POSSIBLE EFFECTS OF DISCHARGE OF WASTE WATER USED BY SOME ECONOMIC AGENTS FROM ROMAN MUNICIPALITY AND NEAMT COUNTY

EFECTE POSIBILE ALE DEVERSĂRII APELOR UZATE DE CĂTRE UNII AGENŢI ECONOMICI DIN MUNICIPIUL ROMAN, JUDEŢUL NEAMŢ

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Abstract*. The studies of environmental impact are focused on the physico-chemical parameters of environmental quality, moving in a secondary place the analysis of the potential or manifested changes on biological systems. Considering that reactions in living organisms are the ablest to describe the effects of pollutants discharge into the environment, this paper proposes you to describe the ecotoxicological effects of sewage produced by some economic agents from the Roman city. The Daphnia magna high toxicity test was used. In parallel, some indicators of wastewater quality have been determined and we intended to observe the influence on the seed germination and the growth of the Medicago sativa plantlets. The results obtained show an acute toxicity effect on daphnia and of delayed seed germination / plantlets growth in the test species.*

Key words: industrial effluents, acute toxicity testing, water quality indicators, physiological indicators.

Rezumat. *Studiile de evaluare a impactului asupra mediului acordă mare atenţie parametrilor fizico-chimici de calitate ai mediului, trecând în plan secundar analiza modificărilor potenţiale sau manifestate asupra sistemelor biologice. Pornind de la considerentul că reacţiile organismelor vii sunt cele mai în măsură să descrie efectele deversării poluanţilor în mediu, lucrarea de faţă îţi propune să identifice şi să analizeze efectele ecotoxicologice exercitate de apele uzate provenite de la unii agenţi economici din oraşul Roman. S-a utilizat testul de toxicitate acută cu Daphnia magna. În paralel, s-au determinat unii indicatori de calitate ai apelor uzate şi s-a urmărit influenţa asupra germinaţiei seminţelor şi creşterii plantulelor de Medicago sativa. Rezultatele obţinute evidenţiază un efect de toxicitate acută asupra dafniilor şi de întârziere a germinaţiei seminţelor/ creşterii plantulelor la specia test.*

Cuvinte cheie: efluenţi industriali, test de toxicitate acută, indicatori de calitate a apei, indicatori fiziologici.

INTRODUCTION

The ecotoxicity of chemicals to aquatic and terrestrial ecosystems is estimated based on standardized bioassays with standard organisms, representative of the most important trophic levels. Using bioassays to assess the toxicity of industrial waste is a necessity legislatively regulated by the Directive 91/689 EEC, and heavily recommended for the direct and integrated estimation of the environmental toxicity (WFD, 2000). The ecotoxicology laboratory tests are

applied in different countries of Western Europe / Romania in order to demonstrate the adverse effects of various chemicals on the biological systems (Costică Naela and collab., 2006; Neamţu Mariana and collab., 2009). These tests, together with other complementary tools available in ecotoxicology are and continue to be useful to quantify the correlation exposure - effect of the toxic substances under defined, controlled and reproducible conditions.

On the line of these developments, the ecotoxicological determinations made with the *Daphnia magna* species on the wastewater issued by Arcelor Mittal Tubular Products Roman SA and Agrana Romania SA, the Roman branch are included. Note the fact that the two industrial units have pre-purifying sewage stations

Experimental data show that *Medicago sativa,* by its root system is able to absorb heavy metal ions from aqueous solutions (Gardea – Torresdey - J.L., and colab.,1995,1998) and to remove from the environment the organic compounds such as polycyclic aromatic hydrocarbons (Flocco C.G., and collab., 2002). Also, this species is considered to have a potential for the phytoremediation of soils contaminated with heavy metals. (Hernandez Pinero J.L., and collab., 2002).

Based on these considerations, we selected *Medicago sativa* as a test species to study the influence of wastewater coming from the metallurgical industry-specific processes/ the sugar-beet processing industry on certain physiological processes.

