EVOLUTION OF THE OLT RIVER QUALITY, UPSTREAM AND DOWNSTREAM OF THE WASTEWATER DISCHARGES FROM S.C. OLTCHIM S.A. RAMNICU VALCEA IN THE PAST THREE YEARS

Maria Taralunga[1], Mihaela Iordache[1, 2], Luisa Roxana Popescu[1, 2]

[1] National Research and Development Institute for Industrial Ecology– Ramnicu Valcea Subsidiary, 1 Uzinei St., tel./fax: +40 250 73 75 43, email: ecoind@vl.ro

[2] „Politehnica" University of Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Polizu Street, Sector1, Bucharest, 011061, Romania

The aim of this study was to indice evolution of the Olt river water quality in the Ramnicu Valcea industrial aria in the past three years.

S.C. Oltchim S.A. discharging wastewater with inorganic and organic load by two final effluent wastewater „Camera de amestec" and „Biological Treatment Station".

The Olt river quality control was realized between Priza Olt Nr.2, upstream, Cremenari and Babeni Marcea, downstream, according with National Legislation.

In the downstream sections, in the all three years, was observed increased of the organic and inorganic water pollution in comparison with Section Priza Olt.

In all section, γ-HCH izomer, was situated into limit by 0.02 μg/l, 1,2 dichloroethane was falling values in the 10,0 μ g/l imposed by National Legislation, the other organochlorine chemicals (hexachlorobenzene and 1,2,4 trichlorobenzene) taking values below the detection method.

In the last three years there was no heavy metal pollution: mercury, nickel, chromium and cobalt, in three sections.

The other factors which affect the Olt river water quality in the Ramnicu Valcea industrial aria, are the hydro-electric plant programs, the quantity of precipitation and the other pollutant accidents.

***Keywords**:* surface water, water pollution, organochlorine substances, heavy metals pollution

1. Introduction

Discharge of wastewater into rivers polluted physical, chemical and biological affects river water quality in the receiver, making more difficult to ensure water supply downstream. Protection of water quality is a complex and difficult problem that requires an extensive program of data collection on physical, chemical and biological characteristics of rivers and lakes. Knowing permanent stage, the evolution trends of the quality of waterways is essential to adopt fundamental decisions and need to be looked increasingly closer to their quality. In the middle of the Olt are located some of the major chemical platforms, which in studies performed years ago, proved to be primarily responsible for contamination of this river.

2. Experimental part

2.1. Study area

The surface water samples were collected in 3 sections, distributed upstream and downstream of chemical industrial area. This points was: Priza Olt (PO), 45° 2'20"N, 24°18'41"E; Cremenari (C), 44°58'50"N, 24°16'56"E; and Babeni-Marcea (M), 44°55'3"N, 24°14'52"E.

This area is located at 12 km south of the city of Ramnicu Valcea and in a closer vicinity of an industrial (main chemical) platform. Olt River is one of the most important rivers in Romania and is the largest and the longest Romanian tributary of the Danube river. It flows through the counties of Harghita, Covasna, Brasov, Sibiu, Ramnicu Valcea, Olt and Teleorman. Olt River flows into the Danube near Turnu Magurele, Islaz. It has a length of 615 km.

3.Results and discussion

Assessing the state of pollution of the Olt River upstream and downstream of discharges Valcea chemical platform in the past three years (2008-2010), was based on measurements performed in laboratory ECOIND Ramnicu Vâlcea points Priza Olt No. 2 (PO), Cremenari (C) and Babeni-Marcea (M), comparing results with requirements for approval of the Order Nr.161/2006 , "Norms on surface water quality classification in order to establish the ecological status of water bodies".

According Ord.161/2006, the quarterly average values are seen as indicators of changing class chlorides, calcium and sodium, (C) and (M) points compared to upstream (PO) as follows:

- pointer chlorides, are included in limited quality class I in (PO) and in the downstream sections, are included in the limited class III quality.
- sodium and calcium indicators is framed within the limits of quality class I in (PO) and in the downstream sections are framed to limit class II quality.

Concentrations of nickel and cobalt of water upstream and downstream from the industrial area, showed below the limits indicates in Romanian Environmental Legislation for Surface Water and standards, values that are similar with European legislation (Order No. 161-2006). In 2008, 2009 and 2010 (trim. I, II and III), concentration of chromium total was below the limits of Environmental Legislation for Surface Water. Also, in all three points, in 2010 (trim.IV) concentration of chromium total stay within the class IV of quality.

