Water Quality Discharged from Galati Town Area Throw Sewerage Network, in the Danube River

Stefan Dragomir[1], **Georgeta Dragomir**[2]

Abstract: Water quality is very important and good water must accomplish a lot of standards in domain: chemical, physical, microbiological, biochemical, radiological. The European standards in according with National standards, show the sampling method and the types of analyse that must make for water that must be submitted to diverse analysis. Was establishing some important locating points for sampling of water discharged in the Danube – Galati town area. It was made determination of contaminants from water discharged into the river throw sewage network Danube; quantitative evaluation of contaminants and than selecting appropriate equipment for neutralizing contaminants from wastewater.

Keywords: water quality standards; sewerage network; monitoring system

1. Introduction

To develop good human activities, one of the most important problems for Galati district is to ensure good parameters every day for drinking water. In that case it is necessary to use advanced cleaning technologies to processing approximately six billion liters of water, daily. This cleaning means to make the waste water treatment using mechanical equipment, chemical and biological (Berné & Cordonnier, 2009) that necessity complexes installation. These equipment (pump, filter, settling basins, cleaning substances, pipes and other) make part from modern cleaning installation.

A good standard of life for people means to develop human activities in a clean environment. Following this ideas the drinking water parameters must be all the time in normal range accepted. The new equipment used for cleaning the polluted

[1] Professor, PhD, Dunarea de Jos,University of Galati, Romania, Address: 47 Str. Domnească, Galați, Romania, E-mail: gretadragomir@univ-danubius.ro
[2] Professor, PhD, Faculty of Economic Sciences, Danubius University of Galati, Romania, Address: 3 Galati Blvd., Galati 800654, Romania, Tel.: +40372361102, Corresponding author: gretadragomir@univ-danubius.ro.

water is to diminish the quantities of pollutants substances discharged by diverse users.

We sampling and analyzed waste water in five important discharged points along Danube cliff (Galati town) and the results recorded us comparing with accepted National standards NTPA 001.

A major cause of water polluted is the greatest quantity of waste produced by population, industries and services in quantity of about 250 tones/day.

The waste water is evacuated in same old sewerage of town network through cleaning units or directly through a simple decanting basin.

Many digital devices exists to respond to the demand of methods requiring less time, less manpower and less financial effort, because the hardware and sensor technologies development. These instruments provide accurate on-line estimations for water parameters and samples collect and analyzing give a complex dimension of the water quality status and evolution in hydrological basins of Prut and Danube.

In our country has develop a system to following the environmental quality approach to standard setting and establishing the limits on levels of pollutants in the water.

2. Research and Experiments

The researches may collect and estimate the quantities of polluted substances discharged in Danube River.

First of all we must to identify the location of discharged point of waste water along Danube cliff. Using flow meters we may to determine precisely the amount of polluted water on each point of discharge and with a photoelectric cells we analysis in the infrared spectrum the waste water discharged in the Danube

The decrease of dissolved oxygen quantity in Danube water has determined an incipient process of diminishing the oxygen of Danube Delta waters and the extinction of several valuable fish species (example, sturgeon).

The positioning of Galati City at the “gates” of Danube Delta imposes better and efficient treatment of wastewaters discharged in the Danube River.

The geographical coordinates of the envisaged area (Galaţi district) are: 28 ^{0} 01' E and 45^{0}25' N. Galati district is located in the eastern extremity of Romania, between junction Danube - Siret and junction Danube – Prut.

Galati district is situated at a junction point of five geographical units Danube floodplain, Macin Mountains, Baragan Plain, the Low Siret Plain and the Covurlui Plain.

Galati City is surrounded by two water accumulation: Brateş lake (area of 24 km^2) in the East of the City and Catuşa Lake situated in the West of the city.

The most important point of evacuation of waste water, by using the sewerage network around Galati city is shown in the table no. 1.

Flow rates and discharged wastewater volumes from the evacuation points of Galati City by using sewerage network make part in our research (Dunea & Moise, 2004).

In the Table no.1, we see too, the estimate volume of waste water - in cubic meters- that was discharged in every day, in five important points along Danube cliff(south-east of Galati town).

