APPROXIMATION OF THE SUSCEPTIBILITY TO EUTROPHIZATION OF MUREŞ RIVER ON THE GLODENI – UNGHENI TRACK

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Abstract

The eutrophization at the global scale, as an effect of the anthropic impact, is one of the most serious issues affecting water quality. In the Mure hydrographic basin, one of the economic companies with impact on the eutrophization is SC AZOMUREŞ SA, commercial company with chemical profile having as basic activity the manufacture and commercialization of chemical fertilizers with Nitrogen and Phosphorus of the type Ammonium Nitrate, urea, calcarus nitrogen, complexes (NPK) and of the melamine. SC AQUASERV SA also evacuates waste waters loaded with polluting substances with potential of eutrophization. Their impact is studied within the work.

Key words: sensible eutrophic areas, comparison index.

INTRODUCTION

The eutrophization represents a slow natural process, developed following the aging of the aquatic environment. As long as the characteristic processes are in a balance, the eutrophization may have positive effects. If the process becomes accelerated, usually by anthropic causes, the aquatic systems are unbalanced and the eutrophization may become dangerous for the quality of aquatic environment [10]. Unlike the natural process, the eutrophization determined by the anthropic pollution determines rapid and profound changes of the status of aquatic system, leading to its degradation and to the damage of use.

The eutrophization affects all categories of continental aquatic ecosystems (rivers, lakes), manifesting especially in stagnant and semi-stagnant ecosystems.

The limitative nutrient element of eutrophization, for sweet waters, unlike the marine ones [7] is considered phosphorus [4] [9].

The effects of eutrophization of waters are multiple and they interrest the aquatic ecosystems, production of drinkable water and its quality. In the case of aquatic ecosystems:

- dead plants deposited on the bottom of bed rivers destroy the habitat of numerous invertebrates,

- their decomposure leads to the decrease of the quantity of dissolved oxygen and the dissapearance of species of fish and invertebrates, which leads to a loss of biological diversity,

- the substances resulted following the decay of excess plants may be toxic for certain mammals.

In which concerns the process of drinkability of water and its quality, we can make the following observations:

- cianobacteria which spread in sweet eutrophized waters produce damaging substances for humans: hepatotoxines, neurotoxines and dermatotoxines; this requires the additional treatment of water, either by ozonization, or by chlorination, or by passage over active coal;

- the quantity of mud resulted from the process of drinkability of waters is large,

- the unpleasant taste of water requires adding reagents for correction.

MATERIAL AND METHODS

For the assessment of sensitive euthrophic areas there are no criteria and sole methods, due to the fact that: the phenomena which accompany the euthrofization are complex, and the number and field of values of variables based on which are established these sensitive areas are large [8].

On national scale were adopted a series of normative documents with reference to the quality of surface waters. For the surface waters, as criteria and values which shall be used for the identification of sensitive areas, the following criteria shall be taken into account: total Nitrogen (N_T), total Phosphorus (P_T), ratio N/P and chlorophyl a (Chl a);

The values of quality objectives, on average and long term, established based on quantities of nutrients are calculated in relation to:

The concentrations of nutrients;

- the debt of surface water;
- the surface of hydrographic basin.

The analysis of tracks of water courses identified with excess of concentrations of nutrients shall be achieved based on the loading with nutrients established for each section of control with excess, based on the following calculations:

- The monthly or season average quantity of nutrients shall be calculated, by using the formula:

$$G_{X,J} = Q_m \times f_c \times X_j \quad ,$$

where:

- $G_{X,J}$ represents the average quantity (monthly, season or annual) of X nutrients measured in the J control section

- Q_m represents the average annual debt of the track of water
- f_c represents a conversion factor of the forms of nutrients

- X_j represents the average concentration (monthly, season or annual) of the X nutrient, corresponding to the control section j

➢ The average loading is calculated (monthly, season or annual) with X nutrient of the surface of the respective hydrographic basin, corresponding to the drainage area from upstream of the control section j, by using the formula:

$$(I_{b,h})_X = G_{X,j}/S$$

where:

