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TESTING QUALITY OF TECHNOLOGICAL WASTE WATER IN ZENICA INDUSTRIAL ZONE

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ABSTRACT
The results of quality testing of technological waste water discharged into the Bosna River from the industrial zone in the northern part of the Zenica valley show that concentrations of some of the measured parameters (suspended matter, oil and grease, total phosphorus, detergents, phenols, heavy metals and toxicity) exceed the prescribed limit values for discharge into surface waters and therefore may influence the ecological characteristics of the recipient, the Bosna River.
Keywords: technological wastewater, limited values, quality of the waste water

1. INTRODUCTION

The industrial zone in the northern part of the Zenica basin are concentrated in primary and secondary metallurgical plant with a production capacity close to 2 million tons of steel per year (current production is about 650,000 t / y), with the foundry production capacity of 60,000 t / y of castings (the current production is about 25,000 t / y) and several manufacturing plants in the field of metal processing small production capacity. All plants and facilities in the industrial zone is characterized by the use of industrial water in technological processes (e.g. boiler water, dedusting and gas cleaning, cooling unit, to transport the slag and ash, washing, etc.), from the Bosna river on a water intake. Therefore, the industrial zone emits a large amount of technological waste water. They released at the three major outfalls in the Bosna River as the final recipient of technological waste water from this industrial zone, along with mine and the town sewer [1.2].In the plant is made partly treatment of technological waste water. However, the degree of purification is not satisfactory, because the quality of the effluent does not meet the requirements for discharge into surface water - the river Bosna, prescribed in the Regulations on limit values of hazardous and noxious substances for technological waste water prior to their release in the public sewerage system or any other receiver [3]. Because of that technological waste water from industrial zone entered a large burden of pollution in river Bosna disturbing the ecological conditions of river. This paper presents the results of the technological quality of wastewater of industrial zones, which are discharged into the river of Bosnia into three main outfalls with aim of determining the influence on this recipient.

2. MATERIAL AND METHODS

In order to determine the technological quality of wastewater a series of samples is taken from the three main outfalls into the river and Bosnia: the main collector (GC), circumferential channel (OK) and rolling mills (V3). For each outfall two composite samples were formed. Monitoring of wastewater included two sampling experiment on the day of the period 8:00 to 12:00 and 12:00 to 16:00, flow measurement and analysis of samples. Determination quantity of discharged wastewater was carried out on the basis of periodic measurement of water flow in collectors in order to define the relationship between: level of water-water flow (flow lines). Physic-chemical testing of technological quality parameters of wastewater were carried out using analytical methods prescribed by the

Regulations on limit values of hazardous and noxious materials for technological wastewater prior to their release into the public sewerage system or any other receiver [3].

3. RESULTS AND DISCUSSION

The results of physic-chemical analysis of samples of technological waste water discharges from industrial complexes in the Bosna River are shown in the following table.

Table 1. The results of analysis of monitoring of waste water.

Parameter	Limited value	Main collector (GK)		Circumferential channel (OK)		Rolling mils (V3)	
Calculation of the results provided by the prescribed methodology for testing wastewater pollution load expressed as EBS.							
Average flow (l/s)		205,6		17,5		106,1	
Temperature	30	21,0	22,5	20,5	**31,0**	27,0	27,5
Suspended matters at 105°C (mg/l)	35	**40**	**48**	11	21	20	27
HPK (mgO_2/l)	125	46	15	27	65	12	23
BPK_5 (mgO_2/l)	25	17	13	5	18	6	4
N-Kjeldahl (mgN/l)	10	8,40	6,16	8,12	**11,12**	1,96	2,52
Total phosphorus (mgP/l)	1,0	**1,285**	**1,255**	**1,331**	**2,612**	**0,264**	**0,206**
Toxicity–Daphnia magna test	>50	80%		not		not	
EBS		58.874		2.331		6.040	
Specific quality parameters							
pH value	6,0-9,0	8,26	8,11	8,48	8,64	**9,26**	**9,30**
Conductivity (µS/cm)		633	619	801	1049	485	464
Fuzziness		11,1	11,1	3,44	4,56	3,12	2,53
m-alkalinity ($mgCaCO_3$/l)		200	200	226	268	76	72
p-alkalinity ($mgCaCO_3$/l)		6	8	6	8	16	10
Evaporation rest at 105°C (mg/l)		476	470	543	677	303	307
Ash at 550°C (mg/l)		288	328	437	527	237	237
Volatiles at 550°C (mg/l)		188	142	106	150	66	150
Ammonium nitrogen (mgN/l)	10	8,31	4,76	8,09	**10,77**	0,35	0,26
Nitrate nitrogen (mg/l)	10	0,47	0,30	2,42	0,42	2,60	3,03
Nitrite nitrogen (mg/l)	0,5	0,008	0,002	0,363	0,007	0,126	0,132
Cyanides (mg/l)	0,01	0,006	0,005	0,004	0,005	0,003	0,003
Phenols (mg/l)	0,1	0,034	0,028	0,063	0,063	0,005	**0,205**
Sulphates (mg/l)	200	106,2	110,7	182,8	**208,7**	174,3	151,0
Chlorides (mg/l)	200	18,8	18,2	25,7	34,4	17,5	19,2
Total oils and fats (mg/l)	20	**50,9**		**25,2**		**25,3**	
Mineral oils and fats (mg/l)	5,0	**6,1**		3,28		4,52	
Detergents (mg/l DBS)	1,0	0,254	0,282	0,325	0,282	0,125	0,098
Iron (mg/l)	2,0	0,12	0,16	0,06	0,14	0,04	0,04
Nickel (µg/l)	500	1,842	3,625	2,267	3,224	6,620	7,851
Zinc (mg/l)	1,0	0,042	0,053	0,369	0,052	0,492	0,013
Copper (µg/l)	300	23,07	22,72	7,782	7,469	23,16	21,49
Cadmium (µg/l)	10	0,076	0,07	0,277	0,079	0,422	0,096
Plumbum (mg/l)	0,2	0,002	0,005	0,001	0,002	0,001	0,002
Chromium (mg/l)	0,1	0,012	0,005	0,014	0,009	0,022	0,017

