THE IMPACT OF THE OIL EXTRACTION ACTIVITY UPON THE SOIL IN THE GORJ DISTRICT

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Abstract
The oil extraction activity in the district of Gorj is a component part of the industrial activities that take place in the Colţeşti-Hurezani area of the district. Among the environmental factors affected, the soil has a great importance being a storage place for the pollutant elements. The direct sources of potential pollution of the soil and subsoil could be the reservoir parks, old separators from purification stations, decantation basins, slime and tar pits, underground pipes and drainage networks.
The paper presents the impact that the oil extraction activity in the Colţeşti – Hurezani area has on the soil. There were determined: the soil pH, the chlorides and heavy metals (Cu, Pb, Zn) using standardized methods of analysis. There have been sampled specimens for analysis from 4 distinct points: the Hurezani area extraction park, the area affected by the eruption of a drilling well and farming land from the vicinity of the oil extraction area.
The values of the chlorides, heavy metals and pH content obtained prove the negative impact that the oil extraction activity developed in the district of Gorj, Colţeşti – Hurezani area, has on the soil.

Keywords: oil, soil, pH, chlorides, heavy metals

1. INTRODUCTION

By the soil pollution we understand any action that results in the degradation of the normal functioning of the soil as a life support and environment (especially for the earthly superior plants) within different natural or man made (anthropic) ecosystems. The disorder manifests itself through physical, chemical and biological degradation of the soil, or through the emergence in the soil of some features that reflect the depreciation of its fertility and the reduction of its bioproductive capacity, both from the qualitative point of view as well as the quantitative one.
From the multitude of pollutants that affect the soil and underground waters quality, the hydrocarbons occupy an important place.
The phase of hydrocarbons pollution, but mostly – the remedy of such a source of pollution, is correlated with the type and features of the polluting hydrocarbons [1].
Among the environmental factors, the soil has a great importance, being an accumulation site of the polluting elements.
With regard to the activity developed within the petroleum exploration and production sector, the soil pollution may have as sources the pipes that feed the oil well parks that might have accidental leaks of deposit petroleum and water.
As sources of soil pollution, one can also mention: parks of separators, well squares, petroleum storehouses and treatment stations, compressor stations and the polluted pipe routes due to the damages (areas that present petroleum covers), slimes resulted from the activities developed in this sector, the installations for transportation and storage of the oil products and, especially, of the injection water, old and dismantled wells, quashed installations and equipment and scrap iron deposited in places without proper set up.
The main feature of the pollution caused by refineries and petrochemical combines consists in the fact that the pollution source is active and, most of the times, on a short period of time, but has an important intensity, the agent of pollution being formed as a rule from narrow petroleum fractions [2,3].
Also, in most of the cases of accidental leaks of petroleum products, the surface of soil affected is much smaller than the contaminated surface of the first water-bearing encountered by the pollution front.

Among the cases of the soil pollution, most of them are caused by the problems that arose in the underground, that is: fissures in the pipes or in the fuel storehouse's walls.
Potential sources of direct soil and subsoil pollution could be the parks of separators, the old separators from the purification stations, the decantation basins, slime and tar pits, C.F. loading and landing platform, underground pipes, drainage networks etc.
The paper presents the impact that the oil extraction activity has on the soil from the area of Colţeşti-Hurezani, district of Gorj.
The reservoirs of petroleum or oil products have a broad surface of contact with the soil. When corrosion of the reservoir bottoms takes place there may appear leaks of oil products. When in small quantities, the leaks cannot be highlighted and may pollute the soil. When a full reservoir breaks out, the products spillover into the park precincts where the recipient is located. The product spilled is collected in the sewerage system and recovered at the purification installation of the used waters, but a part of it may infiltrate the soil due to some fissures of the drainage system [4].
Mud and residues pits may become, in some cases, sources of soil pollution. Thus, if the bottom or the walls of these pits have not been waterproof in an adequate manner for the oil products, these may infiltrate the soil.

2. EXPERIMENTAL

To evidence the quality of the soil area, there have been sampled specimens from 4 distinct points:

- Point number 1 – the area of Hurezani park, district of Gorj;
- Point number 2 – the area affected by the eruption of a drilling well;
- Point number 3 – farm field;
- Point number 4 – farm field.

There have been sampled 2 specimens from every point, with depth profiles of 0-10 cm and 10-20 cm. First, there have been established the concentrations of the specific chemical indicators for the activity developed, namely the presence of the chlorides. These derive from the deposit water that, when some accidental leaks take place, may determine the soil salinization from the area.
To follow the presence of the oil hydrocarbons in the soil, the necessary installation to determine this indicator was not used.
Also, other indicators have been measured, that describe the quality of the soil, namely the heavy metals.

3. RESULTS AND DISCUSIONS

The treatment of the soil specimens sampled with a view to make the analysis was done in conformity with the standard SR ISO 11464/1998 – The quality of the soil. The pretreatment of the specimen for the physical-chemical analysis: thus, the soil samples have been drained in the stove and grinded in the mortar. The pH determination was realized with a Hanna multiparameter. The heavy metal determination was realized in conformity with the ISO 11047/1999 – Soil quality. The copper, lead, cadmium and zinc determination from soil extractions was realized through flame atomic absorption spectrometry.
The metal extraction was realized with concentrated sulphuric acid and then was oxygenated 50% with the help of a Digestal Hach mineralizer.
The Cl^- anion is precipitated under an AgCI form through titration with a solution of lunar caustic in the presence of potassium chromate as indicator.
The interpretation of the results obtained was realized in conformity with the methodology elaborated by the Institute of Pedological and Agrochemical Research Bucharest for chlorides and the Order of the Ministry of the Waters, Forests and the Protection of the Environment No. 756/1997 for the approval of the Regulation regarding the evaluation of the environment pollution for heavy metals.
Following the results obtained, one may draw some conclusions for the indicators analyzed:

- The soil pH from the area analyzed varies within very small limits (6,0 – 6,5);

- The chlorides have values comprised between 63,9 mg/100g and 319,5 mg/100g soil.