- $(I_{b,h})_X$ represents the average monthly, season or annual loading with X nutrient, of the surface of hydrographic basin corresponding to the drainage area from upstream of the j control section j;
- S represents the surface from the hydrographic basin corresponding to the drainage area from upstream of the control section

➢ The average load (monthly or annual) of X nutrient of the surface of the hydrographic basin corresponding to the drainage area from upstram of the control section j, with long term objectives:

- 200 kg N/km^2/an
- 20 kg P/km^2/an

$R=(I_{b,h})_X/I_{t,\ med}$

Where:

- $(I_{b,h})_X$ represents the average load, monthly or annual, with X nutrient of the surface of the hydrographic basin corresponding to the drainage area from upstram of the control section j;
- $I_{t,med}$ represents the quality objective of the water course on average term
- R represents a comparison index

➢ Identification of the risk of appearance of the euthrofiyation phenomenon based on the value of the comparison index (R) obtained:

R□1 → area without euthrofization ris

R□1 → sensitive euthrofic area

RESULTS AND DISCUSSION

In Mureş hydrographic basin, 10% of the total of water bodies are exposed risk from the point of view of the concentrations of nutrients, taking into account the unanimously accepted indexes [2]: ammonium, nitrites, nitrates, total nitrogen, ortophosphates, total phosphorus, chlorophyl a. Especially, for Mureş river, a track affected from a physical-chemical and bacteria point of view, is the one downstream from Tîrgu Mureş municipality, up to the county limit, following the pollution caused by the companies S.C. AZOMURES S.A. si R.A. AQUASERV (Cristeşti Cleansing Station). Special problems to these indexes appear during the months with low flows of the river (January, February, July, August, December).

Within this work I studied the variability in time and space of the susceptibility to euthrofization of the river Mure□. The variability in time was emphasized through the study of situations which characterize 5 different years: 1995, 1999, 2003, 2007, 2009. In which concerns the variability in space, I chose for study the track situated upstream of Tg. Mure□ municipal city (represented by Glodeni section) and the track downstream to the municipality (represented by Ungheni section). The distance between the two sections analyzed is of 34 km. The index chosen for characterization were total natrium and total phosphorus.

The evolution of nitrogen, phosphorus compounds and the assessment of the euthrofization risk in the section upstream *Tg. Mureş* during the years: 1995, 1999, 2003, 2007, 2009 is based on analytical data presented in the tables: 1,2, 3, 4 and are presented in the tables: 5,6,7,8.

The surface of the hydrographic basin taken into account: S= 4105 Km^2

Table1

Evolution of average annual concentrations with nitrogen (mg/l) in the upstream control section Tg. Mure□.

Index	1995	1999	2003	2007	2009
NH^+	0,68	0,58	0,46	0,107	0,366
NO_2^-	0,11	0,108	0,092	0,015	0,076
NO_3^-	4,37	4,15	2,76	0,642	2,097
N-total	1,543	1,422	1,010	1,622	3,403
Q(mc/s)	29,7	53	27,6	38,5	33,7

Table 2

Evolution of average annual concentrations with phosphorus (mg/l) in the upstream control section Tg. Mure□

Index	1995	1999	2003	2007	2009
P-total	0,035	0,063	0,46	0,172	0,065
Q (mc/s)	29,7	53	27,6	38.5	33,7

Table 3

Evolution of average annual concentrations of compounds with nitrogen (mg/l) in the upstream control section Ungheni.

Index	1995	1999	2003	2007	2009
NH^+	2,99	2,34	2,26	1,019	1,181
NO_2^-	0,44	0,40	0,51	0,062	0,064
NO_3^-	15,40	11,90	12,70	1,277	1,884
N-total	5,94	4,63	4,78	3,34	3,97
Q(mc/s)	29,9	53,4	27,2	35,4	36,7

Table 4

Evolution of average annual concentrations with phosphorus (mg/l) in the control section Ungheni.

