FIAlab®
Leaders in Flow Injection Technology

# Phosphate and Potassium

## A dual-channel system that'll get you fired up.

Cole-Parmer Flame Photometer

It is noted that some laboratory instruments, like ICPs, have difficulties analyzing quantities of phosphate and potassium in soil samples. You may have experienced this in your own lab, but potassium readings tend to be inaccurate, often requiring data manipulations. Phosphate analysis has its issues, also. While ICP can quantify the total amount of phosphate in a sample, it does not quantify the amount of free or solution phosphate. This distinction is critical when judging soil nutrition as the it is only the solution phosphate that can be absorbed by plants. This measure gives important insight on plant growth and fertilization recommendations. Errors in both potassium and phosphate concentrations can mislead soil profiles.

Recognizing a need for more accurate phosphate and potassium data, we wanted to create a system that could tackle these problems. We ended up creating a system that can analyze both compounds at once, from the same sample. By combining a flame photometer with a flow injection analyzer, we are able to analyze potassium and free phosphate accurately and very quickly. This is an instrument combo that'll be sure to get you fired up… literally.

One way of determining potassium concentration is using a flame photometer. The mechanism of this instrument is similar to experiments you probably performed in your undergraduate chemistry courses. Instead of using a dedicated instrument however, you probably used a Bunsen burner to ignite compounds like calcium, sodium, and potassium. Burning these elements created different flame colors and intensities. This output corresponded to different compounds and concentrations, respectively.

This instrument works in the same way, but in a controlled and monitored fashion. It feeds a small, propane-fueled flame with a pre-treated aerosol or vaporous sample. When sample meets the flame, it ignites and emits a light characteristic of the sample type and concentration – the more sample, the greater the light intensity. This light is then analyzed by a photodetector, and an analog output routes the data to our software for processing.

Injector on Flame Photometer

Paired with the flame photometer is a flow injection analyzer, the FIAlyzer-2000. This two-channel instrument coordinates reagent chemistries for both phosphate and potassium analysis.

We analyze phosphate in this setup using the molybdenum-blue method. In this method, ortho-phosphates react with molybdate anions to form a yellow complex. This complex is reduced to a molybdenum blue species by ascorbic acid, and then analyzed using a spectrometer. This method is capable of reading samples as low as 2 ppb.

On the potassium channel, the chemistry is much simpler. Because of the effectiveness of the flame photometer, the only necessary reagent is a pre-conditioning solution. This solution mixes with sample in the FIAlyzer-2000 before entering the flame photometer.

Combined, these two methods are capable of analyzing phosphate and potassium at remarkable rates. Adding a potassium unit to an existing phosphate channel would not decrease throughput either.

At FIAlab, we dedicate our efforts to solving tough analytical problems using flow injection and sequential injection techniques. Our solution to potassium and phosphate soil analysis is just one example of that. If you are interested in learning more about this method, please reach out. We'd be happy to answer any questions you have.