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Nitrate pollution of waters in the Timis County

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Abstract: The paper presents the Timis County hydrographical network, a very extended network having a sufficient quantity of water for the population and economy needs. The main issues are the water supply network and the sewage network as well as the nitrate pollution of the surface and ground waters. The water supply networks exist in 73 of the 95 localities of the county whereas the sewage system is totally insufficient. Therefore, some recommendations are mandatory in order to reduce the surface and ground waters pollution.

Keywords: pollution, nitrates, surface and ground waters.

1. INTRODUCTION

The Timis County has a dense hydrographical network meaning that, during canicular periods, the inhabitants do not suffer from the lack of water.

It consists of the following water courses:

The Mures River flows in the northern part of the county for 42 km. At the south of the Mures, flows Aranca for 104 km, of which 65 km in the Timis County. The Bega Veche has a 88-km length and many tributaries such as the Bacin, the Surduc, the Niarad and the Apa Mare streams. The Bega springs from Poiana Rusca mountains and has two linking canals with the Timis River: between Costei and Chizatau (supply) and between Topolovatul Mare and Hitias (drainage) as well as the Bega sailing canal, between Timisoara and the Tisa confluence.

The Timis flows through the county for 141 km and has as tributaries, the Poganis, the Lunca Birda, the Nadrag and the Spaia. The most southern rivers are the Barzava and the Moravita.

In the Timis Plain, there are some types of lakes such as:

- relict lakes which are remnants of the swamps that covered a part of the plain (Satchinez and Becicherecul Mic);
- fluvial lakes formed in the left and partially clogged arms of the Barzava, the Bega and the Timis rivers (Macedonia, Ionel, Nitchidorf, Cebza, Obad);
- compaction lakes fed by the surface waters from rainfalls (Valcani, Deta, Izvin, Voiteg);
- artificial lakes resulted from a direct or indirect action having economic purposes;
- lakes formed in the excavations resulted from clay extraction (Carpinis, Sannicolaul Mare, Jimbolia, Deta, Timisoara);
- water storages formed as a result of building dams (Surduc, Giarmata, Satchinez, Manastur);
- fish ponds (Dinias, Urseni, Nadrag, Bazosul Vechi, Partos).

2. MATERIAL AND METHOD

In urban areas, over 99% of the population has access to the drinking water supplied through the sanitary authorised systems. In the Timis County, 73 of the localities, of which 10 are cities, have drinking water. As opposed to this, only 18 localities, of which 9 are cities, have a sewage network with a length of 728 km. This means that the Timis communes do not have sewage even if they have water supply; therefore, the wastewaters are discharged without any control.

The statistics drawn up by the Regional Agency of Environmental Protection show that the water supply sources, both ground and surface ones, managed to ensure the people's water needs. The population uses over 55% of the surface water in over 135 drillings and catchments and other hundreds of fountains in the rural areas. Industry uses around 28 % and agriculture, 17%.

As far as the drinking waters are concerned, the metering (in the industrial and household areas), the economic agents drillings and the water management have reduced the water volume used.

The Regional Agency of Environmental Protection warns regarding the water pollution in the Timis County, with a lot of critical areas to be dealt with. Thus, the sailing Bega water course, downstream of Timisoara – borderline is suffering for a length of 34 km, a major modification of the water quality in comparison with the upstream part to Timisoara. The main cause is represented by the discharges of wastewaters from Timisoara and the quick process of mineralisation of the organic substances in the mud deposited in the canal bed. The Șurgani watercourse which flows through Buziaș is polluted by the wastewaters discharged from the city, which are insufficiently purged and by the pollution sources in the agricultural area. At Gataia, the Barzava is affected by the unpurged and insufficiently

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purged wastewaters coming from canalling Resita and Bocsa and from the wastewaters discharged by SC Colini Bocsa.

In the Bega- Timis basin, the major sources of pollution are Aquatim Timisoara, Meridian 22 Lugoj, Deta Town Hall, SC Smithfield with Ciacova and Peciu Nou farms.

In the Aranca sub-basin, the pollution sources are S.C. Gosan Sannicolau Mare and SC Zoppas Industries which discharge the wastewaters in the Mureșan canal and Lovrin Town Hall which discharges the waters in the Galațca.

