

7th Congress of Ecologists
of the Republic of North Macedonia with international participation

BOOK OF ABSTRACTS

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OF THE REPUBLIC OF NORTH MACEDONIA,
WITH INTERNATIONAL PARTICIPATION**

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Validation of a modified Egner–Riehm–Domingo (AL) method for determination of plant-available phosphorus in soil

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Determination of plant-available phosphorus in soil is fundamental to agrochemical soil testing, fertilization planning, and high yields in all crops. The Egner–Riehm–Domingo (AL) method, extracting soil with ammonium lactate–acetic acid solution, is widely used for this purpose. However, because a modified version of the AL procedure was adopted for routine use rather than the original standardized method, its analytical performance required formal validation before implementation. The objective of this work was to validate the modified AL method for determining plant-available phosphorus measured by UV-Vis spectrophotometry in soil samples, in order to confirm its suitability for routine laboratory use. Validation followed a standard analytical-quality framework, evaluating limit of detection (LOD), limit of quantification (LOQ), linear and working range, precision (repeatability and reproducibility), recovery, accuracy, and measurement uncertainty (MU) using BIPEA reference soil material and certified reference standards. Calibration curves were constructed from at least five KH_2PO_4 standard solutions, each measured in replicate, with correlation coefficients exceeding 0.995. LOD and LOQ were derived from blank measurements combined with the calibration equation. Repeatability and reproducibility were assessed from ten parallel measurements of control samples and periodic re-preparations, respectively. Recovery was tested using certified reference standards and accuracy was verified through interlaboratory proficiency testing (z-score). Measurement uncertainty was calculated at a 95% confidence level, incorporating precision, bias, and instrument/reagent uncertainty components. The LOD and LOQ were 0.2 and 1.0 mg/100 g P_2O_5 , respectively, with a linear/working range of 1.0–100 mg/100 g P_2O_5 (extendable to 400 mg/100 g via tenfold dilution), repeatability and reproducibility RSD below 10%, recovery within 90–110%, z-score ≤ 2.0 , and a relative measurement uncertainty of $\pm 2.74\%$. The method satisfied all pre-defined acceptance criteria for accuracy, precision, working range, and measurement uncertainty, indicating that the modified AL procedure, combined with UV-Vis spectrophotometry, provides reliable and reproducible results across a practically relevant concentration range, with the dilution step effectively extending applicability to higher-content soils without compromising linearity. In conclusion, the modified AL method for plant-available phosphorus in soils was successfully validated according to internal laboratory quality criteria and satisfies the requirements for accuracy, precision, and measurement uncertainty.

Key words: plant-available phosphorus, modified AL method, soil analysis, reference soil material