The result showed that the concentrations of heavy metals were correlated with each other, demonstrating a common trend of concentration variation in water. For many situations concentrations were close to method detection limit.

Concentrations of mercury of water upstream and downstream from the industrial area showed below the limits indicated in Order No. 161-2006.

For organochlorine substances analyzed in three points, an increase of concentration for 1,2 dichloroethane, in sections downstream of the chemical platform of Ramnicu Valcea (C and M) to the (PO) upstream section of the platform. Also notice that in all three points, hexachlorobenzene, 1,2,4 trichlorobenzene and total isomers HCH taking values below the detection method.

Table no. 1

Physico-chemical characteristics of water in the river Olt in Priza Olt Section

No. crt.	Name requested	UM	PO/2008				PO/2009				PO/20010			
			Trim.I	Trim.II	Trim.III	Trim.IV	Trim.I	Trim.II	Trim.III	Trim.IV	Trim.I	Trim.II	Trim.III	Trim.IV
1	pH	U.pH	7,82	7,88	7,74	7,19	7,33	7,72	7,27	7,3	7,74	7,54	7,38	7,4
2	Temperature	^oC	5,65	16,97	22,3	9,4	3,47	17,17	22,57	10,8	4,0	17,22	21,5	11,52
3	N/NH_4^+	mgN/l	0,229	0,19	0,158	0,21	0,4	0,26	0,135	0,16	0,43	0,18	0,145	0,23
4	Ca^{2+}	mg/l	42,3	38,83	50,21	49,95	42,6	37,26	36,83	41,8	45,53	39,95	44,35	39,9
5	Na^+	mg/l	24,38	21,14	17,13	21,43	23,91	14,59	28,0	34,33	29,4	18,17	16,7	22,4
6	Cl^-	mg/l	40,7	38,96	38,95	45,5	33,1	25,4	36,6	45,45	30,0	24,8	28,35	26,2
7	SO_4^{2-}	mg/l	23,05	29,53	25,48	26,03	29,33	22,13	25,75	25,6	27,0	19,7	19,4	22,1
8	O_2 diz.	mg/l	15,62	10,95	8,95	12,4	11,92	7,95	7,13	12,0	16,65	10,92	9,2	10,6
9	Saturaţie O_2	%	125,3	120,7	104,5	107,7	88,0	83,7	82,0	108,5	131,0	115,0	104,5	98,6
10	Filterable residue 105^{o}C	mg/l	241,3	225,0	264,0	273,3	257,5	239,0	253,7	238,3	244,33	230,33	229,7	239,0
11	CCO-Cr	mgO_2/l	11,55	10,71	10,93	11,22	9,77	12,6	11,4	12,25	12,72	11,82	19,5	10,2
12	CBO_5	mgO_2/l	6,18	5,82	4,72	5,0	5,65	2,7	2,18	3,8	6,62	3,23	3,53	4,64
13	Materials in Suspension	mg/l	29,7	54,5	31,67	31,0	13,58	18,33	32,1	27,4	32,95	68,8	88,7	24,0
14	Fhenols	mg/l	<0,001	0,0023	<0,001*	<0,001*	<0,001*	<0,001*	0,0023	0,023	0,0023	0,0027	0,0052	<0,001*
15	Mercury	mg/l	0,00179	<0,001*	<0,001*	0,0004	<0,001*	<0,001*	<0,001	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*
16	Nickel	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*
17	Cobalt	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*
18	Chromium total	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	<0,01*	<0,01*	0,07
19	1,2 Dichlorethane	μg/l	<0,05*	<0,05*	<0,05*	2,67	<0,05*	<0,05*	<0,05*	0,26	11,79	<0,05*	0,34	0,25
20	Hexachlorobenzene	μg/l	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,005*	<0,0005*	<0,005*	<0,0005*
21	1,2,4 Trichlorobenzene	μg/l	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*
22	Total isomers HCH	μg/l	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*