The quality of the ground waters in the main drillings made in the surface layer is slightly declining, recording exceedings of the maximal admitted limit at at least one water quality index. It is interesting that the pollution level is maintained in the risen surface water layer and in the areas in which some productive units have reduced their activity or have been closed down.

In the depth surface water layer, the water quality is unsatisfactory in the majority of the investigated drillings, recording exceedings of the maximal admitted limit for the ammonium and manganese index.

Critical areas of the pollution well beyond the admitted limits of the surface water layers are:

- In the Margina area from Solventul Margina;
- On the Bega canal – Balint sector due to the lack of sewage and of the incorrect administration of the fertilisers on the agricultural lands;
- On the Timis river, upstream Costei – borderline, from the households, due to the insufficient sewage network and of the lack of the purging stations of the wastewaters;
- On the Barzava river, from the zootechnical compounds and from the households in Deta;
- On the superior stream of the Bega Veche and the tributaries in the superior basin – from the agricultural and zootechnical activities and from the storage basins with the wastewaters from the former pig raising farms.

Lately, there have been some investments in this respect such as:

-sewage for wastewater in Costeiu, Tipari and Paru and purging station at Costeiu;

- sewage for wastewater discharging the wastewaters into the municipal sewage network of Timisoara at Ghiroda;

- sewage for wastewaters for Giera and Toager and a purging station at Giera;

- drinking water supply for Grabaț, Bulgăruș, Lenauheim;

- extension and modernisation of the drinking water treatment station and distribution network Nadrag;

- retechnologisation of the purging station and rehabilitation of the sewage network at Tomești;

- rehabilitation and extension of the drinking water supply system of Varias, Sanpetru Mic, Gelu.

The following works to be done are rehabilitation of the purging technology for the wastewaters and modernisation of the sewage network in Timisoara.

3. RESULTS AND DISCUTIONS

a). Surface waters quality

The surface waters quality has been determined on the Bega river, upstream of Timisoara and Timisoara, on the Bega Veche river, Pischia and Cenei section, on the Timis river, Sag section and on the Lanca – Birda, Ghilad section. The data are presented in tables 1-6.

Table 1. The Bega river, upstream of Timisoara section

Parameters	Minimum	Maximum	Average	Class
Flow	13.7	17.6	15.5	
pH	7.3	7.8	7.5	I
Suspensions mg/l	11	59	21.3	III
NH_4 mg/l	0.054	0.171	0.115	I
NO_2 mg/l	0.005	0.037	0.012	II
NO_3 mg/l	0.140	0.838	0.567	I
Norg mg/l	0.003	1.761	0.537	
Ntot mg/l	0.540	1.960	1.232	I

Table 2. The Bega river, Timisoara Section

Parameters	Minimum	Maximum	Average	Class
Flow	12.7	20.8	16.3	
pH	6.8	7.5	7.2	I
Suspensions mg/l	10	53	19.1	III
NH_4 mg/l	1.524	3.741	2.099	IV
NO_2 mg/l	0.032	1.281	0.170	IV
NO_3 mg/l	0.113	1.359	0.485	I
Norg mg/l	0.003	1.398	0.286	
Ntot mg/l	1.800	4.520	3.040	II

Table 3. The Bega Veche river, Pischia section

Parameters	Minimum	Maximum	Average	Class
Flow	0.10	6.60	0.993	
pH	7.3	8.2	7.9	I
Suspensions mg/l	12	173	65.8	V
NH_4 mg/l	0.031	0.233	0.089	I
NO_2 mg/l	0.001	0.198	0.046	II
NO_3 mg/l	0.178	5.347	2.953	III
Norg mg/l	0.016	1.710	0.730	
Ntot mg/l	1.790	5.880	3.818	II

Table 4. The Bega Veche river, Cenei section

Parameters	Minimum	Maximum	Average	Class
Flow	1.4	11.5	5.15	
pH	7.9	8.4	8.2	I
Suspensions mg/l	2	71	14.8	III
NH_4 mg/l	0.016	0.467	0.134	I
NO_2 mg/l	0.010	0.067	0.033	III
NO_3 mg/l	0.867	6.431	2.471	II
Norg mg/l	0.004	6.552	1.103	
Ntot mg/l	0.897	13.490	3.741	II