This analysis has revealed the following:

- the main collector concentrations of suspended solids, total phosphorus, oil and fat was higher than prescribed limited value and degree of toxicity,

- the peripheral canal concentrations of total phosphorus, ammonium, sulphate and oil and grease were higher than the prescribed limited value,
- the rolling mill collector concentrations of total phosphorus, phenols, oil and grease, and pH value exceeded the prescribed limited values
- increased presence of ammonia in the samples from the ring canals indicates large quantities of sewage water from Podbrežje, Tetovo, Banlozi and Gradišće, and therefore it is recommended that this waste water separate from the industrial zone waste water.

The following table shows the results of technological pollution load of wastewater discharged from industrial zones in the Bosna River in 2007 for parameters that exceed the allowable values [1].

Table 2. Test results of pollution load of wastewater

Parameter	**Limited values**	**Main collector GK**	**Circumferential channel, OK**	**Rolling mill V_3**
Suspended matters	35 mg/l	90 mg/l	40,12 mg/l	37,28 mg/l
Phenols	0,1 mg/m³	29,64 mg/l	6,48 mg/l	0,86 mg/l
Heavy metals (as Pb)	0,2 mg/l	0,47 mg/l	0,73 mg/l	0,45 mg/l
Detergents	1,0 mg/l	68,50 mg/l	95,37 mg/l	43,73 mg/l
Toxicity test - Daphnia magna 48 hours	%	-	92,44	84,30

Based on the results shown in Table 2 can be stated as follows:

- the concentration of suspended solids and phenols were significantly exceeded the limit values at all places, especially on the main collector where the concentrations were several times larger than the allowed value
- concentrations of heavy metals were significantly exceeded the allowable value and the highest were in the wastewater of circumferential channel, which is probably a result of waste waters from slag and ash sedimentary basins, and industrial waste dump, "Raca,"
- concentration of detergent is much exceed the prescribed limit values and the highest were in the circumferential channel, which is probably the result of the influence of wastewater Podbrežje village, Tetovo, Banlozi and Gradisce, whose waste water is discharged into the circumferential channel
- toxicity tests with Daphnia Magna (48EC50) concluded that the waste water from the circumferential channel, rolling mill and steel mills collector were toxic.

In following table are presented values of EBS for typical year, divided by the collectors (major testing places).

Table 3. EBS values.

EBS	1984.	2001.	2007.
Municipal Sewage	23.787	26.123	21.312
RMU Zenica	34.444	90.809	10.939
Main collector (GK)	464.682	209.571	44.073
Circumferential channel (OK)	81.997	2.013	27.974
Rolling mill and steel plant collectors (V3	16.691	2.918	6.364
Total	505.139	97.570	46.160

Based on the results shown in Table 3 can be stated as follows:

- the prewar regime in the industrial zone was a double "dirty" or technological waste water were twice more loaded because the plants were working at full capacity and the technology was less advanced,
- in the meantime some indoor cycles were done, and recirculation systems, such as in steel mills and rolling mill plants, and introduced a streamlined system for wastewater treatment (e.g. DSD), and the level of pollution decreased,

- pollution load of municipal wastewater is quite uniform, which was to be expected,
- expressed varying pollution load of mine waste water is probably the result of pronounced variations in production volume and primary treatment of wastewater
- decrease of pollution load of wastewater of main collector is primarily a result of significantly lower volume of production, but also taking specific measures of the primary treatment of wastewater before their discharge into the river Bosna
- varying pollution load of waste water in the other two discharge places is primarily a result of variation in production volume.

4. CONCLUSION

Quality of technological waste water discharged from the industrial complex in Bosnia River do not meets the requirements for discharge into surface waters, because the concentration of some of the measured parameters (e.g., suspended matter, oil and grease, total phosphorus, detergents, phenols, heavy metals and toxicity) exceed the limit values prescribed in the Regulations on limit values of hazardous and noxious substances for technological waste water prior to their release into the public sewerage system or any other receiver. It is therefore necessary to take measures to provide adequate wastewater treatment prior to their discharge into the river Bosnia. According to the cited Regulations any subject that emits technological wastewater into surface waters must meet the requirements for discharges into surface waters in order to preserve their natural environmental features.

5. REFERENCES

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