Sewage sludge – a possible fertilizing resource in agriculture

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Abstract
The possibility to distribute sewage sludge in agriculture appears as a consequence of the increasing price, in each year, of the chemical fertilizers and because of the higher quantities of sewage sludge worldwide. In Romania are in present 732 stations for waste water cleaning and 416 stations are in main industrial cities. The paper present the chemical properties of sewage sludge from the Waste Water Treatment Station Timisoara and the content in valuable nutrients.

Key words: sewage sludge, organic resource, nutrients, heavy metals.

Introduction
The distribution of sludge, which results from the cleaning of wastewater, in agriculture, is practiced from a few decades in the countries of UE. This fact has the role to clean the environment by reducing the quantities of sludge and to fertilize the soils with valuable manure. But, to protect the environment against pollution, it must be respected some conditions, regarding the quantities of sewage sludge who might be distributed on lands. In Romania were made researches by the universities from Iasi, Bucharest, Timisoara, concerning the distribution of sludge on agricultural lands. Sewage sludge soil distribution is usually the most used solution in case of sludge from small and middle waste water treatment station. (Mihalache, 2006). In France, the most important researches were made at INRA, by Guivarch A. (2000), Morel C. (2007), concerning the distribution of sewage sludge on agricultural and forestry lands. Other researches, concerning the distribution of sewage sludge in agriculture, were made in Spain, at the Department of Environment from INIA, Madrid, between 2001-2002. Ma. Del Mar Degrado Arroyo, studied the effect of sewage sludge upon the maize crop, but also, the content of heavy metals in soil. Between 1980-1990 were made researches in the Scandinavia area, especially in Sweden, regarding the accumulation of heavy metals in soils, after sewage sludge distribution on lands. The researches results were published in scientifically papers session at Uppsala, Sweden. Between the most important researchers are: Anderson A., Dam Kofoed A., Grant R.O., Hall J.E., Hovmand M.F., Kuntze H., Larsen K.E. Agricultural utilization of sewage sludge is a solution for the future, on short and middle term, but will be necessary to adopt new technologies for waste water treatment and to reduce the quantity of produced sludge. (Dudkowski, 2000)

Materials and methods
We analyzed the chemical properties of sewage sludge from the Waste Water Treatment Station Timisoara to establish the fertilizing potential for agricultural soils. Analysis methods are currently used in national and international laboratories from research centers or universities. The content of organic matter in the sewage sludge was determined by the calcination method, and the result was reported on dry matter basis. The potassium content was determined in ammonium acetate-lactate and value was recorded by atomic absorption spectrophotometer at 766 nm. The content of total nitrogen was determined by Kjeldahl method. Phosphorus content was determined by Egner-Rheim-Domingo method, with Able-Jasco spectrophoto-colorimeter at 660 nm. To measure the heavy metals content we made an extract in aqua regia and the
values were established by atomic absorption spectrophotometer at 217 nm for Pb, 470 nm for Cu, 240.7 nm for Co, 232 nm for Ni., 213.9 for Zn. The Ca and Mg content were determinated by complexion-metrical method.

**Results and discussion**

The average values presented in the next tables, are obtained after a period of five years (2006-2011), in which we take sewage sludge samples and analyzed them. The content in nutritive elements of analyzed sewage sludge is presented in table 1.

The content of organic matter, reported to dry matter of sewage sludge is normal. From the agro-chemical point of view, the content of nutrients in sewage sludge dry matter is normal. We observe a high content of total nitrogen, potassium and calcium, middle content of phosphorus and weak content of magnesium.

| Table 1. Fertilizing potential of sewage sludge from Waste Water Treatment Station Timisoara (from 2006 to 2011) |
| Indicator | M.U. | Value | Observations |
| Organic matter | % | 17 | - |
| Total nitrogen | % | 1,7 | High content |
| P | ppm | 28 | Middle content |
| K | ppm | 211 | High content |
| Ca | ppm | 346 | High content |
| Mg | ppm | 41,3 | Weak content |

M.U. – measurement unit

| Table 2. Content in heavy metals of sewage sludge from Waste Water Treatment Station Timisoara (from 2006 to 2011) |
| Metal | M.U. | Value | Limit value after CEE Directive for sewage sludge | Observations |
| Zn | ppm | 2100 | 2500-4000 | Normal value |
| Cu | ppm | 92 | 1000-1750 | Normal value |
| Co | ppm | 82 | - | - |
| Pb | ppm | 620 | 750-1200 | Normal value |
| Ni | ppm | 73 | 300-400 | Normal value |

M.U. – measurement unit

The average heavy metals content, as it is shows in table 2, is normal for all the analyzed metals, compared to CEE Directive for sewage sludge who might be distributed on agricultural soils.

The higher content was determinated in case of zinc (2100 ppm) and lead (620 ppm).

Those high values of heavy metals can be explained, because of the specific industry of the town Timisoara: factories in which are made batteries, industry of detergents etc. and because of the municipal waters commune system, which collects the residual industrial waste water together with the precipitations and household’s waters.

**Conclusions**

The research material, in our case the sewage sludge from the waste Water Treatment Station Timisoara, can be distributed on agricultural lands because of: the high content in nutritive elements, such as, total nitrogen, potassium and calcium. The content in phosphorus is medium and the content in magnesium is weak, but in this case we can apply chemical fertilizers, if not enough for the plants needs. The organic matter present in sewage sludge could ameliorate the poor and intensively exploited soils. The risk to pollute soils with heavy metals by using sewage sludge is reduced, because heavy metals content not exceed, maximum permissible levels indicated in CEE Directive for sewage sludge. Also, it is recommended that the sewage sludge not be
used to crops which are consumed uncooked or in direct contact with the soil (strawberries, peas, carrots etc.) because of the fruits and vegetables contamination risk with germs and heavy metals are possible.

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