

THE REACTION AND SOME PROPERTIES OF SOILS FOUND CLOSE TO MUNICIPAL REFUSE AREA*

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A b s t r a c t. There were analyses on reaction, sorptive properties and some macroelements content carried out in A₁ horizons of soils found in the area influenced by the dumping ground pollution. It was proved that the greatest impact on the characteristics value was a distance from the dumping area and the location in the directions of various blowing winds. The above points were modified according to a type of soil use.

K e y w o r d s: soil reaction, soil sorptive properties, macroelements, municipal refuse area

INTRODUCTION

The functioning of towns and countries causes a steady rise of waste and household litter quantity that are almost entirely stored at the refuse area. This way of waste handling results from lack of other possibilities and methods of the utilization [4,8,9].

In the year 1991 the household waste area covered 2600 ha in Poland and actually the area put under refuse is bigger especially in countries where refuse is stored in some illegal places [3].

According to regulations, a fill area should be surrounded by the protective zone for insulation and sanitary-productive function [2,4,5,9].

Proper localization, management and operating of waste dump should minimize its arduous influence to neighbourhood. Unfortunately,

the problems are not always solved adequately [2,4].

Hence, the objective of the present investigations is to evaluate the physical and chemical properties in soils found in the proximity of municipal waste area.

MATERIALS

The investigations included the soils near a municipal waste area located in Lipiny Stare close to Wołomin. At the fill area, waste from Wołomin and Warsaw have been stored.

At the studied area; acid, light and sandy soils prevail. They are of similar granulometric composition and organic matter content and that enables performing the comparative analyses. Due to the soil quality, both the agricultural productivity and their resistance to pollution are quite low. It has been confirmed by a poor evaluation of agricultural valorization of productive space that obtained 48.8 points out of 123 points scale.

The mean precipitation for the examined area is 525 mm and during the vegetative period 323-357 and in the rest 177-206 mm.

The studied region is dominated by western and north-western winds, from the rest directions are insignificant. Complete silence makes

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a considerable ratio, too. Percentage of down winds in the examined region:

W and NW	33.2
E and NE	14.6
SE	12.6
N	7.0
S	9.2
silence	23.2.

The soil samples were collected in 4 directions (N,S,E,W) and 3 distances: 20 m, 250 m and 350 m out of A₁ humus layer. They were taken from cultivated land (N,E,W -arable land, S - grassland). A soil sample from woodland 600 m south of waste area was collected for comparison.

Moreover, some sludge samples of water draining from the dumping ground were analysed. The following characteristics were determined in the soil samples:

- granulometric composition after Cassagrande's method modified by Prószyński,
- organic matter after Tiurin,
- reaction electrometrically,
- specific surface according to Kutilek's method,
- calcium carbonate after Scheibler,
- sorptive properties and hydrolytic acidity by Kappen's method,
- mobile aluminium according to Sokolov's method, and
- macroelement content in 0.5 mol HCl/dm³.

RESULTS

Distance from waste area and the changes of physicochemical characteristics of soil

The values of the analysed soil properties show a relation with their distance from refuse area. Soil acidification explicitly increases together with distance increase (Table 1). This influence is evident quite clearly in case of hydrolytic acidity when the increment in more distant area as against the direct zone is equal 308-333 %; less apparent changes (27-29 %) are noted at exchangeable acidity and the last (20-25 %) at active acidity. On the whole, the

soils that surround fill area demonstrate positively less acidification compared to control.

The presented description of acidification proves that its participation in the change of this property value results from the following anthropogenic factors operation: pollution emitted by waste area, the ways of area utilization as well as their relatively stable character that change the property value in the sorptive complex mainly.

The confirmation of the mentioned factors operation that have a close connection with acidification [1] is mobile aluminium content as well as basic cations in soils. In the zones surrounding the refuse area a mobile aluminium content is expressly lower (by 3.7-1430 times) then in the control and the lowest concentration values were recorded in the direct neighbourhood of waste area (Table 1). Generally, an aluminium content ranges within the interval of increased (in more distant zones from the waste area) to high (control soil).

The lowest content of basic cations was recorded in the control soil while in the studied region, taking into account their incremented concentration due to agrotechnical and fertilization operations, there was an evident influence of their emission by the dumping ground, in its close proximity in particular. This fact was proved by the values of specific surface of the analysed soils (Table 1).

The changes of physicochemical properties of soils from various directions around the refuse area

The analysed physicochemical properties of soils found around the waste area demonstrate differentiation owing to their location in various directions regarding the source of pollution (Table 2). Low winds are the cause of the phenomenon.

