



Prediction of variables related to microbial community composition of soils using near-infrared spectroscopy

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Since soil microbial properties have proved to be sensitive and reliable indicators for soil quality, there has been a great expansion of research into the possibilities of using variables related to soil microbial community structure to assess degradation processes, restoration strategies or management practices. One of the most employed techniques has been the phospholipids fatty acid (PLFA) analysis. PLFA analysis uses the lipids of the microbial membranes as biomarkers for specific groups of microorganisms. The ability of near infrared (NIR) reflectance spectroscopy to predict these variables based on PLFAs has been tested in this study. We used 60 soils from the Alicante Province of Spain, sampled from sites with different climatic conditions, vegetation cover and land uses. For the models construction (empirical calibration functions), we used partial least squares (PLS) regressions and the cross validation method. Our results indicate that NIR reflectance spectroscopy could satisfactory predict several variables related to soil microbial groups based on PLFAs biomarkers. Successful calibrations were achieved for bacteria, Gram positive bacteria, actinomycetes, vesicular-arbuscular mycorrhizal fungi and total biomass ($r^2 > 0.90$). The predictions of fungi, Gram negative bacteria and protozoa were not as good as those of the previous variables, although approximate quantitative predictions are possible (r^2 between 0.60 and 0.80). The ability of NIR to predict these variables based on PLFAs is particularly promising because PLFA analyses are expensive, laborious and require great amounts of chemical reagents, while NIR spectroscopy is much faster,

inexpensive and cleaner.

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