Factors Affecting Quality of Compost Produced from Agricultural Waste: Assessment of Risk

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Abstract Agricultural wastes (AW) are often characterized by rather low pH and substantial contamination potential which is usually related to their high organic load, affecting thus living organisms, soils, water bodies and plants when improperly disposed of. Composting of AW is the most commonly used management option which results in minimization of the risk for soil, water and ecosystems while the final product can be used as soil improver to enhance crop growth due to its nutrient content. However, various parameters should be taken into consideration in order to select the most appropriate composting method and define the optimum use of the final product. In the present paper, selected parameters such as optimal conditions for compost production, application rates of compost on soil, limit values for concentrations of heavy metals in soil as well as risk for humans exposed to various recalcitrant compounds contained in treated or untreated AW, are presented and discussed. Pre-treatment of AW, careful application on soils, use of standardized procedures to evaluate toxicity and determination of the fate of contaminants in soil and water will improve sustainability in agriculture and minimize impacts on ecosystems and human health.

Keywords: *agricultural waste, compost, soil, water and human risk*

1. INTRODUCTION

The most important AW produced in the Mediterranean region include olive oil mill and winery wastewater, swine and other animal waste, rice and wheat straw, as well as wastes from handling of fruits and vegetables. AW are mainly characterized by seasonal production, have often a substantial contamination potential and can cause various adverse effects when disposed untreated on soil or in water bodies. Thus, application of manure on crop land can result in decreased soil permeability and adversely affect crop growth due to inhibitory amounts of nitrogen, phosphorus and salts applied on land and also cause eutrophication of water bodies or contamination of drinking water sources [1-4].

The annual olive oil mill wastewater (OMW) production in the Mediterranean countries is estimated to be over $3x10^7$ m^3. OMW is easily fermentable, dark and turbid liquid and its characteristics vary depending on the extraction process, the olive variety, the soil and climatic conditions and the cultivation method. OMW is characterized by high organic load (BOD_5: 20-120 g/L; COD: 25-240 g/L), high content of phenolic compounds (0.5-24 g/L), rather low pH (4-6), high electrical conductivity (3-22 mS/cm) and significant concentration of magnesium, potassium and phosphate salts. In addition, it contains several other organic compounds such as lipids, sugars, organic acids, tannins, pectins and lignins [5-10].

Due to the scattering of small olive oil production units (mills) in the Mediterranean countries, evaporation in lagoons with no impermeable basin and disposal on agricultural land are the most commonly used OMW management options. Uncontrolled disposal of OMW may affect soil acidity, salinity, N immobilization, microbial activity, nutrient leaching, lipids concentration, soil hydrophobicity, water retention capacity and thus cause strong phytotoxic effects [11, 12]. Discharge of even diluted OMW in streams, rivers and other water bodies may severely affect ecosystems and reduce the potential of self-purification mechanisms necessitating thus the application of monitoring schemes to assess spatial and temporal effects [13-15].

Various treatment options, involving physical, physico-chemical, biological and thermal methods, aiming to decontaminate OMW prior to discharge, reuse or safe disposal have been investigated and some of them have been applied at mill scale to mitigate environmental impacts [16, 17]. Among them, co-composting of OMW with other AW may result in the production of products with low phytotoxicity or high horticultural value which can be used as soil additives, thus protecting soil and water quality as well as human health [18, 19].