* method detection limit

Table no. 2

Physico-chemical characteristics of water in the river Olt in Cremenari Section

No. crt.	Name requested	UM	C/2008				C/2009				C/20010			
			Trim.I	Trim.II	Trim.III	Trim.IV	Trim.I	Trim.II	Trim.III	Trim.IV	Trim.I	Trim.II	Trim.III	Trim.IV
1	pH	U. pH	8,07	7,99	7,91	7,48	7,58	7,79	7,42	7,3	7,79	7,63	7,52	7,7
2	Temperature	^oC	5,43	17,23	22,83	9,7	3,57	18,0	23,0	10,7	4,0	17,28	21,6	11,7
3	N/NH_4^+	mgN/l	0,29	0,146	0,33	0,16	0,47	0,19	0,118	0,14	0,53	0,29	0,36	0,58
4	Ca^{2+}	mg/l	98,7	83,23	94,28	88,13	90,65	70,5	91,2	130,2	90,3	75,6	89,1	92,6
5	Na^+	mg/l	49,93	43,73	37,43	39,73	46,13	37,13	51,7	78,65	64,84	43,36	44,0	57,7
6	Cl^-	mg/l	187,7	117,08	182,1	189,1	171,35	122,8	216,15	235,1	173,7	130,0	147,7	170,1
7	SO_4^{2-}	mg/l	28,82	39,13	31,43	31,8	36,0	29,5	23,9	22,7	29,8	26,53	27,6	29,4
8	O_2 diz.	mg/l	14,9	10,33	9,08	11,23	11,28	8,1	7,32	11,2	15,9	10,48	9,05	9,7
9	Saturaţie O_2	%	118,33	107,5	106,7	100,17	84,8	86,3	83,8	102,3	124,0	108,7	98,5	91,0
10	Filterable residue 105^oC	mg/l	456,7	461,7	440,0	475,0	463,3	414,7	522,7	614,7	485,3	464,7	483,7	465,6
11	CCO-Cr	mgO_2/l	13,78	12,95	14,1	14,05	17,13	16,4	17,2	14,0	16,62	14,7	22,6	13,4
12	CBO_5	mgO_2/l	6,58	6,23	5,58	4,47	5,3	3,4	3,03	4,18	8,43	3,28	3,5	4,38
13	Materials in Suspension	mg/l	45,33	82,83	41,5	40,5	28,7	32,8	33,92	16,45	45,9	54,75	106,0	27,2
14	Fhenols	mg/l	0,0017	0,0023	0,04	0,002	<0,001*	0,0053	0,016	0,043	0,031	0,016	0,022	0,0056
15	Mercury	mg/l	0,00097	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	<0,001	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*
16	Nickel	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	0,06	<0,01*	<0,01*
17	Cobalt	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*
18	Chromium total	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	0,15	<0,01*	0,11
19	1,2 Dichlorethane	μg/l	<0,05*	<0,05*	<0,05*	<0,05*	<0,05*	<0,05*	<0,05*	<0,05*	20,15	<0,05*	12,14	9,1
20	Hexachlorobenzene	μg/l	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,005*	<0,005*	<0,005*	<0,0005*
21	1,2,4 Trichlorobenzene	μg/l	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*
22	Total isomers HCH	μg/l	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*

* method detection limit

Table no. 3

Physico-chemical characteristics of water in the river Olt in Babeni Marcea Section