MATERIAL AND METHOD

The biological material that tests were made on was the culture of *Daphnia magna* provided by *MicroBioTests* Inc., Belgium. The cultures were propagated and maintained in laboratory conditions, at the Faculty of Biology - Iaşi, and the tests were conducted according to the standard protocol (OECD, 2004; XXXX, 2000). In order to realize the test, the daphnids were exposed for a period of 48 hours at a temperature of 20 ° C and in the dark. After this exposure, the inhibition of mobility of the young adults can be noticed and is reported at 24 hours and 48 hours; they must be old 24 hours and be at least at the third generation. The water for the dilution environment is distilled or deionized water with a pH of 7.8 and dissolved oxygen over 80%. The total volume of tested solutions is at least 2 ml per daphnid, and the minimum number of individuals is 20, divided into four lines. The results of the ecotoxicity tests with *Daphnia magna* were analyzed and expressed with the parameter EC50. It expresses the concentration that produces a toxic effect in 50% of individuals (immobilization, mortality) compared with the control. The results were expressed as the number of immobilized *Daphnia* individuals after their exposure to dilute wastewater solutions, in a standard environment, at 24 and 48 hours. The statistical interpretation of data obtained was performed using the EPA Probit program.

In parallel, qualitative / quantitative measurements were performed regarding the following indicators of water quality: smell, appearance, pH, conductivity, phosphates, sulfates, nitrates, nitrites. In order to determine the pH and conductivity, a Consort C532 type multiparameter was used, while for the other indicators specific methods of analysis were used (Mănescu, S., and collab.,1978). We studied the influence of wastewater on the *Medicago sativa* seed germination and growth during the early ontogenetic stages. The germinated seeds were made in laboratory

conditions in Petri dishes on filter paper soaked with distilled water (control variant) / wastewater (sewage from P1-Mittal Tubular Products; P2, waste water from Agrana). For each experimental variant 250 seeds were used (200 seeds to study the effect on the germination and 50 to study the influence on the growth of plantlets). We calculated the percentage of germination and the measurements were made on germinated seeds regarding the rootlet length (two days from the mounting of the experiment) and the plantlets and in order to determine the water and dry substance content (gravimetric method) (at 30 days). The results obtained for the rootlet length were statistically processed by applying the ANOVA Kruskal-Wallis nonparametric unifactorial test.

RESULTS AND DISCUSSIONS

In a comparative analysis of the results obtained for the two types of water, differences in the chemical composition and their effect on daphnids and seed germination and growth in early ontogenetic stages (at *Medicago sativa*) are highlighted.

The pH plays an important role in vital activity of the vegetal, animal and human organisms and in the technological processes. The water pH is neutral to the P1 variant and acid to the P2 version (5.95). In the second case the average value does not fall within the acceptable limits (6.5 to 9.5) for wastewater. The conductivity is determined by the presence of solutes in water. For water analysis, the conductivity has values between 532-535 μS/cm. They showed materials in suspension, phosphates, sulfates, nitrates (in both types of water) and aromatic hydrocarbon (wastewater from Arcelor Mittal) (table 1).

Table 1

Water quality indicators

No. crt.	Varianta experimentală	Quality indicators							
		Smell	Aspect	pH	Conductivity (μS/cm)	Sulphates i	Phosphates	Nitrates	Nitrites
1	M	odorless	clear						
2	P1	hydrocarbon	opalescent	7.03	535	+	+	-	+
3	P2	penetrating	opalescent	5.95	532	+	+	-	+

The wastewater from the two economic agents has an acute toxic effect on the daphnids. The calculated value of the concentration that produces an immobilization effect on 50% of *Daphnia* individuals (EC 50) is different (in 24 hours) in the case of the two categories of water (figure 1).There is a higher toxicity when comparing the case of Agrana to that of the Arcelor Mittal, toxicity which is due to the acid pH of the water. However, at 48 hours the EC 50 values are significantly closer (figure 2).

