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Title: Waste Management From Pulp and Paper Industry: Recycling to Soil as a Viable Management Option

Authors: Nuno Cruz, Armando Pereira, Paula Gomes, Luís Tarelho, Sónia Rodrigues

Abstract: Currently the EU is working towards a transition from a linear economy to a more circular economy where existing resources such as nutrients and organic matter present in materials classified as waste are effectively being recycled.[1] In fact, the re-use of materials that are now classified and disposed of as waste is one of the key principles underlying the launch of the revision of the Fertiliser Regulation by the EC in 2016.[2]

The aims of this study were to prepare mixtures of biomass ashes with biological sludge from wastewater treatment in order to obtain new soil improvers and to test their efficacy in the recovery of degraded soils collected at selected mining sites (correction of acidic pH and input of organic matter and plant nutrients). Two different types of soil improvers (with different proportion of biomass ashes/biological sludge) were produced, and were subjected to a stabilization period prior to their addition to soils.

Pots and columns experiments were conducted, testing two dosages of these new soil improvers (5 and 10%, in weight) in two soils from São Domingos mine (south of Portugal). These soils are acidic (3.55 and 3.92), with a low content of organic matter (0.10 and 0.31%), and are sandy loam in nature.

Soil incubation experiments were conducted during a period of 30 to 70 days. During that period, pore water samples were collected from pots/columns and analysed (for pH, dissolved organic carbon (DOC), electrical conductivity (EC), chloride content, macro- and micronutrients and potentially toxic elements (PTEs)).

Results showed that the addition of soil improvers led to an increase in the pore water pH relative to control pots (0% of soil improvers added), and had an impact on the solubilisation of both macro- and micronutrients. The main factors determining pore water properties, namely pH and DOC, as well as the solubility of macro- and micronutrients and PTEs in amended soils will be discussed in detail in this work.

These results provided information on adequate dosages of soil improvers to be added to soils for the correction of soil acidity. This study also provided an insight on the potential of the new soil improvers for the recovery/ improvement of soil functions at mining areas.