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# NUMERICAL MODELING OF THE PROCESS OF DISPLACEMENT OF OIL PRODUCT WATER WET SOIL

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**Abstract**: In addition to surface water pollution is frequently extended to the groundwater. Pollution of this water is more dangerous than surface waters because these waters besides the main source of drinking water, polluted habitat determining the amount of pollutant and the date and who the polluter pollution are questions which is quite difficult to answer. In this paper we studied groundwater pollution is one of the most problematic issues of the modern world, because in addition to contaminated drinking water supply, habitat pollution determining the nature of the pollutant and its water discharge date and who is polluter are questions that often is not an accurate answer. We therefore studied how the thermal recovery of oil and oil mixtures in groundwater and has developed a numerical model written in the programming language Matchad.
**Keywords**: Oil pollution, thermal extraction

## 1. INTRODUCTION

In addition to surface water pollution is frequently extended to the groundwater. Pollution of this water is more dangerous than surface waters because these waters besides the main source of drinking water, polluted habitat determining the amount of pollutant and the date and who the criminal pollution are questions which is quite difficult to answer.

Soil layer crossed by various contaminants discharged to the surface does not have sufficient capacity retention of harmful substances. Therefore, such pollutants are found in the aquifer, such as: synthetic detergents, phenols, cyanides, pesticides, insecticides, herbicides, salts from the use of chemical fertilizers, residues in the nuclear industry, etc.

Petroleum hydrocarbons are an important class of groundwater contaminants. Water-soluble hydrocarbons, especially alkylbenzenes, strongly affecting the quality of the water is dissolved. In addition, some water-soluble components, such as benzene, are carcinogenic.

Petroleum products can be removed from ground water and spills produced at the surface. Oil contact with the ground causes changes in its physical, chemical and biological properties of the soil due to volatilisation compound lighter, the stratification and the selective migration of the pollutant in the soil profile, depending on the polarity of the components. The saturated hydrocarbons penetrate deeper than followed by aromatic hydrocarbons such as polar components, such as asphaltenes, remain on the surface as a thin compact creating anaerobic condition, which reduce the microbial metabolic activity.

## 2. SOURCES OF GROUNDWATER POLLUTION FROM DOBROGEA

The sources are multiple and can be localized: the surface, underground, above ground water and groundwater below. Sources of soil and groundwater with petroleum products on the territory of Dobrogea are fueling parks scaffolding pipes, accidental spills of crude oil and formation water separators parks, squares wells, storage and handling of petroleum stations, stations compressors and pipeline routes, slurries, waste transport and storage of petroleum products and water injection wells decommissioned old facilities and equipment scrapped particularly unsuitable

places. Groundwater pollution can come and pollutants emitted into the atmosphere are carried by wind and deposited on the soil are washed rainfall, infiltrating underground.

Other sources of groundwater pollution can be waste from refining and petrochemicals, which can be acidic ground dead (slurry), deposits of tanks for storing petroleum products, spent catalysts from different manufacturing processes organic solvents, halogenated compounds and macromolecular waste sludge from biological treatment plants in the refinery wastewater.

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

A special case is the pollution of groundwater in the Oil Terminal Constanta. Recent study shows that in the street there Caraiman - Constanta oil contamination of subsoil and groundwater in the deposits and their vicinities. For the determination of oil pollution have conducted several research studies and status of contamination by hydrocarbons during 2010-2012 and MENER Programme - Priority Project 6 Objective no. 1 " Evaluation of contamination by petroleum products in the Oil Terminal Constanta deposits " made in collaboration by: National Institute of Marine Geology and Geoecology - GEOECOMAR, Faculty of Geology and Geophysics, University of Bucharest, Institute for Studies and Institute for Land ISPIF, ECOIND national Industrial Ecology, in June 2013.

Accumulation of oil in sediments associated with the groundwater in the aquifer SP England (situation in 2012 to 2013 ) is shown in Figure 1.

Given the situation in the years 2012-2013 on aquifer contamination was organized monitoring system and water levels in wells made product and its extraction with frequencies ranging from monthly to bi-weekly and daily. Where the situation required it, because of the risks to human health and depletion of boreholes was performed 2-3 times per day.