Volumes of polluted water daily discharged in area of Danube cliff river

Table 1

No.	The overflow points around town	Volumes of polluted water daily discharged, m^3	Name of the effluent
1.	Neighborhood Dunarea	78.5	Discharged from Micro 17, Micro 19, micro20 and 21.
2.	Ferryboat sector	114.5	In Danube River, discharged from Tig.1,2.3.4.
3.	Kaptan ship point	45.9	In Danube River , discharged from Mazepa1and 2 neighborhood
4.	Danube waves restaurant	28.7	In Danube River throw cleaning unit (I.C.Bratianu park), discharged from down town city.
5.	Damen Shipyard	17.9	In Danube River, discharged from PORT neighborhood and shipyard Damen.

The total flow discharged by public sewage systems is about 285.0 m^3/ daily. We observe in the next table (table no. 2A, 2B, 2C, 2D, 2E) that the recorded parameters for water samples collected from Danube. Like example we show the measurement recorded in each sector made in middle of August 2014, and we compare with acceptable level (National quality standards NTPA 001). We made in every point sowing in the table no.1, a number of 22 to 24 measurements of pollutants between 8 – 9,30 hour a.m.

For sampling we used standardise bottle (marked with hour and day of sampling) with thermo isolation and keep at 4° C in the fridge.

In our experiment we use SL 159 UV/VIS Spectrophotometers - code: SPECTRO-V/UV-16/18.

UV/Visible spectroscopy offers the maximum flexibility and is suitable for applications in the wavelength range 190 to 1100nm.

In UV/Visible spectroscopy the UV region is considered to be any wavelength less than 340nm. Nucleic acid, purified proteins and other organic molecules are often measured in the UV region.

A single-beam spectrophotometer measures the relative light intensity of the beam before and after a test sample is inserted. Single-beam instruments can have a larger dynamic range and are optically simpler and more compact.

In this paper are presented the most significant measurements. We see a exceeding of the quantities of pollutants by comparing with National Standards of the most dangerous pollutants for human health are **ammonia nitrogen, synthetic detergents, cyanide, phosphates.**

Quantities of pollutants at the high Danube cliff

Table 2A

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
1	Temperature	25	26	°C
2	pH	6,5 – 8,5	7,7	unities pH
3	Suspension in water	35	120	mg / l
4	CBO_5	20	132	mg / l
5	CCO - Cr	125	146	mg / l
6	**Ammonia nitrogen NH_4^+**	2	15	mg/l
7	Nitrogen total N	10	13	mg / l

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
8	Sulphides and H_2S	0,5	0,8	mg /l
9	Phosphorus	1,0	3	mg /l
10	**Synthetic detergents**	0,5	16	mg /l
11	Substances extractable	20	33	mg /l
12	Total iron ion Fe^{2+}, Fe^{3+}	0.5	0.9	mg /l
13	**Total Cyanide**	0,1	1,7	mg /l
14	Nickel, Ni^{2+}	0,1	1,4	mg /l
15	Chromium trivalent Cr^{3+}	1,0	1,3	mg /l
16	Chromium hexavalent Cr^{6+}	1,0	1,1	mg /l
17	Copper Cu^{2+}	0,1	1,2	mg /l
18	Chlorides Cl	500	532	mg /l
19	**Phosphates PO_3^-**	1	2,2	mg /l

Quantities of pollutants at **Ferryboat sector**

Table 2B

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
1	Temperature	25	26	ºC
2	pH	6,5 – 8,5	7,2	unities pH
3	Suspension in water	35	280	mg / l
4	CBO_5	20	189	mg / l
5	CCO - Cr	125	327	mg / l
6	**Ammonia nitrogen NH_4^+**	2	34	mg/l
7	Nitrogen total N	10	17	mg / l
8	Sulphides and H_2S	0,5	1,2	mg /l
9	Phosphorus	1,0	5	mg /l
10	**Synthetic detergents**	0,5	22	mg /l
11	Substances extractable	20	40	mg /l