Index	1995	1999	2003	2007	2009
P-total	0,075	0,117	0,149	0,184	0,133
Q (mc/s)	29,9	53,4	27,2	35,4	36,7

Table 5

Evolution of loads of index N-total (tons/year), of the indexes I and R, in the upstream control section Tg. Mure

Index	1995	1999	2003	2007	2009
N-total (G)	1445,2	2376,7	870,4	1969,3	1681,3
I= G/S	352,0	578,9	212,0	479,7	409,6
R=I/200	1,76	2,89	1,06	2,39	2,04

Table 6

Evolution of loads of index P-total (tons/year), of the indexes I and R, in the upstream control section Tg. Mure

Index	1995	1999	2003	2007	2009
P-total	32,8	105,3	40,0	99,31	69,38
I= G/S	7,9	25,6	9,7	24,19	16,90
R=I/20	0,4	1,2	0,5	1,21	0,845

Table 7

Evolution of loads of index N-total (tons/year), of the indexes I and R, in the control section Ungheni

Index	1995	1999	2003	2007	2009
N-total (G)	5601	7797,0	4100,2	3728,68	4593,88
I= G/S	1303,2	1814,1	954,0	867,53	1068
R=I/200	6,5	9,1	4,8	4,33	5,34

Table 8

Evolution of loads of index P-total (tons/year), of the indexes I and R, in the control section Ungheni

Index	1995	1999	2003	2007	2009
P-total	70,7	197,0	127,8	205,07	154,24
I= G/S	16,4	37,4	29,7	47,71	35,88
R=I/20	0,8	1,9	1,5	2,38	1,79

I presented the sensitivity to euthrofization, expressed through the index R, for the years 1995, 1999, 2003, 2007, 2009, upstream and downstream of Tg. Mure, as diagrams presented in the Images 1, 2, 3 and 4.

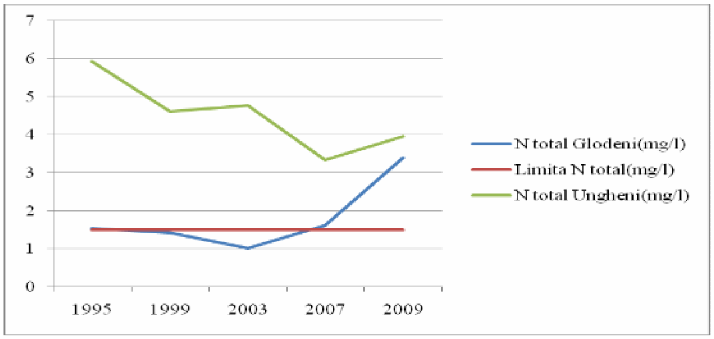

Image 1. Variation of concentration of total nitrogen (mg/l) in the period studied

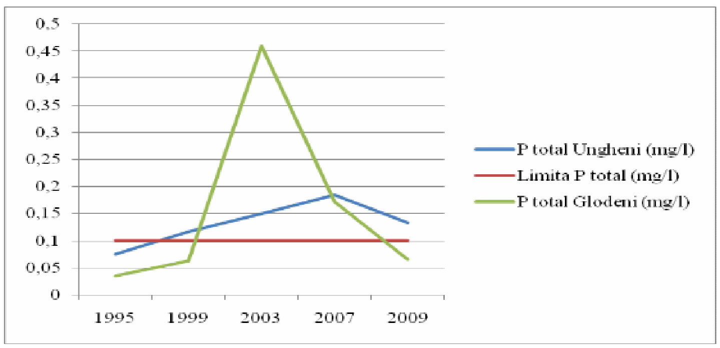

Image 2. Variation of the concentration of total phosphorus (mg/l) in the period studied

