RECOVERY WAYS FOR DEPRECIATED SOILS GENERATED FOLLOWING UNCONTROLLED WASTE DISPOSAL IN THE SALONTA PLAIN

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Abstract

The purpose of this study is the assessment of soil quality status in the landfill area in order to identify opportunities for optimal use of the land in the future. By disposing of municipal waste directly into soil the acidification of the later occurs, following the development of fermentation processes and implicitly acidic compounds are generated (CO_2, acetic acid, fatty acids, H_2S, NH_4+, etc.).

In order to quantify the effects of waste disposal activities on the quality of soil and subsoil samples were taken at points considered as significant for the waste dump evolution.

The results obtained indicate possible damage to soil and groundwater and provide evidences about the possibilities of further exploitation of the land.

Keywords: landfill, pollution, soil acidification, alert threshold, intervention threshold, heavy metals.

INTRODUCTION

Salonta waste dump was installed in 1975 on a marshy land surface totalling 114,900 sqm, the current occupancy level being of 50%.

According to GD 349/2005, on waste disposal, the waste dump is an urban warehouse is holding, incompatible, Class B and the deadline to cease the depositing activities is 2017.

The purpose of this study is the assessment of soil quality status in the landfill area in order to be able to identify optimal opportunities for land use after the cessation of activity.

Analysis of local soil conditions

On poorly drained topography of the digression plain around Salonta city (Posea G., 1997), with ground water near the surface, the phreatically humid, levigated chernozem, occur (Moise, 2009).

Characterized by thick profile and sharp gleyzation, they make the transition to pronounced wetlands: white alkali and juniper humid areas – specific for this zone (Posea G., 1997) - , which are caused by the phreatic layer, located at the low depths rising to the surface of the land during the in the humid time of the year.

Due to the low-depths phreatic layer and highly mineralized water, allomorph soil sectors with mosaic distribution occur in the area (Chiş S., 2003), especially in areas with poor drainage.

Inside the active landfill, cannot speak of the soil presence in the soil and geochemical meaning of the term, at least at the surface layer. Through successive depositing of inorganic wastes, oily and biodegradable organic materials, the composition of the first layers was altered to increase the pollutant content (Călinoiu, 2006).

Small and medium depth drilling one revealed that natural litho-logic sequence, consisting in compacted clay and different sands was modified by type uncontrolled depositing of urban and industrial waste over the years. This led to the formation of a filling layer of anthropogenic origin, porous consistency, and with relatively high permeability.

Household waste and those assimilated thereto contain a high percentage of biodegradable organic matter. By depositing them directly on soil the later acidification occurs, following the development of fermentation processes and implicitly one generates acidic compounds (CO_2, acetic acid, fatty acids, H_2S, NH_4+, etc.) (Chiş S., 2003).

Since the metal content of domestic waste and other types of wastes that fall into the category of urban waste is about 4%, it is expected that some of these metals to be included in the composition of the soil, subsoil and groundwater(Sabău C. et al, 2002)..

The end products of organic decomposition, coming in contact with meteoric waters are transformed into salts, especially chlorides, sulphates and nitrates and, at their turn, they become sources of soil pollution and groundwater.

MATERIAL AND METHODS

In order to quantify the effects of waste disposal activities on soil and subsoil quality samples were taken at depths of 0.2 m and 0.4 m, at 3 points considered significant for the evolution of the dump:

- P1, dump point located outside dump, in the vicinity of the enclosure limit (blank)
- P2, point located within the inactive area of dump, where waste is no longer deposited;
- P3, point located in the core of the dump, at a distance of about 100 m away from the inactive area.

Soil sampling was done by hand drilling, with pedological probe.

The indicators analyzed were as follows: pH, P-cell, K-mobile, N-NO3, Humus, C org, total N, C/N, Oil report, CaCO3, Zn, Pb, Cu, Cr, Mn, Fe(Sabău N. C., 2009).

The samples were initially dried, after which they were analyzed using the following methods:

- ISO 1146498 potentiometer for pH;
- Gravimetric, according to STAS 12607-88 for petroleum residue;
- Spectrophotometry of atomic absorption for heavy metals.

The test results are shown in Table 1.

