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EXPERIMENTAL RESEARCH ON THE PRESENCE OF HYDROCARBONS IN THE SOIL OF THE NORTH CONSTANTA ZONE

VASILICĂ Florentina-Aurelia [1], SAFTA Carmen-Anca[1], [2] PANAITESCU Mariana[2], PANAITESCU Fanel-Viorel[2], VOICU Ionut[2]

[1] National University of Science and Technology POLITEHNICA BUCHAREST, Bucharest-Romania, Blvd. Spl.Independentei, no. 313, sector 6, 060042, Bucharest, Romania
e-mail: vasilica.florentina16@gmail.com, safta.carmenanca@gmail.com
[2] Constanta Maritime University, Faculty of Electromechanics, 104 Mircea cel Batran Street, 900663 Constanta, Romania
e-mail: panaitescumariana1@gmail.com, viopanaitescu@yahoo.ro, ionut.voicu@cmu-edu.eu

Abstract: This experimental research engages in an investigation of sediment quality, with a focus on the identification and quantification of hydrocarbons and other contaminants that may adversely affect the health of the marine and terrestrial ecosystem in the Black Sea region. The purpose of this experimental research is to contribute to the understanding of the dynamics of hydrocarbon pollution and its impact on the marine and terrestrial environment in the Black Sea area.
Key words: Black Sea, pollution, soil, hydrocarbs

1. INTRODUCTION

The global environmental problems facing humanity today are largely the result of human overexploitation of natural resources, namely (fossil) fuels, minerals, water, soil and biodiversity. [1]

Water is a valuable resource under pressure in Europe, with only 40% of surface water bodies in good ecological status and 38% in good chemical status.

Water and soil are two fundamental elements of the marine and terrestrial ecosystem, and their quality is vital for the conservation of biodiversity and the maintenance of environmental health. In the Black Sea area, one of the most important and sensitive marine ecosystems in the world, sediment and hydrocarbon analyses in water and soil have become increasingly relevant in the context of increasing anthropogenic pressures and climate change.

This experimental research engages in an investigation of sediment quality with a focus on the identification and quantification of hydrocarbons and other contaminants that may adversely affect the health of the marine and terrestrial ecosystem in the Mamaia Nord area.

2. EXPERIMENTAL DATA FROM THE NORTH CONSTANTA COASTAL AREA FOR SOIL

Petroleum products tend to settle on the bottom of the basin, covering especially the species that have a high degree of mobility. In this case, entire colonies of organisms that naturally constitute food for fish are destroyed by poisoning or axphysis.[4]

To determine the degree of soil pollution in the Romanian coastal area of the Black Sea, for the period 2021-2023, samples of dredged material were taken, which were analysed in specialized laboratories, accredited by RENAR, to determine the chemical indicators.

To compare the obtained values and determine the alert threshold, the reference values were used according to Order no. 756/1997 for the approval of the Regulation on environmental pollution assessment. The regulation regarding the classification of surface waters, annex B for: heavy metals (cadmium, copper), pesticides (sum of DDD/DDT/DDE), total polynuclear aromatic compounds (sum of PAH). Total polychlorinated biphenyl compounds (PCB amounts), mononucleic aromatic compounds (benzene, toluene, phenols).[2]

In the calculation of the standard deviation, from this chapter, the results for polycyclic aromatic hydrocarbons were used. Standard deviation is a measure of the dispersion or variability of data in a statistical distribution. It is used in a variety of fields, including scientific research, financial analysis, engineering, psychology, and many other fields where it is important to understand the dispersion and variability of data.[3]

Polycyclic aromatic hydrocarbons (PAHs) are organic compounds containing two or more benzene rings. They are often considered persistent organic pollutants (POPs) and can accumulate in soil, water and living organisms, including the human body.[5]

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3. METHODOLOGY AND RESULTS

3.1 Methodology

The values resulting from the analysis of the material dredged from the Constanta North Coastal area in the period 2021-2020, in an accredited laboratory, are presented in Tables 2-4.

The values for Polycyclic Aromatic Hydrocarbons (PAH) in these areas were determined.

The coordinates of the areas where the samples were taken are presented in table 1.

