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Mineral rejection and treated sewage sludge application in soil reclamation of limestone quarries in Alicante (Spain): test in columns

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Restoration of degraded soils with organic wastes could be a feasible practice to minimise erosion in the Mediterranean area, but this practice shows a risk of soil and groundwater pollution. Currently the use of sewage sludge to improve the nutrient contents of a soil is a common practice. The soil leaching in which a great amount of fertilizers is usually applied, favours the solubilization of inorganic compounds. Reclamation of limestone quarries working areas with organic wastes may be subjected to less restrictive regulations than the application of these materials in agriculture. Rejection materials coming from limestone quarries extraction are often used in the working reclamation process. These materials could be actually employed profitably once conveniently amended with organic matter. On the other hand, the amount of dehydrated sewage sludge that is subsequently composted or thermally dried is more and more important, but only a small proportion of it is used in agriculture. New EC regulations could also difficult the use of this biosolid for agricultural purposes.

The aim of this research is to contribute to solve these problems by using treated sewage sludge and municipal solid waste in limestone quarries reclamation. Environmental risks may be checked by leaching monitoring (heavy metals, soluble salts,

organic pollutants and others indicators related to soils). Physical and chemical fertility parameters may also be determined in materials used for soil reclamation. Finally, viability of using biosolids and the save applying these reclamation conditions will be decided from the obtained information. In order to study the mobility of some of these elements through the soil, we have designed an experiment that tries to reproduce the behaviour of different compounds and heavy metals in the soil as a part of the non-saturated zone. A controlled experiment in a greenhouse using soil columns was used. The experiment was carried out under controlled conditions inside a greenhouse (20ºC and 50% of relative humidity). The procedure was based on the construction of 36 columns with a height of 60 cm, from a PVC pipe with an internal diameter of 10.5 cm. Each column was cut into two sections: 0-15 and15-30 cm. In the case of limestone quarries, it may be possible to add higher dose of waste without causing environmental problems or food pollution. This type of application must be compatible with environmental security by avoiding displacement of dissolved pollutants to drainage. A mineral rejection from limestone outcrops was amended with 30000, 90000 and 180000 kg sludge/ha. Nitrate, ammonium, cadmium, and nickel were analyzed in leachates collected at the bottom of the columns.

We found high concentrations of nitrates in leachates, which imply an important environmental risk.

The application of sewage sludge to this mineral substrate has a risk of soil and groundwater pollution. With regard to cadmium and nickel, their presence in leachates has not been observed. This fact indicates that the polluting agents analysed in this research and under these conditions of irrigation should not be a source of groundwater pollution. This work and the accomplishment of similar experiments with other types of soils, could lead to obtain more general conclusions and relations applicable to each concrete situation. On the basis of this objective, we think that this work contributes with data of interest and immediate application. This is a starting point to develop a mathematical study that allows to model and to evaluate the evolution and mobility of these elements in calcareous soils from these quarries.