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
12	Total iron ion Fe^{2+}, Fe^{3+}	0.5	-	mg /l
13	**Total Cyanide**	0,1	1,9	mg /l
14	Nickel, Ni^{2+}	0,1	0,8	mg /l
15	Chromium trivalent Cr^{3+}	1,0	1,3	mg /l
16	Chromium hexavalent Cr^{6+}	1,0	1,1	mg /l
17	Copper Cu^{2+}	0,1	1,5	mg /l
18	Chlorides Cl	500	584	mg /l
19	**Phosphates PO_3^-**	1	3,2	mg /l

Quantities of pollutants at Kaptan ship point

Table 2C

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
1	Temperature	25	26	ºC
2	pH	6,5 – 8,5	7,5	unities pH
3	Suspension in water	35	174	mg / l
4	CBO_5	20	142	mg / l
5	CCO - Cr	125	225	mg / l
6	**Ammonia nitrogen NH_4^+**	2	21	mg/l
7	Nitrogen total N	10	11	mg / l
8	Sulphides and H_2S	0,5	1,3	mg /l
9	Phosphorus	1,0	3.2	mg /l
10	**Synthetic detergents**	0,5	17	mg /l
11	Substances extractable	20	28	mg /l
12	Total iron ion Fe^{2+}, Fe^{3+}	0.5	-	mg /l
13	**Total Cyanide**	0,1	1,3	mg /l
14	Nickel, Ni^{2+}	0,1	0,2	mg /l
15	Chromium trivalent Cr^{3+}	1,0	1,1	mg /l

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
16	Chromium hexavalent Cr^{6+}	1,0	1,3	mg /l
17	Copper Cu^{2+}	0,1	0,4	mg /l
18	Chlorides Cl	500	528	mg /l
19	**Phosphates PO_3^-**	1	2,2	mg /l

Quantities of pollutants **Danube waves restaurant**

Table 2D

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
1	Temperature	25	26	ºC
2	pH	6,5 – 8,5	7,4	unities pH
3	Suspension in water	35	187	mg / l
4	CBO_5	20	96	mg / l
5	CCO - Cr	125	221	mg / l
6	**Ammonia nitrogen NH_4^+**	2	24	mg/l
7	Nitrogen total N	10	13	mg / l
8	Sulphides and H_2S	0,5	0,8	mg /l
9	Phosphorus	1,0	2.8	mg /l
10	**Synthetic detergents**	0,5	12	mg /l
11	Substances extractable	20	28	mg /l
12	Total iron ion Fe^{2+}, Fe^{3+}	0.5	-	mg /l
13	**Total Cyanide**	0,1	1,3	mg /l
14	Nickel, Ni^{2+}	0,1	0,3	mg /l
15	Chromium trivalent Cr^{3+}	1,0	1,2	mg /l
16	Chromium hexavalent Cr^{6+}	1,0	0,9	mg /l
17	Copper Cu^{2+}	0,1	1,2	mg /l
18	Chlorides Cl	500	513	mg /l

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
19	**Phosphates PO_3^-**	1	1,2	mg /l

Damen Shipyard

Table 2E

No.	Indicator	NTPA 001 Maximum acceptable level	Recorded	u. m.
1	Temperature	25	26	^oC
2	pH	6,5 – 8,5	7,2	unities pH
3	Suspension in water	35	232	mg / l
4	CBO_5	20	136	mg / l
5	CCO - Cr	125	187	mg / l
6	**Ammonia nitrogen NH_4^+**	2	3	mg/l
7	Nitrogen total N	10	12	mg / l
8	Sulphides and H_2S	0,5	0,9	mg /l
9	Phosphorus	1,0	2.1	mg /l
10	**Synthetic detergents**	0,5	21	mg /l
11	Substances extractable	20	43	mg /l
12	Total iron ion Fe^{2+}, Fe^{3+}	0.5	0.8	mg /l
13	**Total Cyanide**	0,1	1,8	mg /l
14	Nickel, Ni^{2+}	0,1	0,6	mg /l
15	Chromium trivalent Cr^{3+}	1,0	1,1	mg /l
16	Chromium hexavalent Cr^{6+}	1,0	1,2	mg /l
17	Copper Cu^{2+}	0,1	1,2	mg /l
18	Chlorides Cl	500	527	mg /l
19	**Phosphates PO_3^-**	1	1,9	mg /l

