

Abstract

Sewage sludge, is a waste generated in wastewater treatment plants. Their disposal and management is a worldwide problem. Sludge from wastewater treatment plants is contaminated with heavy metal compounds, pathogenic bacteria, organic substances, fungi, parasite eggs, etc. One method of sludge disposal is composting. Sludge's richness in organic matter, nutrients (nitrogen, phosphorus), and macronutrients makes it an important food source for the ecosystem. Composted sewage sludge is used as a fertilizer, a structuring material, as well as a material for the reclamation of degraded soils.

The dissertation deals with the effect of reduced carbon supplementation on the transformation process of chemical forms of three elements (Zn, Cu and Ni) during composting of municipal sewage sludge.

A commonly used supplement that is a rich source of organic carbon is straw. The applied addition of straw or wood chips to sewage sludge, aims to increase the C/N ratio to a value of at least 15, due to the risk of forming toxic forms of nitrogen, the concentration of which in sewage sludge is extremely high.

The aim of the study was to present the direction of the transformation of chemical forms of selected heavy metals during composting of sewage sludge and to evaluate the effect of the initial C/N value, of the sewage sludge mixture, on the distribution of selected heavy metals in the different fractions. The next objective was to assess the quality of the compost, taking into account the chemical forms of selected heavy metals, which can pose a real threat to the environment. The paper presents the results of field tests under real conditions, involving composting a mixture of sewage sludge that differed in the amount of straw addition (different initial C/N value). Compost samples for testing were taken from the compost mixture at intervals of several days. The sample to be tested was a mixture of intakes from different locations of the compost pile. First, the basic physico-chemical parameters of the composted sludge samples during the process were determined, such as organic sub., TOC, total nitrogen, dry mass, and C/N quotient. Then the total content of selected heavy metals (Cu, Zn, Cd, Cr, Hg, Pb) was determined. The total content of heavy metals in the compost does not indicate their mobility and bioavailability, so fractionation of selected heavy metals (Ni, Cu, Zn) was performed to determine this. Fractionation of the three elements was carried out using the Tessier sequential extraction method. Then the values of heavy metal mobility coefficients were determined and the risk brought by compost application to the soil was determined. In conclusion, a statistical analysis was carried out to assess the quality of the compost.

The realized research proved that the low initial value of the C/N quotient of the sewage sludge mixture, intended for composting, does not negatively affect the quality and maturity of the compost. The results obtained show that a reduction in the addition of material, with a high organic carbon content, causes heavy metals to transform into environmentally inaccessible forms as composting continues.