

7096 84
10.12.21

STATEMENT REVIEW

on a dissertation for obtaining a educational-scientific degree "doctor" (PhD) in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.4. Earth Sciences, scientific specialty "Ecology and Ecosystem Conservation".

Author of the dissertation: DESISLAVA GOSPODINOVA ANGELOVA, part-time PhD student at the Department of Microbiology and Environmental Biotechnology at the Agricultural University, Plovdiv.

Topic of the dissertation: "Utilization of sludge from wastewater treatment plants by composting and vermicomposting".

Reviewer: Assoc. Prof. Ivelin Aldinov Mollov, PhD, University of Plovdiv "Paisii Hilendarski", Faculty of Biology, Department of Ecology and Environmental Conservation (field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.3. Biological Sciences, scientific specialty "Ecology and Ecosystems Conservation"), appointed as member of the scientific jury by order № RD-16-1173 / 20.10.2021 by the Rector of AU.

1. Relevance of the problem.

The problem of utilization of the sludge from wastewater treatment plants is extremely relevant, as in practice this is a waste that is deposited or, in worst case, re-enters and pollutes the environment. From this point of view, the methods for utilization of these sludges are extremely relevant and the issue of the dissertation, for the utilization of wastewater treatment plants sludges through composting and vermicomposting is chosen accurately and has not only scientific value but also valuable application.

2. Purpose, tasks, hypotheses and research methods.

The goal and the tasks are formulated and set correctly and reflect the topic indicated in the title of the dissertation. The research was conducted according to a modern and adequate, well-developed methodology, correctly applied, which allows the achievement of the set goal and the solution of the tasks. A suitable place for the experimental settings was chosen, where for the purposes of the experiments, sludge was delivered from two different batches of WWTP-Plovdiv. Mixtures in different proportions of WWTP sludge, manure, straw, wood chips, cut grass and dry leaves were used to obtain compost in the three experiments. The method chosen for the purpose of the experiment is pile composting, and for vermicomposting the species *Eisenia fetida* and *Lumbricus rubelus* were used, which are widespread and traditionally used for vermicomposting. During the experiments, a number of physicochemical, microbiological indicators were monitored and some indices were calculated, and subsequently the influence of composts and vermicomposts on experimental plants was tested. The obtained

results are appropriately processed by mathematical methods and statistical analysis.

3. Visualization and presentation of the obtained results.

The results presented in the dissertation work follow the logical sequence and correspond to the set goal and tasks. They are presented on 158 pages, illustrated with the help of 23 tables and 85 line and bar graphs, which also present the results of statistical data processing. The presented results are completely sufficient in volume and discussed and analyzed in detail.

4. Discussion of the results and used literature.

The obtained results show that the combination of composting followed by vermicomposting leads to a satisfactory level of decontamination of the substrate, shortens the time for stabilization of the organic matter and produces a product with desired characteristics, faster than each of the two processes carried out independently. The combination of different biowastes in all three experiments resulted in quality compost, and in addition, the transformations in the vermicomposting process with the species *Eisenia fetida* and *Lumbricus rubelus* lead to improved quality of the final product. As a result, the final product of the combined biological treatment by composting followed by vermicomposting satisfies the state requirements for use in agriculture as compost or organic soil improver.

A total of 10 conclusions have been formulated, which also follow the set goals and objectives and correctly reflect the obtained results.

The literature used in the dissertation includes 481 titles (471 in Latin characters and 10 in Cyrillic characters). The literature review is detailed and adequately reflects what has been done so far on the issues of the dissertation.

5. Contributions to the dissertation.

The combined treatment of WWTP sludge presented in the dissertation has not been done in our country so far. It has the potential to offer a solution to an existing waste management problem, such as sludge utilization. The following scientific and scientific-applied contributions can be mentioned: **scientific contributions** - models for the utilization of WWTP sludge in agriculture have been developed; an approach has been established to reduce the concentration of heavy metals from WWTP sludge in co-treatment; a way has been established to reduce the loss of organogenic elements in the final products by returning the infiltrate to the system by spraying, in the case of sludges with low content of heavy metals; **scientific and applied contributions:** improvement in vermicomposting technology has been made; the developed technology for recycling of WWTP sludge is successfully applied and as a result the composted sludge amounts to about 1050 tons per year, and the obtained *in situ* vermicomposts meet the requirements for compost product set in the Ordinance on separate collection of biowaste and treatment of biodegradable waste from 2017.

6. Critical remarks and questions.

I have no critical remarks or questions to the PhD student.

7. Published articles and citations.

The PhD student presents a total of 4 publications, 2 of which were published in proceedings of conferences ("Ecology and Health" Seminar from 09-10 June 2016 and "4th National conference" of BHSS, 8-10 September 2016), one was published in a collective monograph "Microbial Interventions in Agriculture and Environment, Volume 2: Rhizosphere, Microbiome and Agro ecology", published by Springer and one was published in a refereed journal - Journal of Environmental Protection and Ecology, Q3. The presented publications reflect some of the results achieved in the dissertation and carry the required number of points for PhD degree in the professional field 4.4. from The Act on Development of the Academic Staff in the Republic of Bulgaria.

The presented abstract objectively reflects the structure and content of the dissertation and is prepared entirely according to generally accepted criteria.

CONCLUSION:

Based on the research methods learned and applied by the PhD student, the correctly performed experiments, summaries and conclusions, I believe that the presented dissertation meets the requirements of The Act on Development of the Academic Staff in the Republic of Bulgaria and the Regulations of the Agricultural University for its application, which gives me reason to evaluate it as **POSITIVE**.

I allow myself to suggest to the esteemed Scientific Jury also to vote **positively** and to **award** DESISLAVA GOSPODINOVA ANGELOVA the scientific and educational degree "Doctor" (PhD) in the field of higher education 4. Natural sciences, Mathematics and Informatics, professional field 4.4. Earth Sciences, scientific specialty "Ecology and Ecosystem Conservation".

Date: 01.12.2021 г.
Plovdiv

Подписите в този документ са заличени във връзка с чл.4, т.1
от Регламент (ЕС) 2016/679 (Общ Регламент относно защитата на данни).