Table 1. Sampling points

Name of section	Longitude
Constanta North coast	28,3858
Constanta North- 5 m	28,3858

3.2 Results

3.2.1. The variations of PAHs in period 2021-2023

The results of PAHs(Polycyclic Aromatics Hydrocarbons) were presented during period 2021-2023 on Constanta-North coast and on Constanta-North at 5 m depth from coast in the following tables (Table 1, Table 2, Table 3):

Table 2. PAH Results 2021

2021	Place of sampling	Constanta North coast	Constanta North- 5 m
Date of sampling		aug.21	aug.21
Parameter	**Unit**	**Result**	**Result**
Polycyclic Aromatics Hydrocarbons (PAHs)			
Naphthalene	mg/kg SU	0,03	0,015
Acenaphthylene	mg/kg SU	0,03	0,015
Acenaphthene	mg/kg SU	0,035	0,015
Fluorene	mg/kg SU	0,035	0,015
Phenanthrene	mg/kg SU	0,04	0,015
Anthracene	mg/kg SU	0,04	0,015
Fluoranthene	mg/kg SU	0,02	0,015
Pyrene	mg/kg SU	0,01	0,015
Benzo(a)anthracene	mg/kg SU	0,028	0,015
Chrysene	mg/kg SU	0,01	0,015
Benzo(b)fluoranthene	mg/kg SU	0,01	0,015
Benzo(k)fluoranthene	mg/kg SU	0,02	0,015
Benzo(a)pyrene	mg/kg SU	0,04	0,015
Indeno(1,2,3,cd)pyrene	mg/kg SU	0,06	0,015
Benzo(g,h,i)perylene	mg/kg SU	0,04	0,015
Dibenzo(a,h)anthracene	mg/kg SU	0,01	0,015
Amount of 16 PAH	mg/kg SU	0,45	0,24

Table 3. PAH Results 2022

2022	Place of sampling	Constanta North coast	Constanta North- 5 m
Date of sampling		aug.22	aug.22
Parameter	**Unit**	**Result**	**Result**
Polycyclic Aromatics Hydrocarbons (PAHs)			
Naphthalene	mg/kg SU	0,22	0,25
Acenaphthylene	mg/kg SU	0,19	0,18
Acenaphthene	mg/kg SU	0,17	0,17
Fluorene	mg/kg SU	0,1	0,1
Phenanthrene	mg/kg SU	0,18	0,17
Anthracene	mg/kg SU	0,15	0,15
Fluoranthene	mg/kg SU	0,1	0,1
Pyrene	mg/kg SU	0,1	0,1
Benzo(a)anthracene	mg/kg SU	0,1	0,1
Chrysene	mg/kg SU	0,1	0,1
Benzo(b)fluoranthene	mg/kg SU	0,1	0,1
Benzo(k)fluorant	mg/kg	0,11	0,11

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hene	SU		
Benzo(a)pyrene	mg/kg SU	0,12	0,12
Indeno(1,2,3,cd) pyrene	mg/kg SU	0,13	0,13
Phenanthrene	mg/kg SU	0,14	0,14
Dibenzo(a,h)anth racene	mg/kg SU	0,13	0,13
Amount of 16 PAH 16 PAH	mg/kg SU	2,14	2,15

Table 4. PAH Results 2023

2023	Place of sampling	Constanta North coast	Constanta North- 5 m
Date of sampling		aug.23	aug.23
Parameter	**Unit**	**Result**	**Result**
Polycyclic Aromatics Hydrocarbons (PAHs)			
Naphthalene	mg/kg SU	0,17	0,18
Acenaphthylene	mg/kg SU	0,18	0,17
Acenaphthene	mg/kg SU	0,13	0,11
Fluorene	mg/kg SU	0,14	0,12
Phenanthrene	mg/kg SU	0,11	0,11
Anthracene	mg/kg SU	0,1	0,1
Fluoranthene	mg/kg SU	0,1	0,1
Pyrene	mg/kg SU	0,1	0,1
Benzo(a)anthrace ne	mg/kg SU	0,1	0,1
Chrysene	mg/kg SU	0,1	0,1
Benzo(b)fluorant hene	mg/kg SU	0,1	0,1
Benzo(k)fluorant hene	mg/kg SU	0,13	0,12
Benzo(a)pyrene	mg/kg SU	0,11	0,12
Indeno(1,2,3,cd) pyrene	mg/kg SU	0,11	0,12
Phenanthrene	mg/kg SU	0,1	0,1
Dibenzo(a,h)anth racene	mg/kg SU	0,1	0,1
Amount of 16 PAH 16 PAH	mg/kg SU	1,88	1,85

3.2.2. The standard deviation

After analysing the results obtained for the PAHs values, we calculated the standard deviation, and then we compared its result with the values imposed by the legislation.

