Área: _____ANA_____

Sequential Injection Analysis(SIA) method for determination of phosphorus species in fertilizers

Lara R. Gianini (IC),[1]* Vitória M. Mariano (PG),[1] Jorge C. Masini (PQ).[1]

lara.ribeiro.gianini@usp.br; jcmasini@iq.usp.br

[1]*Instituto de Química, Universidade de São Paulo*

Palavras Chave: Spectrophotometry, Automation, Agriculture, SIA, Fertilizers.

Highlights

Automation of spectrophotometric phosphorus determination method; Oxidation of phosphite in an auxiliary coil prior to total phosphorus reaction.

Resumo/Abstract

A Sequential Injection Analysis instrument (SIA) was used to distinguish phosphate and phosphite in various phosphorus solutions. The first step is determining only phosphate through the formation of molybdenum blue and the usage of a spectrophotometer. To guarantee correspondence between all the steps, the solution is aspirated in a way which forms layers of water and phosphorus solution, then sent to the auxiliary reaction coil. Ammonium molybdate, sample and Ascorbic Acid are aspirated, then the flow is reversed to mix the three zones in the reaction coil. The reaction coil is connected to the spectrophotometer for absorbance measurements corresponding to phosphate. Then, all the steps are repeated in the presence of potassium permanganate at the auxiliary coil. This step oxidizes the phosphite to phosphate, making it possible to react with the Ammonium Molybdate and Ascorbic acid.

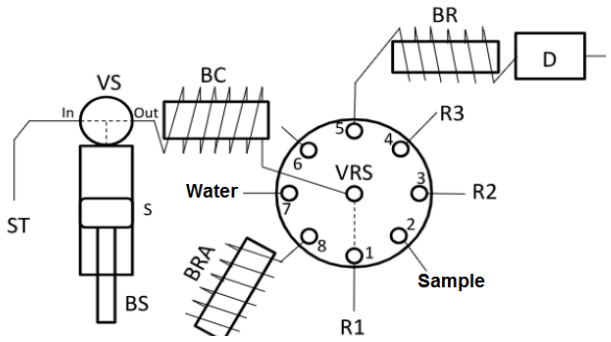

Fig. 1. Typical sequential injection analysis system. BR = Reaction coil, BRA = Auxiliary reaction coil, R1, R2, and R3 = Reagents, D = Detector.

S	EV (Pi)	AV (Pi)	SD (Pi)	EV (Phi)	AV (Phi)	SD(Phi)
1	23	27	5	1871	1830	181
2	31	37	1	620	771	92
3	22	25	6	1259	1335	108
4	36	38	3	1020	1194	154

Table 1. Obtained values for phosphate in random solutions containing Phosphate (Pi) and Phosphite (Phi). S= sample; EV = expected value; AV = Average; SD = Standard Deviation.

The reactions are not in equilibrium, neither in the molybdenum blue formation nor in the phosphite oxidation, but the automation can guarantee both of them would be analyzed at reproducible residence times, which makes it possible to get a calibration curve and comparison between different solutions in less time giving a reasonable accuracy with deviations varying from 4 to 19% for Pi and from 2.2 to 17% to Phi.

Agradecimentos/Acknowledgments

CNPq - Processes 126095/2024-8