Table 1

Evaluated indicators	P1, dump point located outside dump (blank)		P2, point located within the inactive dump		P3, point located in the core of the active dump.	
	0-20	20-40	0-20	20-40	0-20	20-40
pH	7,40	8,25	7,70	7,85	7,80	7,60
P-mobile ppm	283	193	323	268	432	486
K-mobile ppm	1400	800	2200	2800	4800	5400
N-NO_3 ppm	73,5	13,5	81,2	73,4	11,6	10,6
Humus %	10,32	9,04	10,42	9,85	11,28	15,03
C org %	5,98	5,24	6,04	5,71	6,54	8,72
N tot %	0,485	0,412	0,476	0,442	0,475	0,564
Report C/N	12.33	12.72	12.69	12.92	13.74	15.46
Oil report ppm	540	560	540	620	2680	3020
$CaCO_3$ %	1.94	4.45	4.32	8.43	6.18	7.08
Zn ppm	437.6	589.7	578.5	906.8	617.2	973.2
Pb ppm	54.1	159.7	31.9	82.5	55.6	70.2
Cu ppm	69.7	241.4	132.5	139.4	86.4	98.3
Cr ppm	200.6	191.5	253.5	296.2	181.5	186
Mn ppm	546.6	608.4	811	2427.6	951.8	867.4
Fe ppm	27906.3	23562	43921.1	44667.5	19359.3	18283.6

Concentrations of pollutants in soil have been reported to: blank, normal values, alert thresholds and interventions thresholds, as set by the Order no. 756/1997 of Ministry of Agriculture, Forests and Environment on soils for sensitive use, considering that a possible use of these lands might be agricultural land.

RESULTS AND DISCUSSIONS

Analyzing the values of the analyzed indicators one notice the following:

1. Oil residue indicator:
   - At all sampling points, residual oil content increases with depth;
   - Residual oil content increases to 5.39 times in the active area as against the blank sample area;
   - For blank sample, the normal values are exceeded by 5.6 times;

- For the sample taken from the active area the intervention threshold is exceeded by 1.5 times;
- Sample taken from the active area exceed 4.9 times as against the inactive, i.e. 5.6 times the blank sample.

2. Zn Indicator
    - In all sampling points, the zinc content increases with depth;
    - For blank sample, the normal values are exceeded by 5.89 times normal;
    - For the sample taken from active area, the alert threshold is exceeded by 1.3 times but the threshold for intervention is not exceeded;
    - The sample taken from the active zone does not significant overruns as against the one sampled from inactive area but it increased by 1.76 times compared to the blank sample.
3. Lead (Pb) Indicator
    - In all sampling points lead content increases with depth;
    - For blank sample, the normal values are exceeded by 8 times;
    - Alert and intervention threshold are not exceeded.
4. Cu indicator:
    - For blank sample, the normal values are exceeded by 12 times;
    - Alert and intervention threshold are not exceeded.
5. Cr indicator:
    - For blank sample, the normal values are exceeded by 6.7 times
    - Neither alert nor the intervention thresholds are exceeded.
6. Mn indicator:
    - In all sampling points, the manganese content increases with depth;
    - Alert and intervention threshold are not exceeded for any of the samples;
    - For blank sample, the normal values are not exceeded.
7. Fe Indicator:
    - The indicator is not standardized by Order no. 756/1997;
    - For the sample taken from the inactive dump one reveals a significant increase in iron content compared with the control sample, and as against the depositing active area, respectively.

8. K and P mobile indicators which feature soil organic content show a continuous increase of the blank values from the blank sample to the sample derived from the depositing active area.

CONCLUSIONS

Analysis of soil samples reveals the following:

- ✓ Active storage area has, with some exceptions, the highest content of heavy metals;
- ✓ As for Zn, Cu, Pb, Cr indicators one noticed the exceeding of the normal range even in the case of blank sample, suggesting that the "natural background" of the site is characterized by a chemical composition of soil, richer in heavy metals than usually as a direct consequence of successive deposits of metal waste;
- ✓ Waste oil indicator shows significant increases in terms of comparison with normal values; in the case of sample taken from the active area the intervention threshold is exceeded, thus it presents clear evidence of pollution of both soil and dump outside and inside the waste dump, especially in the active area;
- ✓ The vegetation of control zone and inactive area of the waste develops spontaneously and its shows no structural features indicating a possible impairment.

This situation represents the combined effect of a plurality of causative factors, among which the most relevant are as follows:

- ✓ Waste dump age (over 35 yeas) and quantity, and the wide variety of waste deposited respectively;
- ✓ Throughout this period there have been made no selection of waste;
- ✓ Absence of a drainage system of levigation;
- ✓ Occurrence, over time, of accidental pollution by oil leakage from auto vehicles.

In order to identify opportunities for an optimal land use related to waste dump, we recommend the following:

Monitoring of soil quality based on annual hydrodynamic evolution of the area, so as to perform on annual basis at least two sampling campaigns (Sabău N.C. et al, 2002);

- Bi-annual monitoring of groundwater quality status(Vicaş et al, 2010);
- Using data from obtained from monitoring to enabling accurate assessment of the temporal evolution of key-indicators on soil and groundwater quality and thus identifying optimal alternatives for recovery and use of land.

Given the particularities of the field soil studied in alternative land use as agricultural land is recommended:

- Annual crops to recover and put into value the top layer of soil(Vicaş, 2009);

- Ploughing of 40 cm depth, to ensure the transfer of salty layer into depth;
- Avoiding crops that require irrigation.

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