

COMPARISON OF THE NITRATION-SPECTROPHOTOMETRIC METHOD WITH THE NITRATE QUANTIFICATION BY ION CHROMATOGRAPHY IN ATACAMA’S DESERT SOILS

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The Atacama Desert can be used to track the presence of nitrate on Mars. We tested the equality of nitrate measurements from ion chromatography (IC) and nitration-spectrophotometric method (UV-Vis), with the purpose of using the UV-Vis as an alternative technique for nitrate quantification in Atacama’s Desert soils.

We collected 26 samples of surface soils (~ 10 cm depth and ~10 kg weight) along the Atacama Desert. Of each sample, 3 subsamples were isolated (~ 1 g) and NO₃⁻ quantification was conducted by IC (Zamora et al. 2016) and UV-Vis (Yang et al. 1998). A non-parametric linear regression was adjusted for method comparison (Passing & Bablok, 1998) by using data with a quality flag of 1 (Rönkkö et al. 2016).

Results showed intervals of NO₃⁻ concentration of 6.24–171 μg g⁻¹ (IC) and 5.38–142 μg g⁻¹ (UV-Vis) where both methods were not equivalents (Fig. 1a), as reflected by the 95% confidence interval (CI₉₅) for the slope, which did not include the ideal value of 1: β₁ = 1.10 (1.04–1.22). In accordance with Passing & Bablok (1983), this indicates at least a proportional systematic difference between the two methods, although nonsignificant deviation from linearity was observed (Cusum test, p = 0.65) between them (Fig. 1a).

We divided the measurements in two intervals of concentration where both methods were identical, i.e., lower interval (~5–50 μg g⁻¹ NO₃⁻, n = 38; Fig. 1b) and upper interval (~50–180 μg g⁻¹ NO₃⁻, n = 12; Fig. 1c). Method comparison on each interval did not demonstrate that both methods differ at least by a constant amount (bias), as indicated by CI₉₅ for intercepts that included the ideal value of 0: β₀ = 0.395 (-1.18–1.71, lower interval), and β₀ = 8.41 (-41.2–23.7, upper interval). Similarly, proportional differences were not observed, due to CI₉₅

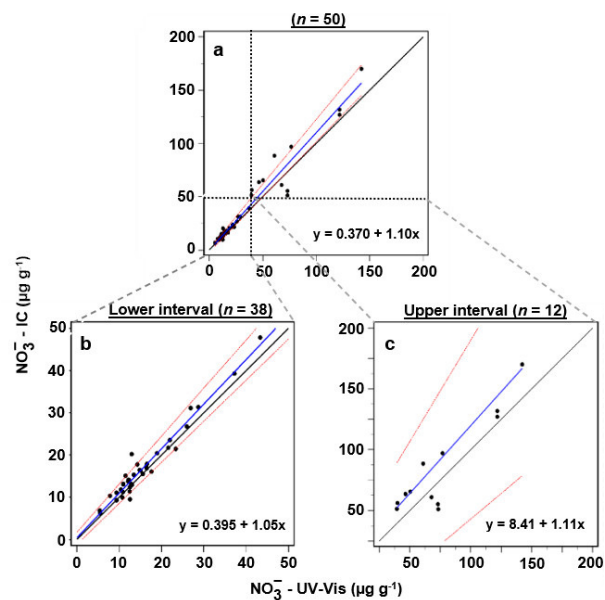


Fig. 1. Match up of nitrate concentration for both methods in the (a) entire interval, (b) lower interval, and (c) upper interval. Red, blue and black lines stand for the 95% confidence intervals, the slopes and the reference of 45°, respectively. Testing of Passing & Bablok (1983).

for slopes included the ideal value of 1: β₁ = 1.05 (0.973–1.14, lower interval); β₁ = 1.11 (-0.842–1.66, upper interval).

Partitioning the data into two nitrate concentration intervals showed that both methods were identical since the errors were comparable. This result suggests that the UV-Vis nitration method could be used as an alternative method to ion chromatography for nitrate quantification from Atacama’s Desert samples and even from Mars.

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