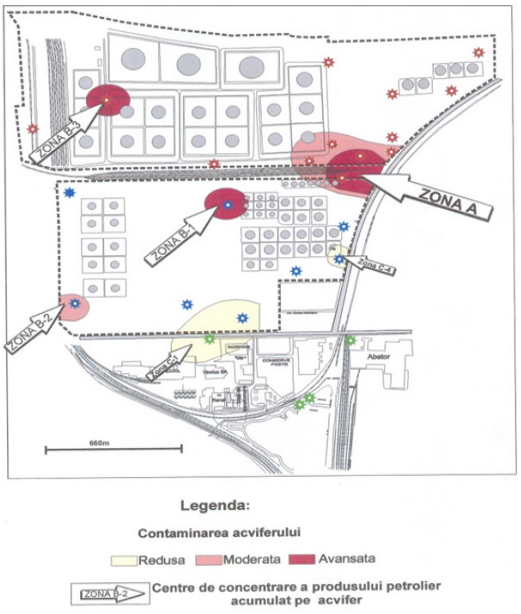


Figure 1. Oil Terminal acvifer pollution

The method gives results in long time, both for groundwater remediation and for reducing pollutants in soil sediments, groundwater due to their money during their pumping wells. This washing is carried out, mainly due to the increase of traveling speed in the ground in the depression formed plug but also in adjacent areas, which feeds the cone, to achieve the natural balance.

**3. NUMERICAL MODELING OF THERMAL RECOVERY OF PETROLEUM**

In carrying out experimental study, we simulated water and soil pollution by:

a. slight gasoline density 0.7556 g/cm3,

b. a heavy oil density 0.9454 g/cm3,

which was poured onto the soil composed of sand and gravel bed of water.

In the first step we simulated the thermal extraction of both product and 50% of a mixture of heavy oil, 50% light gasoline consisting of a sand and gravel soil moistened with water.

For the recovery of the ground product of the distillation apparatus we used, in which heated product have contaminated the soil at various temperatures and then we cooled with water, as

Figure 2. Recovery of petroleum products in the soil moistened with water

shown in Figure 2 (I applied to the apparatus described in the atmospheric distillation, but changed my conditions).

Table 1

| Volume extracted ml | Gasoline temperature, °C | Temperature diesel, °C | Blend temperature °C | Gasoline recovery time, min | Diesel recovery time, min | Blend recovery time, min |
|---|---|---|---|---|---|---|
| 0 | 50 | 211 | 55 | 0 | 0 | 0 |
| 10 | 84 | 244 | 100 | 3 | 23 | 17 |
| 15 | 88 | 248 | 110 | 5 | 28 | 25 |
| 20 | 90 | 254 | 149 | 7 | 43 | 31 |
| 25 | 110 | 273 | 180 | 11 | 57 | 33 |
| 30 | 130 | 288 | 209 | 16 | 63 | 39 |

B3 is the recovery time diesel-gasoline mixture (min), B2 represents diesel recovery time (min), B1 is the recovery time gasoline (min)

The evolution of the temperature of the volume of the gasoline extract is given by the equation:

$$Y=54,054 + 2,168\ X \quad (1)$$

The evolution of the temperature of the volume of the diesel extract is given by the equation:

$$Y=214,027 + 2,284\ X \quad (2)$$

The evolution of the temperature of the volume of the mixure diesel-gasoline extract is given by the equation:

$$Y=50,162 + 4,903\ X \quad (3)$$

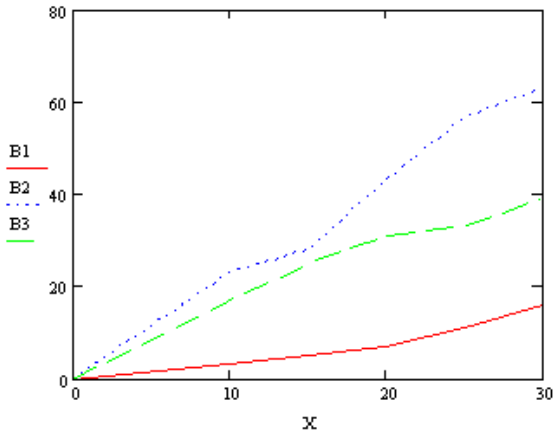


Figure 3. Variation of thermal recovery of petroleum products from water wet ground according to the recovery time, wherein: X is the amount of product recovered (ml)

## 4. CONCLUSION

The experiment aimed to recover 60% of the pollutant namely light fractions because they are more soluble in water and higher pollution area. The heavy ends are less soluble in water and are also more easily transported by the flow of water to slapping.

It also used an experimental model of Dobrogea soils namely stuffed green shale mold. In the green shale groundwater is not circulating, so we considered only a water wash soil created and not total filler (only 10% of volume).

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