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WASTE WATERS OF THE TOWN OF STIP AND THEIR CHARACTERSITICS

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SUMMARY

The paper presents the results of the investigations carried out for the determination of Fe, Mn, Pb, Zn, Cd, Cr, Co and Cu contents and organic pollutants in wastewaters of the town of Stip.

The results obtained indicate that the main polluters of the town of Stip and its waters are the Animal Farm, the Slaughter House, the main sewer, the Balkan Express Freightforwarding Company, the Brilliant Cooking Oil Company, the Makedonka Textile Industry, the Bargala, Shoe Company, Multi Cream as well as Balkanska and Zeleznicka settlements.

Key words: waste waters, polluters, organic, have metals,

UDC: 628.312(497.7-21)

INTRODUCTION

The first small human settlements were built when nomadic life style ended. They are often associated with urbanisation and the commencement of agriculture, which enormously increased the runoff of materials and nutrients into rivers and waters.

At the time, the new communities could easily cope with the small amount of agricultural and domestic waste. The early settlers buried the waste in ditches located close to their homes.

From biological point of view, the amount and kind of waste disposal was not large and did not affect the environment to a great extent. Remains can be revealed in rural areas even today.

At that time, the only harmful bioactive wastes close to the settlements were anthropological and animal sewage. Inappropriate disinfecting of faeces resulted in the pollution of waters and topsoils.

However, the first severe pollution of human environment is related to urbanisation and industrial development.

It should also be mentioned that towns came into being as fairly new formations. History tells us that the first cities appeared along the valleys of the Tigris and Euphrates Rivers some 5 to 6 thousand years ago.

Until the middle of XIX century urbanisation was not of great importance in any part of the world. Thus, in the year 1800 only 2.4 per cent of the population lived in towns. In 1850 there were only four cities in the world with population exceeding one million inhabitants.

The gradual increase of population and the proportional increase of waste distorted the natural balance that resulted in undesired increase of pollution of the environment.

Present day settlements, first of all larger cities, are a source of large volume of polluting material. The most obtrusive aspect is that large number of polluters is concentrated in a relatively small area.

The sources of pollution can be divided into:

1. Energy sources such as heating plants, local and family fireboxes, installations for heating plants in family houses,
2. Traffic, including all kinds of vehicles and the fuel that they use,
3. Industry, including large facilities, medium and small size workshops and production activities,
4. Households, including all constructions and institutions, shops, catering services etc.

All polluters mentioned above affect the environment in various ways. The town of Stip disposes of a large volume of wastewater from its industry. Processing of wastewaters is carried out in accordance with the amount discharged and the facilities available at the sewer. The wastewaters enter the River Bregalnica, which is the major artery in the area.

It is worth mentioning that the river water is used as the major source of water for the filter station that processes and supplies drinking water for the population of Stip.

METHOD OF WORK

The samples taken from wastewaters close to the waste discharge and from the main sewer were filtered and separated into two individual samples and treated in different ways. One sample was used for the determination of the levels of heavy and toxic metals. It was preserved with nitrogen acid.

The other sample was used to determine organic pollutants and was treated on the same day.

Determinations were carried out in accordance with current standards by ICP-AES and UVE-VIS methods.

RESULTS OBTAINED AND DISCUSSION

Organic matter derived from diverse human activities is the major source of pollutant discharge to rivers. The decomposition and breakdown of the matter is carried out by micro-organisms and takes place mainly at the surface of the sediment and vegetation of smaller rivers and the water column of larger rivers. As the process requires the participation of oxygen, large organic pollution may lead to rapid deoxygenation of river water and disappearance of fish and invertebrate. This results in uniform habitat, only the strongest species can survive in low oxygen concentration.

Decomposition of waste matter that enters rivers is domestic and industrial sewage. Decomposition of organic matter along sewage effluent reduces the oxygen content and releases ammonium. Further on the concentration decreases as a result of dilution and continuing decomposition. As the distance from the source increases, bacteria oxidise the ammonium to nitrate and nitrogen enters the water via the water surface and increases the oxygen content. Eventually the levels of organic matter, oxygen and ammonium reach the levels characteristic of the upper stream of the sewage effluent. This process of recovery is called self-purification. An example of this is the River Danube, which is polluted when it enters Hungary. When it flows in Hungary it is polluted by organic matter from tributaries and towns, particularly Budapest.

However, by the time the river leaves the country and enters Croatia some amount of organic matter equal to that discharged in Hungary has decomposed. Still, this does not imply that rivers can take up an unlimited amount of organic matter without suffering. Pollution can be so severe and widespread and last for a long time that self-purification is insufficient. Thus, the Danube is still polluted when it leaves Hungary and Rhine was polluted with excessive amounts of organic matter between World War II and the early 1070s. There was very serious oxygen depletion in its middle and lower courses that the river virtually died.

Determination of organic matter in the wastewaters of Stip is shown in Table 1.

The table shows that biological oxygen demand (BOD), chemical oxygen demand (COD), colour, residual evaporation, odour, turbidity and pH in the environment were analysed.

The major parameter pointing out the presence of organic polluters in waters is the biological and chemical demand of oxygen.

