwin  $\text{K}^+$  measurements with 0.01 mol/L  $\text{CH}_3\text{COONH}_4$  extraction.

Fig. 1 : Variation of extraction efficiency with  $\text{CH}_3\text{COONH}_4$  concentration.

\*Extraction efficiencies will vary amongst soil samples.

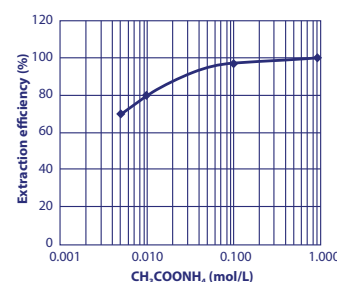
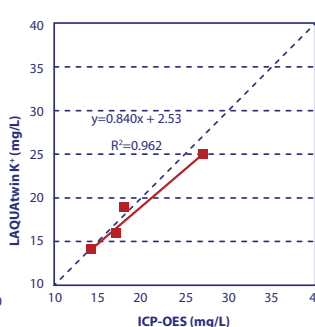
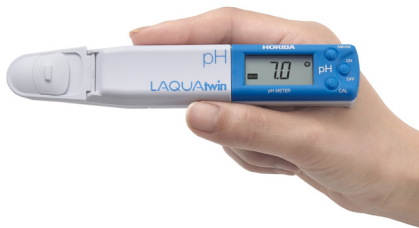


Fig. 2 : Relation between measured values of  $\text{K}^+$  (mg/L) by ICP-OES and by LAQUAtwin.



# LAQUAtwin

## Unique Features



LAQUAtwin: the only meters with flat sensor technology.

HORIBA's highly-sensitive, flat sensor technology opens up new possibilities for sampling and sample types. Only a small amount of sample is required, so you can easily sample in situ without the need for beakers or other labware. Sensors are easily replaced as required.

Calibrate and measure at the touch of a button—the smiley face will tell you when the result can be read.

Hassle-free automatic calibration with a few drops of standard solution reassures you of your measurement accuracy. Two-point calibration is also possible.\*1

\*1 Except for B-711



LAQUAtwin is fully waterproof and dustproof.

The meter and sensor are fully waterproof\*3 and dustproof, so you can take it anywhere.

\*3 IP67 rated. Will withstand immersion for 30 minutes at 1 m. Not suitable for underwater use.

Carry case comes as standard for handy portability.

The compact carry case contains everything you need for your measurements, including the standard solution and sampling sheets.



# 1 X 6

## One meter, six methods.

Only LAQUAtwin allows you to be this flexible!

Choose the best method according to your sample, your situation, and your needs.



01 Immersion

When you're in the lab, you can test the sample in a beaker. Ensure the sensor guard sliding cap is open.



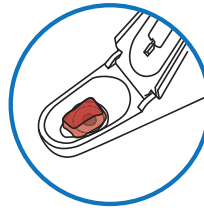
02 Scoop

Use as a scoop to test water eg from a river. A vertical scoop for an aquarium is also available with a unique sensor guard.



03 Drops

Place a drop of the sample onto the sensor with a pipette. LAQUAtwin meters can measure sample volume as low as 0.1mL



04 Solid Samples

Foods containing some moisture can be tested by placing a small piece directly onto the sensor.



05 Powders

LAQUAtwin meters can also test dry powders. Simply place the powder sample onto the sensor and drop on your defined volume of pure water.



06 Paper and textiles

To test sheets of paper and textiles, cut up the sample into small pieces and place directly onto the sensor. Drop on your defined volume of pure water.

### pH



Accurate pH measurements in a few seconds, from a single drop.

Water pH varies in different environments, and a slight change can often have a major effect.

Whether you need to keep the pH of an aquarium within tight limits, are checking for the acidity of rain water or for the quality of meat and fish products, LAQUAtwin compact pH meters are ideal for you. No matter where and when you need to test.

### COND



Determine water conductivity with as little as 0.12 mL of sample.

The conductivity of rain water is a trusted guide to determining atmospheric purity. In agriculture, measuring the conductivity of soil allows farmers and agronomists to determine optimum fertilizer usage and check the 'health' of soil after salt water damage. The LAQUAtwin meter makes conductivity testing simple, anywhere.

### Na+



Only compact meter for a quick and reliable measurement of sodium ion at the scene using ion selective membrane.

### K+



Only compact meter for a quick and reliable measurement of potassium ion at the scene using ion selective membrane.

### NO3-



Only compact meter for a quick and reliable measurement of nitrate ion at the scene. Special application packages for crop (B-741) and soil (B-742) are also available.

### Ca2+



Only compact meter for a quick and reliable measurement of ionized calcium at the scene using ion selective membrane.



<http://www.horiba.com/laquatwin>

### IMS

HORIBA Group is operating Integrated Management System (IMS)  
ISO9001 JOA-0298 / ISO14001 JOA-E-90039 / ISO13485  
JOA-MD0010 / OHSAS18001 JOA-OH0068

