THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE IX. METALLURGY AND MATERIALS SCIENCE
N°. 4 - 2017, ISSN 1453-083X

ANALYSIS AND RECOVERY OF SLUDGE FROM THE WASTE WATER FILTERING STATION OF GALAŢI FOR USE IN AGRICULTURE

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ABSTRACT

The paper presents a study on the use of sludge from sewage treatment plants for the purpose of using it in agriculture. The use of biosolids in agriculture is considered the most sustainable option of sewage-sludge management. The purpose of the use of sludge in agriculture is the recovery of content of nutrients and organic matter to mud, thus improving the fertility of the land and reducing farmers' dependence on chemical fertilizers. Due to this, damaging effects on soil, water, vegetation, animals and humans, pollutants can be reduced by using mud.

The application of sewage-sludge on agricultural land is generally the most economical solution, though, because it is seasonal and it represents an opportunity for recycling nutrients, organic matter, and plants for agricultural crops. The nitrogen and potassium contained in mud supplements consistently the demand for fertilizers. Soil fertility can also increase by improving the physical properties of the soil, through the application and incorporation of organic matter contained in the mud.

KEYWORDS: sludge, waste water, agriculture

1. Introduction

The use of treatment/sewage biosolids in agriculture is regarded as the most sustainable method of using them for this purpose and the guide, based on the most consistent scientific data available, ensures that the use of biosolids in agriculture: is compatible with good agricultural practices, does not put at risk the health of humans, animals and plants, maintains the integrity of the soil ecosystem, and avoids polluting environmental factors.

The biosolids can be used in the production of arable crops and fruit trees (10 months before harvesting). Application of biosolids for legumes and berries or pastures is forbidden.

The use of sewage sludge on agricultural land has been a traditional agricultural practice worldwide. These methods eliminate waste and recycle valuable nutrients within the soil-plant system.

The problem of sludge application in agriculture is complex and needs very good monitoring to avoid the occurrence of adverse effects; account must be taken of the physical, chemical and microbiological properties of the sludge and of the soil properties, the capacity of the plants to benefit from the nutrients to be found in the sludge and the danger of environmental pollution. The issue of transport and access roads to agricultural land should also be considered.

The use of sludge in agriculture is an economical and beneficial solution for both soils and agricultural crops. The purpose of using sludge is to utilize the sludge from Wastewater Treatment Plants so it could be used in agriculture, while any adverse effects of sludge on human health and the environment be avoided [1, 2, 6].

2. Experimental results

We took a set of 5 sludge samples from the Galati Waste Water Treatment Plant and these are: primary sludge; dehydrated sludge; sludge thickened with polyelectrolyte added; fermented sludge; sludge from the anaerobic fermenter.

Determination of the metals from the sludge samples, were analyzed in the laboratories of the Faculty of Engineering, using the X-ray spectrometer (Fig. 1).

Sewage sludge samples were processed to analyze them in a number of steps.

Fig. 1. *X-ray spectrometer*

Primary sludge

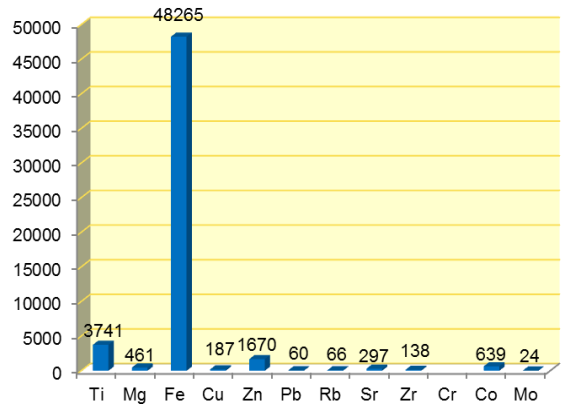

Fig. 2. *Metals detected in the primary sludge sample*

From the primary sludge sample taken by the Wastewater Treatment Plant in Galati from the secondary stage we found that all the elements are above the admissible limits, which means that the primary sludge has to be treated before being used in agriculture [3].

In the sample with primary sludge, all elements are above permitted limits, which results in the primary sludge being treated before it is used in agriculture (Fig. 2).