Measurement of BOD is done in almost every country in Europe, although in some countries only the chemical oxygen demand is measured. In order to get better information about the level of organic matter effluent in wastewaters in Stip, the present authors measured both parameters. The results obtained were compared with those of waters in Europe.

Table 1. Organic matter effluent in waste waters of Stip

	Colour	Odour	Turbidity	pH	COD mgO_2/l	OD mgO_2/l	Residue mg/l
1	15	slight	turbid	8.22	752	128.3	2265
2	15	without	without	7.75	31.17	5.1	1054
3	10	without	without	7.77	10.34	5.2	320
4	5	without	without	7.71	18.05	5.2	447
5	15	unpleasant	without	7.83	31.67	6.5	495
6	25	slight	present	7.50	47.64	8.6	363
7	20	slight	without	7.87	148	32.1	1363
8	10	slight	without	6.95	9.01	7.2	463
9	25	unpleasant	present	6.95	98.97	58.3	624
9*	25	unpleasant	present	6.95	129.6	61.48	582

Table 2. Concentrations of heavy and toxic metals in the wastewaters of Stip (in ppm).

	1	2	3	4	5	6	7	8	9
Ca	83.55	61.61	54.91	56.56	48.61	48.91	112.16	45.38	30.04
Mg	12.96	52.39	13.78	26.81	21.52	7.77	29.67	6.26	5.08
Na	77.03	248.36	23.08	55.8	87.13	24.33	314.17	42.71	46.04
K	323.55	6.13	3.89	1.88	8.04	8.34	23.75	3.64	9.96
Al	0.44	0.377	0.407	0.399	0.346	0.365	0.669	0.362	0.243
Fe	0.339	0.065	0.021	0.043	0.037	0.099	0.341	0.011	0.07
Mn	0.117	0.016	0.007	0.012	0.005	0.016	0.022	0.124	0.039
P	7.323	0.31	0.264	0.402	1.448	1.929	0.148	0.01	6.347
Sr	0.203	1.603	0.424	0.976	0.573	0.277	0.899	0.224	0.171
Ni	0.016	0.029	0.014	0.035	0.001	0.015	0.004	0.001	0.002
Co	0.001	0.0009	0.002	0.0009	0.004	0.005	0.004	0.005	0.0009
Cr	0.001	0.001	0.001	0.001	0.001	0.001	0.0026	0.001	0.001
Zn	0.116	0.0026	0.0226	0.0051	0.0127	0.0153	0.0119	0.0099	0.0106
Cu	0.0651	0.0104	0.0141	0.0159	0.0122	0.0092	0.0206	0.0026	0.0046
Pb	0.005	0.005	0.005	0.0066	0.0017	0.005	0.005	0.005	0.001
Cd	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
As	0.094	0.034	0.006	0.071	0.071	0.0001	0.036	0.0038	0.05
Mo	0.012	0.002	0.052	0.001	0.018	0.008	0.003	0.003	0.028
W	0.005	0.012	0.015	0.005	0.029	0.005	0.005	0.002	0.006
V	0.086	0.188	0.048	0.096	0.088	0.025	0.138	0.038	0.016
Ag	0.001	0.002	0.001	0.001	0.009	0.005	0.001	0.004	0.001

1. Waste water from the animal farm,
2. Waste water from the Balkan Express and Brilliant Oil Companies,
3. Waste water from the Textile Company,
4. Waste water from the Svinigojstvo settlement,
5. Waste water from the Industrial region and the Zerleznicka settlement,
6. Waste water from the Bargala Shoe Company,
7. Waste water from the Multi Cream Company,
8. Waste water from the slaughterhouse,
9. Waste water from the main sewer,
9*. Waste water from the Main sewer (double check).

Data indicate that the amount of biological oxygen demand (BOD) is from 5.1 to 128.3 mgO_2/l. It is a 5 mgO_2/l increase compared with the limit of concentrations allowed. It can be said that all waters yielded increased amounts of organic matter pollution.

The same can be said of the chemical oxygen demand (COD) that ranges from 9.01 up to 752 mgO_2/l. Compared with the mean COD in rivers in Europe (that amount to 18.2 mgO_2/l) it leads to the conclusion that organic matter effluents exceed the concentrations allowed.

It was determined that the wastewater of Stip also contains heavy and toxic metals. The results obtained are shown in Table 2.

Table 2 shows that almost all elements found in waste waters are within the concentrations allowed except for those of phosphorus in all samples. Increased concentrations of arsenic were also found in sites 1, 3, 4, and 5 with regard to the allowed concentrations of 0.05 mg/l.

CONCLUSION

The geochemical and hydrogeological investigations and measurements carried out on wastewaters of Stip made it possible to conclude that the amount of wastewater in the sewer before it empties into the River Bregalnica is from 0.122 to 0.179 m^3/sec.

The contents of heavy and toxic metals are within the limits allowed except for those of phosphorus and, in some places, those of arsenic whose contents exceed the levels allowed.

Data obtained for biological (BOD) and chemical oxygen demand (COD) are indicators of significant organic pollution in samples collected from wastewaters and the sewer.

It can be concluded that further and detailed investigations on the wastewaters of Stip, the River Bregalnica and the quality of the water supply system in the town are necessary.

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