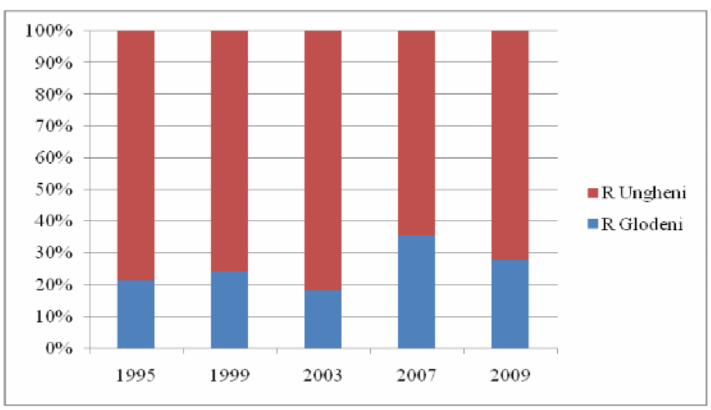

Image 3. Diagram in percentage for sensitivity of eutrophization for natrium

The previous diagram has the purpose to reveal the fact that in the last years studied, the contribution of the two major sources of pollution from the municipal city (S.C.Azomureş S.A. and R.A. AQUASERV) at the sensitization of the course to euthrofization was diminished. By performing the ratio $R_{Ungheni}/R_{Glodeni}$ for the 5 years studied, we notice a decrease of the contribution of total nitrogen of these pollution sources. This phenomenon is mainly caused to investments at the levels of the two sources of pollution (SC AZOMURES SA and SC AQUASERV SA), for the improvement of cleansing technologies and, implicitly, of the quality of cleansed waters. Thus, at SC AQUASERV SA the capacity of the biological step was extended to the level of the capacity of mechanical step of cleansing and, starting with September 2009 the tertiary step of cleansing was applied. All these steps address almost exclusively to the advanced elimination of nitrogen compounds.

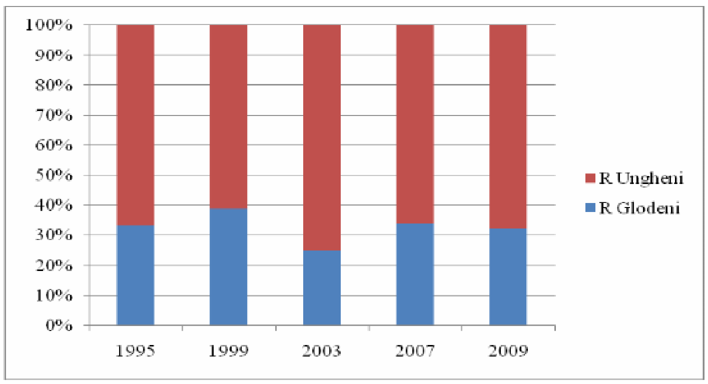

Image 4. Diagram in percentages for the sensitisation to euthrofization for phosphorus

We notice that the influence of the two sources of pollution is not as meaningful for the total phosphorus index as in the case of nitrogen. An explanation would be the fact that waste waters with large content of phosphorus resulted in the manufacture of complex fertilizer NPK are not eliminated in the emissary, but they are recycled in the technological process. The new catch pit through which the waters arerecycled is in a good technical status, and the phosphorus is not an element with excess in control drills. Another observation is the one that, after the year 2007, we do not notice in this case a special improvement of the quality of water.

CONCLUSIONS

The study’s major conclusions are:

Section upstream of Tg. Mure□:

- From the point of view of total nitrogen, on the entire duration of time studied, the quality of water in the section reveals the fact that it is a sensitive trophic area, without significant excess
- From the point of view of total phosphorus on the entire duration of time studied, the quality of water in the section reveals the fact that, in general, it is not a sensitive euthrofic area.

Ungheni section:

- From the point of view of total nitrogen, on the entire duration of time studied, the quality of water in the section reveals the fact that it is a sensitive euthrofic are with significant excess.
- From the point of view of total phosphorus on the entire duration of time studied the quality of water in the section reveals the fact that it is a sensitive euthrofic area with significant excess

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