

Abstract

The work is focused on the pretreatment of sewage sludge after anaerobic stabilization by the process of biodrying. Biodrying is a process in which the organic substrate undergoes aerobic decomposition and at the same time, due to the increased temperature and the blowing air, it is dried. The aim of the work was to optimize the most important process variables, to verify whether the process is suitable for pretreatment of sewage sludge before use as fuel or fertilizer in the context of Czech legislation and to investigate which groups of organisms and how they participate in the degradation of endocrine disruptors. For these purposes, quarter- and semi-operational bio-drying reactors were designed. The results of the work show that the most important process parameters are the aeration rate and temperature as its dependent variable and the substrate composition. The setup with a fixed time interval of blower switching was found to be the optimal aeration regime. The optimal substrate composition was a 5:2 ratio of sludge:birch chips. The results of the work further show that the bio-drying process is suitable for the preparation of fuel for co-incineration with other material. It is not very suitable for mono-incineration due to exceeding emission limits. The calorific value of the resulting fuel is at the level of lignite. The bio-drying process is also applicable for the preparation of fertiliser. The results show that biodrying does not lead to concentration increase of contaminants such as toxic metals, PAHs or PCBs. From the point of view of pathogen removal, biodrying makes it possible to meet the Czech legislative limits for the use of treated sludge on agricultural land. Moreover, the results show that biodrying can eliminate the content of substances with residual antibiotic activity and reduce the content of some endocrine disruptors. The positive effect on the removal of these substances is probably due to the group of actinobacteria in which the biomass content does not decrease due to elevated temperatures and decreasing water content in the substrate, but in some cases the content of fatty acid phospholipids characteristic of actinobacteria increases at the end of the processes. The choice of the final use of the biodrying-treated substrate should be based on the content of contaminants such as toxic metals, PAHs and PCBs, which cannot be reduced by the biodrying process or the required reduction may not be achieved within the reasonable time limit. At high levels of these contaminants, the treated material should be directed for incineration, otherwise for use as fertiliser.