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# Influence on Polychlorinated Biphenyls Content Using Three Types of Biowastes As Fertilizers In Agricultural Soils

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A 4-year field study was carried out to investigate the effects of three types of biowastes application on PCB accumulation in agricultural soils. This study was based on the experiments designed for four soils in two areas of Palencia province (Spain) (Cerrato and Tierra de Campos) for non irrigated and irrigated land after applying biowaste. The amounts of the three different types of biowastes added were determined according to the fertilization needs of nitrogen for the crop. The concentrations of PCBs in soils were determined before and after biowaste application. The three biowaste treatments raise the concentration of PCBs in the soil, sewage sludge compost (SC) treatment produced the main increase in PCBs concentration, followed by municipal solid waste compost (MC) treatment and the dehydrated sewage sludge (SD) treatment. The values of biowaste treated areas were 3.7-11.5 times higher than the respective values of the non treated areas. Changes observed in the congener distribution also suggest the influence of the biowaste on the soil. The biowaste used had an average PCBs concentration of  $63.16 \text{ ng g}^{-1}$  with a range from  $34.08 \text{ ng g}^{-1}$  to  $118.93 \text{ ng g}^{-1}$ , which are values below the EEC recommended limit ( $800 \text{ ng g}^{-1}$ ). In the soils without treatment was found an average concentration  $0.206 \text{ ng g}^{-1}$  of PCBs, typical of areas with low levels of environmental pollution.

## Introduction

The majority of modern societies are achieving development without adequately controlling all the generated environmental pressures. This development has been built by processes and activities, which produce a large amount of waste. Consumption patterns and economic activity are leading to increase waste generation and problems arising from their mismanagement. Economic growth and waste production unfortunately are still linked. The EU Directives 91/271/EC and 98/15/EC concerning urban wastewater treatment have promoted an increase in the number of WWTP plants operating in the European Union, and consequently the quantities of sewage sludge (biowaste) generated. This fact has raised the problem of their elimination and management. The price increase of mineral fertilizers used in agriculture shows an ideal scenario for the application of these biowastes in agricultural soils, reducing the use of chemical fertilizers (Tideström 1997). The biowaste applied to agricultural soils are beneficial because they improve the physical, chemical and biological properties of soils by increasing crop yields (Beck *et al.* 1996). These compounds are rich in organic matter and nutri-

ents, therefore, recycling through their application as fertilizers on agricultural land has been proposed as the best measure to avoid their economic and environmental disposal costs. However, these biowastes have the disadvantage of having a wide range of pollutants (like PCBs) that may adversely affect the environment, as well as plants and human and animal health (Langenkamp and Marmo 2000). PCBs are one of the greatest twentieth-century environmental pollutants, due to their persistence and negative potential impact on biota as carcinogens and endocrine disruptors. In 2001, they were included in the list of persistent organic pollutants adopted by the Stockholm Convention to prevent environmental pollution (UNEP 2001). Although, their manufacture has been prohibited in most of the countries between 1970 and 1980, they are still found worldwide, even in places as remote and distant from industrial pollution sources like the Antarctic and the Arctic (Larsson *et al.* 1993). Over 1 million tons generation of PCBs has been estimated and one-third of this amount is still dispersed in the environment (Birkett and Lester 2003). Regarding the application of sewage sludge in agriculture, the directive 86/278/EEC sets limits on heavy metal concentration but there is no restriction for organic pollutants. The European Union is