No. crt.	Name requested	UM	M/2008				M/2009				M/20010			
			Trim.I	Trim.II	Trim.III	Trim.IV	Trim.I	Trim.II	Trim.III	Trim.IV	Trim.I	Trim.II	Trim.III	Trim.IV
1	pH	U. pH	8,07	7,85	7,69	7,36	7,46	7,65	7,41	7,32	7,81	7,7	7,66	7,6
2	Temperature	^oC	5,4	17,47	23,95	9,9	3,95	18,6	23,7	11,63	4,15	18,92	22,9	12,2
3	N/NH_4^+	mgN/l	0,285	0,112	0,118	0,24	0,34	0,19	0,165	0,28	0,50	0,16	0,554	0,3
4	Ca^{2+}	mg/l	81,47	68,22	83,75	89,35	86,25	62,33	84,4	106,7	76,0	63,84	71,15	80,4
5	Na^+	mg/l	42,91	32,22	33,1	35,35	39,3	29,2	54,7	50,9	53,0	30,64	31,7	42,6
6	Cl^-	mg/l	150,0	116,91	170,15	186,6	145,25	95,6	201,0	211,45	137,0	102,8	107,5	151,6
7	SO_4^{2-}	mg/l	26,45	33,2	30,73	30,34	32,7	23,9	30,55	20,32	31,4	22,3	21,8	24,7
8	O_2 diz.	mg/l	14,68	12,28	10,4	11,03	10,42	8,9	7,33	8,55	15,85	10,68	9,6	8,3
9	Saturaţie O_2	%	117,0	126,5	124,83	98,5	79,3	96,17	85,7	78,8	121,5	116,5	108,0	79,8
10	Filterable residue 105^oC	mg/l	421,7	360,0	421,0	459,0	388,3	348,3	487,7	497,3	388,3	389,33	382,7	415,2
11	CCO-Cr	mgO_2/l	12,55	11,95	12,21	12,78	14,0	12,9	16,84	16,8	13,1	13,94	22,3	12,44
12	CBO_5	mgO_2/l	5,75	6,07	3,98	3,73	4,63	4,0	2,93	1,52	6,6	3,37	2,7	2,26
13	Materials in Suspension	mg/l	32,0	41,83	26,0	32,83	15,17	22,3	24,4	14,65	39,7	42,6	85,3	26,0
14	Fhenols	mg/l	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	0,001	0,0023	0,019	0,014	0,0055	0,01	
15	Mercury	mg/l	0,00174	0,00045	<0,001*	<0,001*	<0,001*	<0,001*	<0,001	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*
16	Nickel	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*
17	Cobalt	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*
18	Chromium total	mg/l	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01*	<0,01	<0,01*	<0,01*	0,006	<0,01*	0,08
19	1,2 Dichlorethane	μg/l	<0,05*	<0,05*	<0,05*	1,41	<0,05*	<0,05*	<0,05*	1,41	7,89	<0,05*	4,40	2,15
20	Hexachlorobenzene	μg/l	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,0005*	<0,005*	<0,005*	<0,005*	<0,0005*
21	1,2,4 Trichlorobenzene	μg/l	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*
22	Total isomers HCH	μg/l	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*	<0,005*

* method detection limit

Reference values imposed by the Order No. 161/2006

No. crt.	Name requested	UM	Order No. 161/2006				
			Clasa I	**Clasa II**	**Clasa III**	**Clasa IV**	**Clasa V**
1	pH	U. pH	6,5 - 8,5				
2	Temperature	^oC	-	-	-	-	-
3	N/NH_4^+	mgN/l	0,4	0,8	1,2	3,2	>3,2
4	Ca^{2+}	mg/l	50	100	200	300	>300
5	Na^+	mg/l	25	50	100	200	>300
6	Cl^-	mg/l	25	50	250	300	>300
7	SO_4^{2-}	mg/l	60	120	250	300	>300
8	O_2 diz.	mg/l	9	7	5	4	<4
9	Saturaţie O_2	%	90-70	70-50	50-30	30-10	<10
10	Filterable residue 105^{o}C	mg/l	500	750	1000,0	1300,0	>1300,0
11	CCO-Cr	mgO_2/l	10	25	50	125	>125
12	CBO_5	mgO_2/l	3	5	7	20	>20
13	Materials in Suspension	mg/l	-	-	-	-	-
14	Fhenols	mg/l	0,001	0,005	0,02	0,05	>0,05
15	Mercury	mg/l	0,0001	0,0003	0,0005	0,001	>0,001
16	Nickel	mg/l	0,01	0,025	0,05	0,1	>0,1
17	Cobalt	mg/l	0,01	0,02	0,05	0,1	>0,1
18	Chromium total	mg/l	0,025	0,05	0,1	0,250	>0,250
19	1,2 Dichlorethane	μg/l	10,0				
20	Hexachlorobenzene	μg/l	0,0004				
21	1,2,4 Trichlorobenzene	μg/l	-				
22	Total isomers HCH	μg/l	0,042				

Conclusions

The Olt river quality control in the past three years (2008, 2009, 2010) was realized between Priza Olt Nr.2 (PO), upstream, Cremenari (C) and Babeni Marcea (M), downstream, according with National Legislation.

In the downstream points, in the all three years, was observed increased of the organic and inorganic water pollution in comparison with Section Priza Olt.

In all points, γ-HCH isomer, was situated into limit by 0.02 μg/l, 1,2 dichloroethane was falling values in the 10,0 μ g/l imposed by National Legislation, the other organochlorine chemicals (hexachlorobenzene and 1,2,4 trichlorobenzene) taking values below the detection method.

In the last three years there was no heavy metal pollution: mercury, nickel, chromium and cobalt, in three points. In all three points (2010, trim.IV), concentration of chromium total to stay within the class IV of quality.

The other factors, which affect the Olt river water quality in the Ramnicu Valcea industrial aria, are the hydro-electric plant programs, the quantity of precipitation and the other pollutant accidents.

References

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