Regarding the dehydrated sludge from Galati purification plant, the sludge is the result of waste water treatment. This sludge comes from both the primary treatment stage and the secondary stage. The concentration of dry matter in the sludge is low and the volume it occupies is very high, making it difficult to handle and very costly to transport. To overcome these problems, a sludge dehydration plant is always needed.

Dehydrated sludge, although falling within the admissible limits in terms of chemical content should be treated for use in agriculture (Fig. 3).

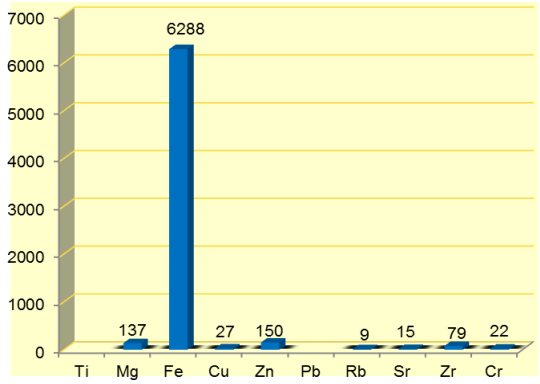

Fig. 3. *The metals detected in the dehydrated sludge sample at the Galati purification plant*

For sludge thickened with polyelectrolyte addition the polyelectrolytes are distributed in solid form (dust and granulate) and liquid, namely emulsion and dispersion.

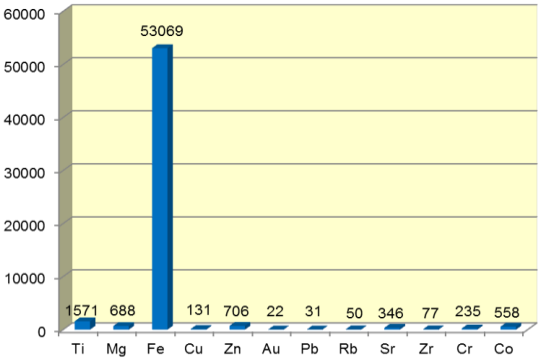

Fig. 4. *The metals detected in the sludge thickened with polyelectrolyte added*

For fermented sludge the samples with sludge thickened with polyelectrolyte added, and fermented sludge, should be treated, although the addition of

polyelectrolyte improves the physical, chemical and biological properties of soil, with the exception of saturated soils (Fig. 4, Fig. 6).

Fig. 5. *Dry sludge sample, inserted into the X-ray spectrometer*

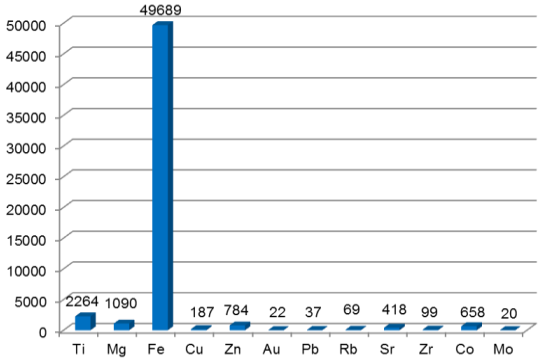

Fig. 6. *The metals detected in the fermented sludge*

In the case of the sludge from the anaerobic fermenter, the anaerobic fermenter-Dig2 is the process of biological degradation of organic substances from sludge by the activity of bacterial populations which, under certain environmental conditions (pH, temperature, etc.), decompose organics from the sludge through biochemical oxidation reduction processes into simple molecules CH_4, CO, CO_2 and H_2, which form the so-called fermentation gas or biogas, and which has an average calorific value of about 5,000 kcal/Nm^3 [4, 5].

Anaerobic Dig 2 fermenter improves sludge dewatering, stabilizes sludge, reduces odor and solids (Fig.7).

Regarding the determination of pH in sewage sludge, this was done on all 5 dry sludge samples from the Galati Waste Water Treatment Plant using the apparatus called Hach HQ40d, pH Multiparameter (Fig. 8).