The most polluted areas are "**Ferryboat sector"** and "**Damen Shipyard".**

The most dangerous pollutants for human health, can be see (table no.2A, 2B, 2C, 2D, 2E): **ammonia nitrogen, synthetic detergents, cyanide, phosphates**. We see that the overcome is about 3 to 8 times higher – In area nominalised- like normal accepted in National quality standards NTPA 001.

5. Conclusions

To investigate potential issues in improving the quality of residents life from Galaţi City and surrounding region and reducing pollution levels in the Danube River and its downstream locations by implementing an automated monitoring system of water parameters (Dunea & Moise, 2004), which integrates satellite images, in-situ measurements and that use informational fluxes, by using GPS technology.

The measures proposed to implement an integrated monitoring of pollution sources along the Danube cliff in Galati town, consist in:

design the hardware, communication and software infrastructure of such informational and decisional system;
establish the points from where we collect water samples and control sections that existing in the monitoring plan for that work;
repair and improving the actual sewerage network system;
ensure the expenditure required for operation of maintenance and repair network sewerage system (Cornelissen, Sijbers, Berkmortel, Koning, De Wit, De Nil & Van Impe, 2001, pp. 6-9);
improving the cleaning units for waste water (Vovich & White, 1990, pp. 235-252) can be considered as a cost capital investment.

Then it must to calculate the costs of construction, cleaning equipments, the maintenance for them and each other variable in this complex process.

One important exercise when it calculates various options for network sewerage system is to examine and compare the costs and benefits of each. Then it must to calculate the costs of construction, cleaning equipment, the maintenance for them and each other variable in this complex process.

These include both capital costs and the operating time. It is important to estimate exactly the number of people who will benefit directly from that facility.

The waste water monitoring (Degrémont, 1991) need for the first to ensure some location in the Galati district and a good link with GPS system that allows automated the correlation with water quality data.

Water quality data can be collected at the sampling points established in the monitoring plan by.

An automated monitoring integrated system must to give information (using the Satellites network) for decisional support and for the measurement that can be making. A specialized computer, controls the system that have instruments and devices for coupling at computer interface, based on real time information receive about quantity of diverse substance dissolved in water samples.

Statistical Processing permits a better interpretation of the parameters evolution according to specialist's will is performing. Data acquisition for water parameters developing, permit to compare the pollution waters water parameters at precisely time periods and then the environmental authority must to take the measures for eliminate the polluted source.

We can say that is necessary to respect the standards concerning quality of Danube, Prut and Siret rivers that influence the Danube Delta ecosystems.

References

Berné, F. & Cordonnier, J. (2009). *Tratement des eaux/Water treatment.* Paris: Ed. Technip.

Cornelissen, E.R.; Sijbers, P.; Berkmortel, H.; Koning, J.; De Wit, A.; De Nil, F. & Van Impe, J.F. (2001). Reuse of leachate waste-water using membranes technology and reverse osmosis. *Technology*, Vol. 2001, Issue 136, pp. 6-9.

Degrémont, G. (1991). *Water Treatment Handbook*. Vol. 2. Paris: Lavoisier Publishing.

Dunea, D. & Moise V. (2004). Automated monitoring potential for water quality assessments in the Galați sector of Danube River, Conference volume *The Danube and Europe-Integrated Space Applications in the Danube Basin*. Mamaia, Romania.

Lvovich, M.I. & White, G.F. (1990). *Use and transformation of terrestrial water in systems, in The Earth as Transformation by Human Action, global and regional changes.* Ed. B.L.Turner A.O., Cambridge Press, pp. 235-252.

Robescu, D. & Robescu, D. (2010). *Procedee, instalaţii şi echipamente pentru epurarea apelor/Processes, installations and equipment for water purification*. Bucharest: Litografia UPB.