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Composting of agricultural waste under hyperbaric conditions

Abstract

Increasing global population growth has a significant impact on waste production, including agricultural waste. Human awareness is affected by the growing greenhouse effect and the problem of waste utilization from different areas of life. The European Union focuses on waste recycling, biological treatment and reuse. A significant problem is the long process of biodegradable waste decomposition, so that the product meets the requirements of national regulations and directives of the European Union. Numerous studies have been conducted on the influence of additives and additional aeration, studies with the addition of Effective Microorganisms (EM), but no satisfactory results have been obtained that would accelerate the process of aerobic decomposition of organic matter. In this study, the composting process under hyperbaric conditions was analysed. In this study, the composting process under hyperbaric conditions was analysed. 8 experiments, 4 experiments with air exchange with frequency t_{wp}= 4 h and 4 experiments with air exchange with frequency t_{wp}= 8 h were established. Each experiment was different from each other by four pressure variants: variant 1: 0 kPa (control), variant 2: 50 kPa, variant 3: 100 kPa, variant 4: 200 kPa. In all experiments and variants, tests were carried out on the same input material, which was characterized by an initial moisture content of 60% and a mass of 2000g. During the composting of agricultural waste, all parameters of the obtained product (moisture content of the tested material, pH, loss on ignition (LOI), C:N ratio, nutrient content (P, K), respiratory activity of microorganisms (AT4) were also evaluated. The analysis of the test results showed a faster temperature achievement than the temperatures occurring in the standard process and better parameters of the composting product under hyperbaric conditions compared to the control sample (0 kPa) in each experiment with air exchange at a frequency of t_{wp}= 4 h and t_{wp}= 8 h. The most effective results were observed in the tests of pressure variants 50 kPa and 100 kPa at the air exchange frequency t_{wp}= 4 h.