According to the I.C.P.A. methodology, the analyzed soils belong, from the point of view of the salinity degree, to the category of soils with a moderate salinity (in 3 sampling points) and to the soils with a strong salinity (for the point 2 – Figure 1). Besides, the highest values corresponding to the soils with a high alkalinity have been registered in point 2, area that was affected by the eruption of a well. The pollution with salted water was done during the drilling work with a view to exploit the oil deposits. In these conditions, the chemistry of the soil was modified by the growth of the chlorides content over the limits allowable.

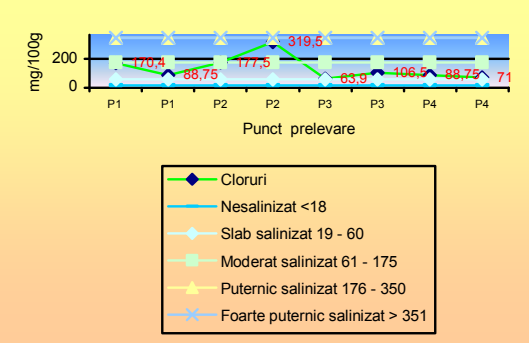

Figure 1 The variation of the Cl^- soil concentration in the Colteşti – Hurezani area

In figura: Sampling point
Chlorides
With a week salinity
With a strong salinity
Without salinity
With a moderate salinity
With a very strong salinity

• Lead

For lead, the Order 756/1997 stipulates a normal value of 20 mg/kg.s.u., an alert threshold of 50 mg/kg.s.u. and an intervention one of 100 mg/kg.s.u. for the type of sensible employment. There were registered values in three sampling points for the depth of 10-20 cm. These values do not pass over the normal value allowed by the legislation. In the other points and depth profiles the values obtained were 0.

• Zinc

The zinc has a normal value in the soil of 100 mg/kg.s.u., an alert threshold of 300 mg/kg/.s.u. and an intervention one of 600 mg/kg.s.u. for the category of sensible employment.

From the 4 sampling points, in point 2 the values obtained for the depth profile 10-20 cm exceeded the normal value but placed themselves under the alert threshold. The highest concentration was registered in point 3, this being with 30.6% over the normal value. In the other points and depth profiles the measured concentrations did not passed the normal value in the soil (Figure 2). The lowest measured value was obtained in the sampling point number 2, the depth profile 10-20 cm, this being with 2.7 times smaller than the normal value.

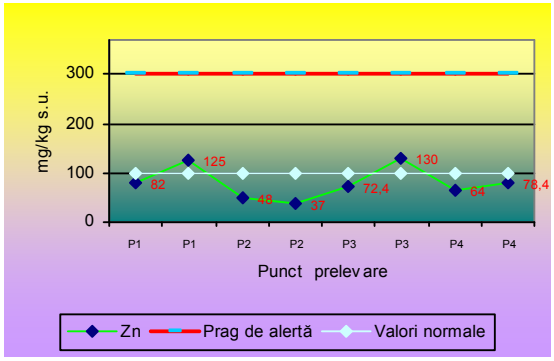

Figure 2 The variation of Zn soil concentration for sensible employment

In figura: Sampling point
Alert threshold
Normal values

• Copper

For the copper, the normal value in the soil is of 20 mg/kg.s.u., the alert threshold of 100 mg/kg.s.u. and the intervention threshold of 200 mg/kg.s.u., for the category of sensible employment. Analyzing the measured concentrations in the soil, one may notice that in all the sampling points and on all the depth profiles, these placed themselves over the normal value (Figure 3).

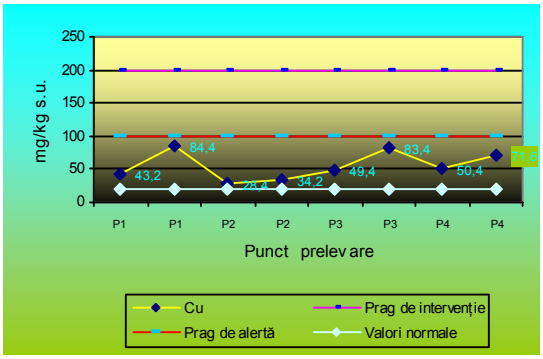

Figure 3 The variation of Cu soil concentration for sensible employment

In figura: Sampling point
Alert Threshold
Intervention Threshold
Normal values

The highest concentration was registered in the point 1 for the profile 10-20 cm, this being with 4.2 times over the normal value. The smallest value was registered in point 2, the depth profile 0-10cm, the growth with regard to the normal value being, in this case, of only 1.42 times.

• Cadmium

It registered 0 values in all the sampling points for all the depth profiles.

4. CONCLUSIONS

- The oil extraction activities represent an important source of soil pollution in the district of Gorj;
- The content of chlorides over the allowable limits is due to the pollution with salted water that resulted during the drilling work;
- The heavy metals exceed the normal values allowed by the legislation due to the oil extraction activity.

Acting as an extreme factor, excessively aggressive, the pollution affects, primarily, the chemical and biological processes from the plants and the soil, followed by the debilitation of the organisms resistance, taken both individual and collectively, to diseases, pests and other adversities. Still there are set off chain ecological imbalances with adverse consequences over the stability, vitality, regeneration capacity and over the polyfunctionality of the terrestrial ecosystems.

5. REFERENCES

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