In the region of waste area pollution influence, the changes of analysed properties values are in proportion to low wind rate. The relation are distorted because of a way the land is used for example: arable land (direction E,N,W) - grassland (S direction). The mentioned above problem and a distance from emission source is

Table 1. Characteristics of physicochemical properties of A₁ soil horizon collected from various distances from the waste area (means values)

Distance from waste area (m)	pH		Al ³⁺ (mg/100 g)	H	S	T=S+H	V (%)	Macroelements - available forms (mg/100 g)			CaCO ₃ (%)	Specific surface (m ² /g)
	H ₂ O	1M KCl						Na	Ca	Mg		
	(mmol(+)/100 g)											
I - 20	6.8	6.2	0.1	1.2	20.0	21.1	94.4	4.1	35.3	3.7	0.3	44.3
II -250	5.1	4.4	3.9	5.2	6.9	12.1	57.1	3.3	13.0	1.9	0.0	42.0
III-350	5.4	4.5	3.6	4.9	7.2	12.1	59.5	1.6	17.8	2.9	0.0	48.0
Control-600	4.1	3.5	14.3	32.0	5.2	37.2	13.9	0.9	12.9	2.6	0.0	138.2

Table 2. Characteristics of physicochemical properties of A₁ soil horizon in various directions of waste area surrounding (means values)

Distance from waste area (m)	pH		Al ³⁺ (mg/100 g)	H	S	T=S+H	V (%)	Macroelements - available forms (mg/100 g)			CaCO ₃ (%)	Specific surface (m ² /g)
	H ₂ O	1M KCl						Na	Ca	Mg		
	(mmol(+)/100 g)											
E	6.2	5.5	0.1	3.4	25.0	28.4	88.0	4.5	44.5	4.2	0.3	96.0
N	5.7	4.7	4.4	3.3	5.6	8.9	62.9	2.1	15.3	2.8	0.0	25.6
W	5.2	4.7	4.7	3.6	2.9	6.5	44.6	1.3	4.5	1.0	0.2	17.7
S	6.0	5.3	1.1	4.8	11.8	26.6	71.0	4.3	23.8	3.5	0.0	39.7
Control (S)	4.1	3.5	14.3	5.2	32.0	37.2	13.9	0.9	12.9	0.0	0.0	138.2

particularly evident in the southern direction where soil (woodland) treated as control shows worse properties, indeed, except the specific surface as against the soil located close to dumping ground but used as grassland.

RECAPITULATION

The waste storage at refuse area of overground level character in particular, exerts some impact on soil properties located in the neighbourhood because of the mechanical blowing various materials away [2,4]. Therefore insulation of refuse area is necessary and the protective zone should function as that [5].

As to the examined object, a possible protective zone should cover the area within the radius of 250-300 m [5] and is of typical agricultural-productive character [4].

Various impurities blow out of fill area influence soil reaction, content of mobile aluminium and basic cations as well as their sorptive

capacities. The properties values in the soils close to waste area are conditioned by a distance from refuse area and down winds, although a distance from dumping ground is of greater importance than is location in the world directions. These dependences are modified by the way the soils are used [6].

However, it should be emphasized that taking into account light, acidified soils the emitted acidification, especially of basic character subserve the improvement of some characteristics.

More dangerous problem also pointed in other papers [7] are water leakages from waste area (Table 3) that are contributive contamination of underground water and water-courses with harmful substances and cause eutrophication.

CONCLUSIONS

1. The changes of soil properties (reaction, content of basic cations and mobile aluminium)

Table 3. Characteristics of physicochemical properties of sludges in waste area neighbourhood

Side of waste area	Organic matter (%)	Macroelements - available forms (mg/100 g)			pH H ₂ O	CaCO ₃ (%)	Specific surface (m ² /g)
		Na	Ca	Mg			
N	20.07	32.5	41.0	4.2	8.0	15.4	195.8
S	40.75	8.4	44.8	6.8	6.5	6.4	174.7

in the surrounding of municipal waste area are conditioned by the distance from the source and down winds rate. In the close neighbourhood of waste area, the influence of its impurities on soil qualities is evident and predominant while in the outlying belts and various directions it depends on the way they are used.

2. Pollution emitted from waste area, of basic character in particular, subserve the improvement of reaction and basic cations content in light soil.

3. The leakages from the waste area are serious menace for the environment, principally for underground water and water-courses. They develop into sludges that give evidence of the problem.

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ODCZYN I NIEKTÓRE WŁAŚCIWOŚCI GLEB W OTOCZENIU WYSYPISKA ODPADÓW KOMUNALNYCH

W obszarze oddziaływania zanieczyszczeń z wysypiska odpadów, w poziomach A₁ gleb, analizowano odczyn, właściwości sorpcyjne oraz zawartość wybranych makroelementów. Stwierdzono, iż największy wpływ na wartość tych cech miało oddalenie od wysypiska oraz usytuowanie na kierunkach o różnym udziale wiejących wiatrów. Kwestie powyższe modyfikowane były przez sposób użytkowania gleb.

Słowa kluczowe: odczyn gleb, właściwości sorpcyjne, makroelementy, wysypisko odpadów komunalnych.