Table 5. The Timis river, Sag section

Parameters	Minimum	Maximum	Average	Class
Flow	4.3	168	51.5	
pH	7.2	7.7	7.5	I
Suspensions mg/l	9	53	21.1	III
NH_4 mg/l	0.047	0.560	0.181	I
NO_2 mg/l	0.003	0.043	0.017	II
NO_3 mg/l	0.059	1.974	0.752	I
Norg mg/l	0.002	2.005	0.649	
Ntot mg/l	0.610	4.560	1.599	II

Table 6. The Lanca- Birda, Ghilad section

Parameters	Minimum	Maximum	Average	Class
Flow	0.001	4.55	0.952	
pH	7.9	8.4	8.1	I
Suspensions mg/l	8	32	18.3	III
NH_4 mg/l	0.016	0.490	0.104	I
NO_2 mg/l	0.018	0.079	0.045	III
NO_3 mg/l	0.359	5.187	2.137	II
Norg mg/l	0.002	2.353	0.408	
Ntot mg/l	0.610	5.570	2.695	II

It is observed that, as far as the pH and the ammonium nitrate content are concerned, all the surface waters are of Class I except for the Timisoara section, where the ammonium nitrate is classified as Class IV.

The total nitrogen content (including the organic nitrogen) classifies the waters in the studied sections into Class II, except for the upstream of Timisoara section, where we find Class I.

The content of ammonium nitrate classifies the surface waters into Class I and II; only in Pischia section, on the Bega Veche river, the quality class is III.

The content of suspensions corresponds to the quality class III; only in the Pischia section, on the Bega Veche river, corresponds to the quality class V.

Of all the six sections from which water samples have been analysed, it is observed that in four sections (Ghilad, Șag, Cenei, Timișoara and Timișoara upstream), the water quality is classified between classes I –III and only in the Pischia and Timisoara section, into classes IV and V.

b). The quality of ground waters in the Bega/Timis Hydrographical Basin (table 7, table 8)

It has been noticed that the pH is between admitted limits while the natrium content exceeds the admitted limit almost twice in the drillings at Cebza, Graniceri and Giera.

The ammonium content is exceeded at Belinț and Foeni, and at Dolaț, Beregsău and Jimbolia it is exceeded almost three times.

The nitrate content is between the admitted limits, but the nitrite content exceeds the admitted limits at Parța and Biled.

The chlorine content is exceeded only at Beregsau.

Table 7. Timisoara, Hydrological Station, Timis Sub-basin

Drilling	pH	Na, mg/l	NH_4, mg/l	NO_3, mg/l	NO_2, mg/l	Cl, mg/l
Găvojdia	6,8	100	0.01	0.23	0.090	14,4
Chevereșu Mare	7,3	72	0.03	37,26	0,048	31,6
Diniaș	7,8	118	0,08	1,67	0,020	14,0
Cruceni	7,1	103	0,43	0,36	0,035	14,7
Jebel	7,8	49	0,02	1,17	0,015	59,0
Parța	7,5	70	0,04	19,61	**0,976**	22,0
Belinț	6,8	23	**0,54**	0,16	0,084	10,8
Urseni	7,1	104	0,18	25,73	0,273	64,6
Foeni	6,9	58	**0,53**	4,23	0,050	10,3
Cebza	8,1	**282**	0,13	0,31	0,038	27,4
Otvești	7,4	40	0,01	1,10	0,012	21,8
Chișoda	7,4	43	0,04	33,33	0,067	32,0
Grăniceri	7,1	**283**	0,03	1,24	0,043	34,7
Giera	5,4	**200**	0,03	16,35	0,014	27,4
Voiteg	7,3	30	0,15	21,68	0,049	23,0
Dolaț	6,2	99	**1,33**	0,72	0,002	92,0

4. CONCLUSIONS

The surface and ground waters pollution has serious effects on the biosphere, affecting the water life from microorganisms to insects, fish and birds, but also the health of the animals and of the plants.

Pollution also affects people's possibility of using the water. Based on the pollution type and intensity, its use may be diminished or annulled.

The most serios complication is related to human health and to the health of different plants and animals which live in waters or come into a direct or indirect contact with them.

In order to diminish the negative impact on the human health, we have to know not only the water's quality, but also its quantity and hydrodynamics, the water courses and the works' morphology. The worsening of the water quality in the neighbourhood affects the migration of the rural population, produces socio-economic effects and cuts down investments.