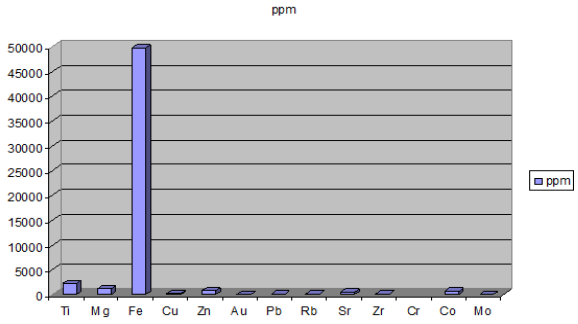

Fig. 7. *The metals detected in the sludge from the anaerobic fermenter*

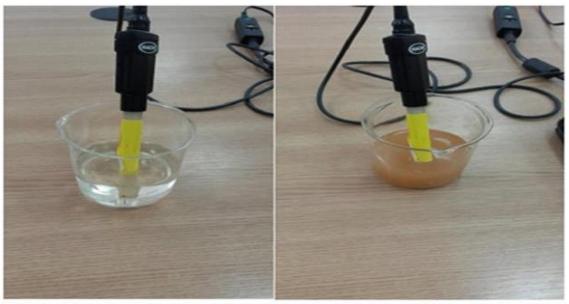

Fig. 8. *PH electrolysis*

Table 1. *PH values of the sludge samples*

Samples	pH
Primary sludge	7.42
Dehydrated sludge	7.75
Slurry thickened with polyelectrolyte added	7.85
Fermented sludge	7.68
Sludge from the anaerobic fermented	7.66

Most plants prefer soil with a pH ranging from 6.5 to 7.5. After determining the pH of the sludge samples, a value ranging from 7.42 to 7.85 was obtained, which means it is obligatory for the sludge to be treated to be used in agriculture. It is necessary to reduce salt and use calcium phosphate (Fig. 9).

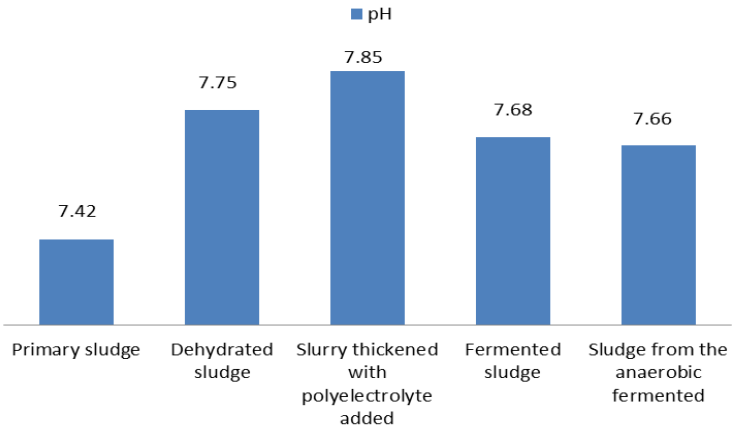

Fig. 9. *pH of sludge samples from the Galati purification plant*

3. Conclusions

The application of sewage sludge in agriculture is an economical and sustainable solution because it has the advantage of recycling nutrients to develop crops while being an ecological solution for the recovery and use of sewage sludge from urban agglomerations.

Most heavy metals found in sewage sludge come from diffuse sources difficult to control, including the erosion of the metallic water distribution network, domestic products.

Heavy metals reach the ground, air, water and sludge. From the surface they descend into the soil through diffusion, absorption, and carried away by water or macro-organisms.

Soil resistance to heavy metal pollution differs depending on the nature of the soil. Thus, clay soils retain more pollutants, neutral and carbonate soils retain strongly, while sandy soils retain the least (leaching is strong, except Mo and Se). Also, the finer the texture of soil is, the more pollutants retained in the soil there are, wherefrom they pass through plants.

Some heavy metals (Zn and Cu) are essential microelements in plant nutrition and feature toxicity only in high concentrations. Other elements (cadmium, lead, mercury) show toxic action in the food chain, and their limit values are set by Order 34412A04 so that humans and animals are protected.

The content of heavy metals is inevitably found in urban sludge, the industrial wastewater discharged into the original sewerage system being always their main source but by controlling the discharge of sewage into the sewage system, it has progressively been reduced the concentrations of heavy metals in the sludge across Europe.

Acknowledgement

The authors wish to thank the student Simona Pesu who helped us in this study.

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