The obtained results are presented in figures 1-3.

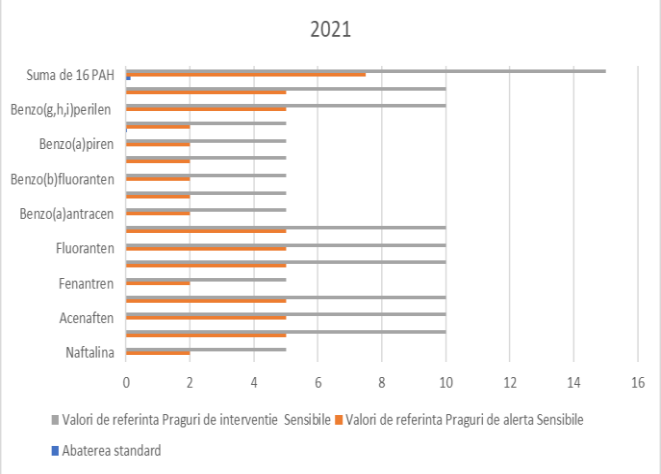

Figure 1 Comparison of reference values and standard deviation values-2021

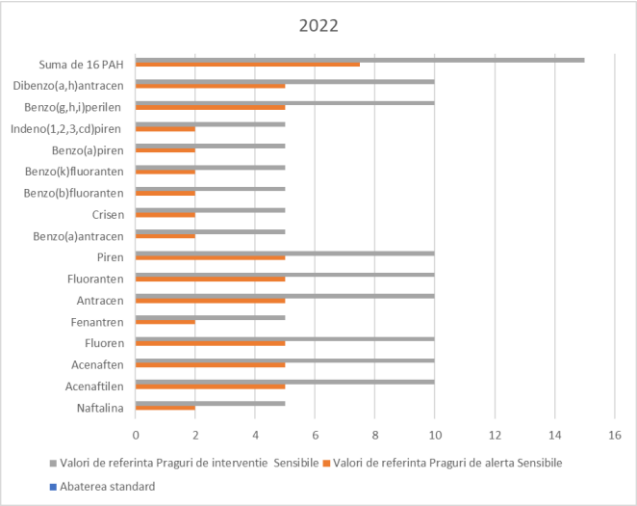

Figure 2 Comparison of reference values and standard deviation values-2022

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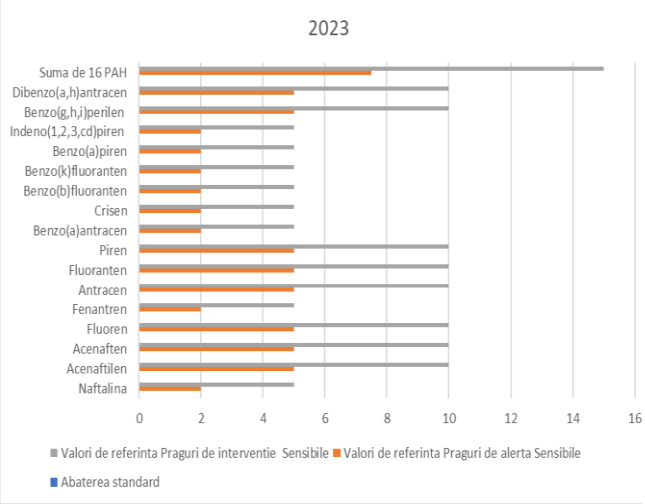

Figure 3 Comparison of reference values and standard deviation values-2023

For the period 2021-2023, the analyzed area of the Romanian Black Sea Coast was subject to minor pollution.

4. CONCLUSIONS

The results of the analyzes indicate a stability of the environment in the area of the Black Sea Coast, with a reduced standard deviation regarding the concentrations of hydrocarbons and sediments in water and soil. This suggests that the area is generally less affected by pollution and that soil quality parameters remain relatively constant.

In conclusion, the results of experimental research indicate a general favorable state of the environment in the area of the Black Sea Coast, with a small standard deviation and a relatively unpolluted area. These findings represent an important starting point for conservation and environmental protection efforts in this region.

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