Table 7. The Bega Veche Sub-basin

Drilling	pH	Na, mg/l	NH_4, mg/l	NO_3, mg/l	NO_2, mg/l	Cl, mg/l
Beregsău-pollution	7,1	110	**1,68**	1,72	0,018	**295**
Jimbolia-pollution	7,5	147	**1,56**	0,99	0,180	38,6
Becicherecu Mic	8,0	130	0,01	9,64	0,070	134,8
Pișchia	7,2	24	0,01	132,5	0,003	27,4
Orțișoara	7,6	66	0,35	2,95	0,003	10,7
Biled	8,3	143	0,01	10,08	**0,340**	113,4
Bobda	7,5	270	0,18	0,33	0,075	30,9
Săcălaz	7,3	134	0,20	0,40	0,020	161,4
Sânandrei	7,8	75	0,03	2,30	0,250	37,5
Grabaț	7,9	143	**0,66**	0,08	0,030	11,8
Bencecu de Sus	8,1	14	0,01	17,00	0,160	220,4

Improvement of the water quality of a river can be obtained through non-structural techniques such as stopping the pollution, modifying the legislation, standars, education, rebuilding the humid areas, and through structural techniques such as fences, protection, use of vegetation and of organic substances.

The prevention of water pollution is much simpler than its treatment. When the preventive measures are taken too late or have not had the expected effect, treatment must be sought, which could be extremely expensive, complicated and might have risks and unwanted adverse effects.

Protection cannot be done only by avoiding the spillage of some pollutants into the waters, but also by maintaining the waters natural and healthy, with their intact capacity of natural purging. The protection of the surface and ground waters' health is very important for the population, animals and plants.

Some of the specific measures characteristic to some pollutant classes are:

- Acidification can be avoided by reducing the discharges of nitrogen and sulphur oxides. The acid mining waters are neutralised with lime or with other alkaline substances.

- Eutrophication affects especially the lakes. It can be controlled through external measures such as the reduction of nitrogen and phosphorus supply.

- The high concentrations of suspensions in the water can be prevented by controlling the erosion, by maintaining the protective curtains, by planting vegetation on the banks of the hydrotechnical works.

- The nitrates in the waters can be controlled by different measures: not applying fertilisers on the ground in excess or outside the vegetation period, reducing the soil erosion.

Salinisation can be controlled by efficient irrigation, by drainage, by depositing and injecting the saline waters, by purging the saline industrial waters and by not sprinkling salt on the roads.

The protection of the surface and ground waters has as a purpose maintaining and improving their quality and natural productivity in order to avoid some negative effects on the environment, on human health and on goods by:

-prohibiting the random discharge of the residues of any kind which might pollute the water and especially the household and industrial wastewaters. They must be collected and removed through sewage systems or through local collecting installations;

- building purging stations in order to collect and degrade the polluting organic substances found in the residual waters of the localities of the zootechnical units before their discharge into the water;

- purchasing some collecting systems for the radioactive substances found in the wastewaters.

The idea of preservation implies abiding by some ecological principles which must include the following:

-inventive actions to solve the environmenal degradation;

-promoting the efficient use of the natural resources;

-applying the 'those who pollute must pay' principle;

-establishing the responsibility for the damages on the environment;

-acknowledging the fact that the laws should be applied immediately.

The protection of the environment, the principles of democracy and market economy must be integrated in any civilised society, having a direct influence on the efforts to achieve a sustainable and healthy development. All of these require the involvement of the local and national authorities.

REFERENCES

[1] N. Benjamin, Nitrates in the human dit-good or bad, Annales de Zootechnologie, 2006, pg. 207-216

[2] Gh.Neag , Depoluarea solurilor şi apelor subterane, Casa Cărţii de Ştiinţă, Cluj-Napoca, 2005

[3] H. Rădulescu, Poluare şi tehnici de depoluare a mediului,, Editura Eurobit, Timişoara, 2001

[4] P. Şerban, Planul de management al Spaţiului Hidrografic Banat, Timişoara, 2005

[5] A. Varduca, Protecţia calităţii apelor, Editura HGA Bucureşti, 2006

[6] D.S.Piwlson, T.M. Addiscott, Nitrates, Elsevier, Encyclopedya, vol.3, pg.

[7] Legea Protecţiei Mediului 137/1995

[8] Legea Apelor 107/1996 cu modificările şi completările ulterioare

[9] Planul de management al spaţiului hidrografic Banat, Direcţia Apelor Banat.