

SOIL POLLUTION WITH CRUDE OIL - A CASE STUDY IN BRAILA COUNTY

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Abstract

Soil pollution with crude oil has become an important problem of our days. Crude oil introduction into soil environment can occur from pipeline blow-out. When released on soil surface, petroleum hydrocarbons adsorb on the organic mineral matter of the soil. This paper presents the data obtained during a case study achieved in Perisoru-Ianca, Braila County. The pollutant is crude oil, and the main parameter followed is total petroleum hydrocarbons.

INTRODUCTION

Pollution is the process of atmosphere contamination (particles, gases and vapors produced artificially), the natural surface or underground water (domestic waste water, industrial, nitrates from fertilizer) or soil (with fertilizers, pesticides, radioactive wastes, etc.) [5, 7].

Currently, about 80% of lands are contaminated/polluted by products of petroleum origin (hydrocarbons, solvents etc.) used as an energy source in the oil industry, as well as chemicals. There is a variety of pollutants affecting soil and subsoil, such as fuel and oil products, hydrocarbon residues, crude oil, other products resulting from the operation (saturated and unsaturated aliphatic hydrocarbons, and the monocyclic and polycyclic aromatic).

These types of products (mainly hydrocarbons) have a harmful risk, affecting the quality of groundwater, which becomes unfit for use for a long time (drinking water, irrigation and different industrial uses). It also poses risks to human health, biological environment and vegetation, aromatic compounds having a strong feature of mutagenic and carcinogenic and, not least, affect the environment security, presenting risks of explosion and fire, when the floating oil reach the groundwater in the basement of various buildings [3].

Accidental oil pollution has become nowadays a common phenomenon that can cause environmental and social disasters [1, 2]. Potential sources of direct pollution

of soil and subsoil can be covered by tanks, separators old from wastewater treatment plants, settling basins, slurries and waste pits of tar, ramp CF loading and unloading, underground pipelines, sewerage networks etc.

Solid residues, unsorted corresponding, which can pollute the soil, come from: solid impurities involved in crude oil, sewage sludge from wastewater treatment plants and raw water treatment, solid waste from the maintenance and cleaning of incinerator ash sludge, powder catalyst [4].

Most oil pollution sources are anthropogenic, but there are also some natural sources. There is evidenced that some organisms, such as high-class plants are able to synthesize hydrocarbons and can penetrate the soil [6].

MATERIAL AND METHODS

The case study achieved was necessary to establish the degree of pollution of the contaminated/polluted area with crude oil. Braila County is known for its historical pollution with petroleum hydrocarbons.

Perisoru City, Braila County is located on the map at 45°7' North 27°29' East.



Fig. 1. Location of case study - area of Perisoru, Ianca, Brăila County (source Google Earth)

RESULTS AND DISCUSSION

The crude oil provided by transport pipelines led to soil cover with a film, which stayed on its surface and formed a crust. At soil surface, there remained asphaltenes forming crust, and the other hydrocarbons with a lower molecular weight penetrated and completely obstruct the soil pores causing air traffic stop. The lack of oxygen involves stopping the process of biodegradation of petroleum hydrocarbons. This phenomenon, comparable to animal bodies hypoxia (lack of oxygen to cells), led to the installation of an anaerobic system in soil, leading to faster or slower death forced aerobic microorganisms and cells root, with the consequent inability of roots to retrieve sap and support plant metabolism.



Fig. 2. Image with the profile achieved in Perișoru-Ianca, Brăila County

Figure 2 presents the profile achieved in Perisoru-Ianca, Brăila County.

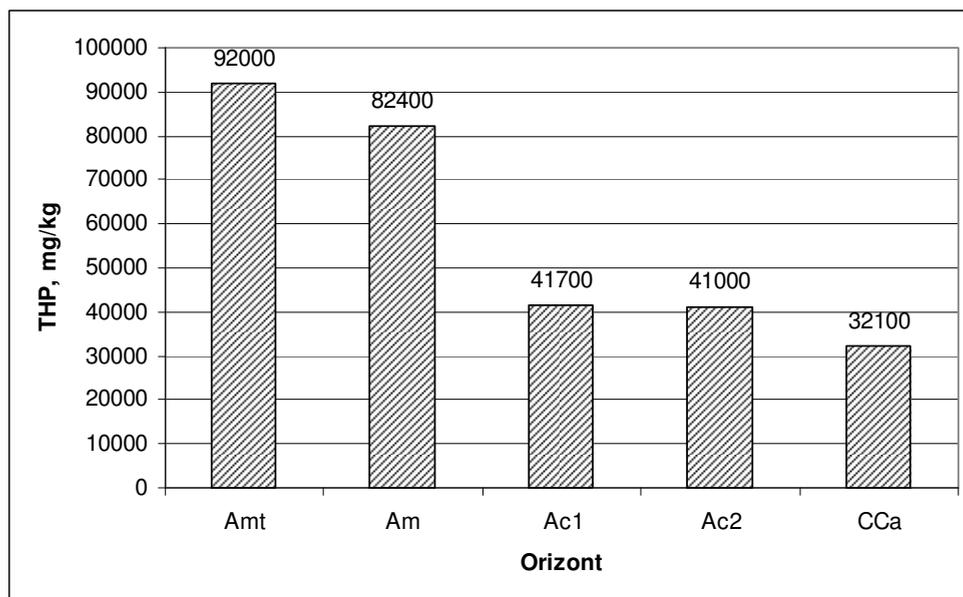


Fig. 3. Evolution of total petroleum hydrocarbon content with horizon in the profile achieved at Perișoru, Ianca, Brăila County