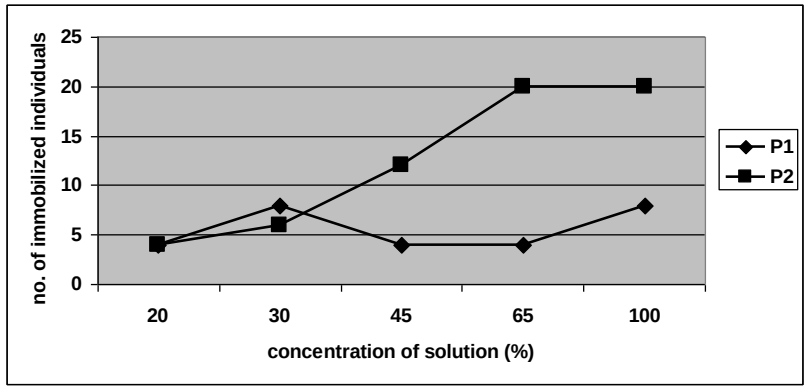

Fig.1. The results of the ecotoxicity tests with *Daphnia magna* after 24 h of exposure – P1, P2 variants

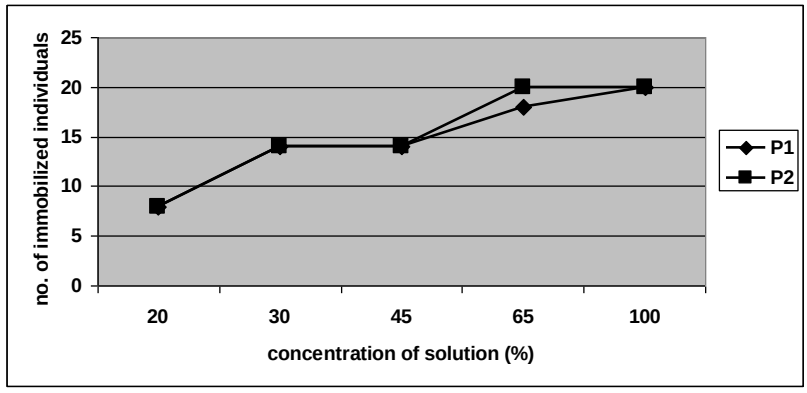

Fig.2. The results of the ecotoxicity tests with *Daphnia magna* after 48 h of exposure – P1, P2 variants

The two specific types of wastewater affect the seed germination at *Medicago sativa*. Compared with the control, the wastewater from Agrana delays the seed germination with 22%. The rootlet length has average values between 7.88 mm (control) and 4.77 to 5.76 mm at the treatment variants (table 2). The differences regarding the rootlet length between the control and treatment variants are statistically significant ($P < 0.05$).

Given that the enzymatic activity takes place at a neutral pH, we appreciate that the seeds germination delay in the case of the P2 variant is due to the acid pH of the water.

Table 2

Analyzed physiological / morphometric indicators at *Medicago sativa*

Nr. crt.	Experimental variant	The percentage of germinated seeds (%)	Average length of the rootlet (mm)	The plantlet average length (mm)	Water content (g %)	Dry matter content (g%)
1	M	75	7.88	58.87	94.03	5.97
2	P1	74	5.76	44.38	93.74	6.26
3	P2	58.5	4.77	45.2	93.52	6.48

Regarding the influence on growth we found out that the at the treatment variants the average length of the plantlet has values inferior to the control. The hydration degree of the plantlets is high (93.52 g% - 94.03 g%) and the dry matter content records low value variations between the control and treatment variants (table 2).

CONCLUSIONS

1. The wastewater from certain specific technological processes specific to the two economical agents have an acute toxicity effect on the daphnids. The most obvious toxic effect in 24 hours of exposure of the water from Agrana is due to their acid pH.

2. The substances present (partially shown by us) in the two types of wastewater analyzed have an unfavorable effect on the plantlet germination and growth during the early stages of the studied test species *(Medicago sativa)*.

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