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«Recycling of municipal waste in crop production as condition for  
reducing the toxicological load on ecosystems»

Authors:

Marina Dogadina, Aleksei Tarakin, Yuri Bukhvostov, Irina Minakova, Tatiana Bukreeva, and  
Marina Parkhomchuk

# Problem statement

- The integral part of human activity is the generation of various kinds of waste of municipal and industrial services. The resulting waste is a major problem that needs to be addressed urgently. At the same time, the properties of some wastes allow using them in economic sphere, it predetermines the interest in wastes as a secondary material resource, and their return to the material cycle acquires important environmental, economic and energy-saving significance. This kind of waste is in great demand in crop farming sector.
- Some wastes cannot be directly used as a fertilizer material; they can be used as a substance for soil and filling layer formation during the reclamation of mined-out quarries only after certain technological transformations.
- It has to be considered that waste use can cause a number of serious negative processes, affecting all components of the ecosystem – soil, atmosphere, groundwater and surface water, etc. For example, soil, plant products and natural waters get polluted with heavy metals. Moreover, the polluting strength depends on the chemical composition of waste and the regulations for waste use (doses, methods, frequency of application, etc.), but in some cases the adjustment of these characteristics can reduce the level of potential negative impact on the environment to an acceptable one.



# Solution methods

- Sampling of sewage sludge was carried out in accordance with GOST 17.4.4.02-84 'Nature Protection. Soils. Methods for taking and preparing samples for chemical, bacteriological, helminthological analysis' and GOST 17.4.3.01-83 'Nature Protection. Soils. General requirements for sampling'.
- The analysis of the physicochemical properties of the substrates was made in accordance with the following government standards (GOSTs): GOST 27753.3-88 'Greenhouse soils. Method of test for determining the pH value of an aqueous suspension', GOST 26213-91 'Soils. Methods of test for determining organic matter', GOST 27753.5-88 'Greenhouse soils. Method of test for determination of water-soluble phosphorus', GOST 27753.6-88 'Greenhouse soils. Method of test for determination of water-soluble potassium', GOST 26715-85 'Greenhouse soils. Method of test for determination of total nitrogen', GOST R 53380-2009 'Soils and ground. Greenhouse soils. Specifications'.
- The analysis of the sanitary condition (a set of physical and chemical properties) of urban soils was performed in accordance with MU 2.1.7.730-99 'Hygienic assessment of soil quality in populated areas' and GOST R 54535-2011 'Resource saving. Sewage sludge. Requirements for placement and use at landfills'.



# Conclusions

## Results, implementation

- Such factors as presence of toxic chemical elements and biological hazards in the composition of sewage sludge limit their practical use. The authors have monitored the composition of sewage sludge collected from the communal water and sewage management utility 'Orelvodokanal'.
- Sewage sludge can serve as an organomineral fertilizer in agricultural industry, landscape work and land reclamation. In this case, the content of fertilizer macronutrients in the composition is important.
- Sewage sludge can be considered as nitrogen-phosphorus fertilizer, but heavy metals in sewage sludge limit its use as soil conditioner.
- It should be highlighted the fact of absence of pathogenic microorganisms, helminth ova and protozoan cysts, larvae and pupae of synanthropic flies, and that the content of Coliform bacteria did not exceed an index of 100.
- Thus, the study has shown that the sewage sludge of 'Orelvodokanal' can be used for reclamation of disturbed lands.
- Monitoring studies of the dynamics of waste accumulation and the content of elements, substances and compounds in them allow concluding that they belong to IV, V classes of danger to the environment, and they can serve as an organomineral fertilizer for the biological reclamation of disturbed lands.



# Contacts

*Marina Dogadina, Aleksei Tarakin, Yuri Bukhvostov*  
State Agrarian University named after N.V. Parakhin

E-mail: [marinadogadina@yandex.ru](mailto:marinadogadina@yandex.ru)

*Irina Minakova, Tatiana Bukreeva, Marina Parkhomchuk*  
Southwest State University

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