In the profile achieved in Perișoru area, Ianca, Braila County a very strong pollution was registered with petroleum hydrocarbons, a descending pollution. In the Amt horizon, 0-20 cm was registered a concentration of total petroleum hydrocarbons by 92000 mg kg⁻¹, in the Am horizon at 20-40 cm depth, the concentration has a value of 82400 mg kg⁻¹. The Ac1 horizon located at a depth of 55-75 cm there is a halving of residual oil content in determining the value of 41700 mg kg⁻¹, almost identical to that of AC2 horizon located at 75-95 cm depth, with a value of 41000 mg kg⁻¹. At 100-120 cm depth there was identified the last horizon of the profile and value of total petroleum content in continued to decrease reaching the value 32100 mg kg⁻¹, which maintains the level of excessive pollution. The evolution of total petroleum hydrocarbon content with horizon in the profile achieved at Perișoru, Ianca, Brăila County is shown in Figure 3.

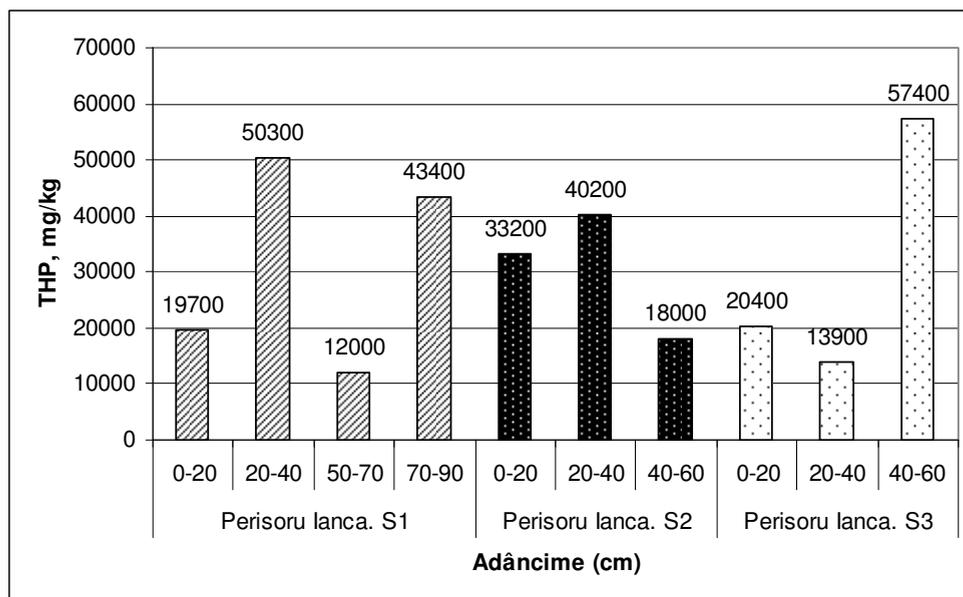


Fig. 4. Evolution of total petroleum hydrocarbon (TPH) content with depth in the 3 soundings achieved in Perişoru, Ianca, Brăila County

In the sounding 1 (S1) made on 4 depths was registered the highest concentration of total petroleum hydrocarbons with a value by 50300 mg kg^{-1} on 20-40 cm depth, followed by 43400 mg kg^{-1} on 70-90 cm depth, 19700 mg kg^{-1} at surface (0-20 cm) and 12000 mg kg^{-1} on 50-70 cm depth. Sounding 2 (S2) have been realized on 3 depths, being registered a decrease in total petroleum hydrocarbons content with depth. Thus, there was a surface concentration of total petroleum hydrocarbons by 33200 mg kg^{-1} , 40200 mg kg^{-1} on 20-40 cm depth, and 18000 mg kg^{-1} on 40-60 cm depth. The concentration of total petroleum hydrocarbons in sounding 3 (S3) presents in the first horizons a descending pollution from 20400 mg kg^{-1} at the surface drops to 13900 mg kg^{-1} at a depth of 20-40 cm and then a strong ascending pollution concentration reaching the value of 57400 mg kg^{-1} . The evolution of total petroleum hydrocarbon (TPH) content with depth in the 3 soundings achieved in Perişoru, Ianca, Brăila County is presented in Figure 4.

CONCLUSIONS

1. The case study was achieved in an area known for the history of petroleum hydrocarbons pollution.
2. The pollution degree of the studied area is excessive in the majority of the soil samples.

3. In the profile achieved in Perișoru area, Ianca, Brăila County a very strong pollution was registered with petroleum hydrocarbons, a descending pollution.
4. In the sounding 1 (S1) made on 4 depths the highest concentration of total petroleum hydrocarbons was registered on 20-40 cm depth and on 70-90 cm depth.
5. Sounding 2 (S2) was realized on 3 depths, being registered a decrease in total petroleum hydrocarbons content with depth.
6. The concentration of total petroleum hydrocarbons in sounding 3 (S3) presented a descending pollution in the first horizons and then a strong ascending pollution concentration.

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