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Soil quality factors in minesoils reclamation by sewage sludge amendments related to soil wettability

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Sewage sludge is currently used in soil reclamation of land degraded by erosion, fire or mining activities, when a rapid and effective topsoil protection is required. However, this possibility of use is limited by the pollutant burden usually present in sludge. In order to reduce it, composting or thermally drying post-treatment processes of sludge previously digested and partially dewatered are used, improving their potential as soil fertilizer and avoiding a number of harmful effects on soil properties and health hazards that may result from its use. A framework to quantify the impact of sludge amendments on soil, relating soil carbon stock, soil wettability and biophysical parameters is proposed. A minesoil from a limestone quarry (reference soil) amended with six types of sludge (4 replicates per treatment) produced in different waste water treatment plants from towns of Catalonia (NE Spain) were tested. Three composted and three thermally dried sludges were applied. 28 lysimeters of 150 L (0,3 m2 in surface area) were maintained in field conditions at the experimental quarry during 14 months, and sampled at one and twelve months. The framework proposed used three different groups of soil quality indicators: (a) soil carbon stock, represented by total organic carbon, dissolved organic carbon and extractable carbohydrates, (b) soil wettability properties represented by soil-water contact angle and the time required to reach cero

contact angle and (c) soil biological and physical properties, represented by microbial biomass, soil aggregate stability and soil water retention. Sewage sludge increased soil carbon stock, soil wettability and other biological and physical properties that were higher during sampling 1 (S1) than sampling two (S2). Sewage sludge amendments changed soil-water interactions as contact angle for several causes such as efficiency digestion process in waste water treatment plant, extracellular polymeric substances contained in the sludge, and influence of composting and thermal drying post treatment of sewage sludge on soil wettability. In this study, composted sludge seems more able to reduce wettability of experimental soil increasing its contact angle, compared to thermally dried sludges. Significant correlations between soil carbon stock, soil wettability and soil biological and physical properties were found. Nevertheless, effects of the different sludge-type depended not only of sludge post-treatments (composting or thermal drying), but on its incorporation on soil aggregates, availability to microbial decomposition and extractable carbohydrate content.