

MONITORING THE MICROBIOLOGICAL AND PHYSICO-CHEMICAL POLLUTION DEGREE OF THE RIVER VISA

Letiția OPREAN^{1*}, Maria POPLĂCEAN², Simona OANCEA¹, Camelia OPREAN¹, Ecaterina LENGYEL¹

¹ "Lucian Blaga" University, Sibiu, Romania

² S.C APĂ-CANAL S.A. Sibiu, Romania

ABSTRACT. The paper presents comparative research regarding the microbiological and physico-chemical characteristics of waters of the river Visa, samples being collected upstream and downstream of the Ocna Sibiului locality. Results of the physico-chemical and hygienico-sanitary parameters showed increased values. In particular we found bacterial contamination of the river with coliform organisms as a result of household wastes discharge the studied area being of great touristic. The discharges come from Ocna Sibiului town which lack a wastewater treatment plant and a system of collecting the household and industrial waste waters. Faecal pollution indices exceeded the value of $2.4 \times 10^6/l$.

Keywords: rivers, water quality, pollution, coliforms, wastewater

INTRODUCTION

Water quality of rivers has been subject of research and concern because of different pollutants coming from many areas. Ocna Sibiului is a balneal place with saline waters and sapropelic sludge situated on the valley of river Visa. This river which is an affluent of Târnavă Mare River has a basin of 555 km² and a length of 42 km (Voicu-Vedea, V., 1983). The inflow at Ocna Sibiului is low and variable, the distance till this region being of 3 km. In this region there is no negative impact on the adjacent lands as there are no pollution sources. At the inflow to Ocna Sibiului there is a flooding risk for the near situated gardens. The process of silting-up of the bed of the watercourse is very high, the water flow being slow. At high rates of flow it has been registered flooding at the northern part of the region, determining the regularization of the bed of the watercourse in this part. Passing the town the river sides deepen and the flooding risk diminishes. For this section of the river it has been detected a high pollution with household-faecaloid wastes because of household waters discharge of Ocna Sibiului which has neither an own sewerage and collecting residual waters systems nor a wastewater treatment plant (Oprean, 1996).

The present paper deals with the research regarding the microbiological and physico-chemical characteristics of Visa River. Water samples were collected upstream and downstream the Ocna Sibiului locality.

MATERIALS AND METHODS

The bacteriological analyses were determined at the Laboratory of drinking water analyses in Sibiu, Laboratory of Bacteriology from the Water Treatment Section of Dumbrava Sibiu and Laboratory of Microbiology, Laboratory of Biochemistry from the

University „Lucian Blaga” of Sibiu. Physico-chemical analysis of Visa river waters were done at the Laboratory of the Romanian Agency of Environment Protection, Sibiu.

Sampling

Samples were collected in May 2005, October 2005, March 2006 and July 2006. Samples were collected in plastic bottles in accordance with the national standards STAS 12526-87 and SR EN ISO 5667-13:2000, preserved and stored at 4°C until further use.

Physico-chemical determination

The following analyses were determined: pH, dissolved oxygen, CBO₅, CCO-Mn, oxygen concentration at saturation, O₂ saturation, O₂ deficit, fix residue, calcium Ca²⁺, magnesium Mg²⁺, chlorides, sulphates SO₄²⁻, total hardness of water, temperature. The parameters oxygen concentration at saturation, O₂ saturation and O₂ deficit were determined by the methods of Schwoerbel (Schwoerbel J., 1994).

Bacteriological analyses

Microbiological assays (number of colonies, most-probable number of coliform bacteria, most-probable number of coliform termotolerant bacteria, most-probable number of *Streptococcus fecalis*, *Escherichia coli*) were determined in accordance with national standards [STAS 3001/1991].

RESULTS AND DISCUSSIONS

The determined physico-chemical and bacteriological characteristics of Visa River after passing Ocna Sibiului locality are presented in table 1, figure 1-4.

Table 1

Physico-chemical and bacteriological characteristics of Visa River

| Type of analysis | Determined parameters (measurement units) | | May 2005 | October 2005 | March 2006 | July 2006 | Mean value |
|------------------|--|-------------------------|-------------|-----------------|---------------|--------------|---------------|
| Physico-chemical | pH | pH units | 7.0 | 7.2 | 7.4 | 7.5 | 7.25 |
| | Dissolved oxygen | mg/l O ₂ | 8.52 | 8.21 | 4.99 | 5.65 | 6.84 |
| | CBO ₅ | mg/l O ₂ | 24.4 | 36.4 | 41.0 | 43.42 | 38.80 |
| | CCO-Mn | mg/l O ₂ | 47.04 | 47.32 | 74.13 | 71.29 | 57.45 |
| | Fix residue | mg/l | 5488 | 5639 | 3350 | 4452 | 4732 |
| | Calcium Ca ²⁺ | mg/l | 164.0 | 171.0 | 140.0 | 152.0 | 157 |
| | Magnesium Mg ²⁺ | mg/l | 4.84 | 4.61 | 4.86 | 4.92 | 3.81 |
| | Chlorides | mg/l | 1710 | 1620 | 1704 | 1538 | 1643 |
| | Sulphates SO ₄ ²⁻ | mg/l | 3102 | 3302 | 2408 | 2261 | 2768 |
| | Total hardness | °G | 44.8 | 42.2 | 21.8 | 29.66 | 24.30 |
| Temperature | °C | 32 | 34 | 14.0 | 14.0 | 12.3 | |
| Bacteriological | Number of colonies at 22°C | (UFC/c m ³) | 24000 | 24000 | 48370 | 45200 | 3539 |
| | Number of colonies at 37°C | (UFC/c m ³) | 1880 | 1880 | 47000 | 41630 | 31557 |
| | Coliform bacteria | (/100 cm ³) | > 2400 | > 2400 | >240000 | >240000 | >240000 |
| | Fecal Coliforms | (/100 cm ³) | > 2400 | > 2400 | >240000 | >240000 | >240000 |
| | Fecal streptococci | (/100 cm ³) | > 2400 | > 2400 | >240000 | >240000 | >240000 |
| | <i>Escherichia coli</i> | (/100 cm ³) | - | - | >240000 | >240000 | >240000 |

As illustrated in table 1, figure 1-4, the obtained physico-chemical results of Visa river waters show a pollution degree downstream the Ocna Sibiului locality. The river water is slowly oxygenated with a mean value of oxygen deficit of 68.71%, has a high organic compounds content with mean values of CCO-

Mn and CBO₅ of 57.45 mg/l and 38.80 ml/l respectively. Also we registered an increase in chlorides (1643 ml/l) and sulphates (2768 ml/l) concentrations with a fix residue of 4752 ml/l. The total hardness of the water samples has a mean value of 24.30 °G.

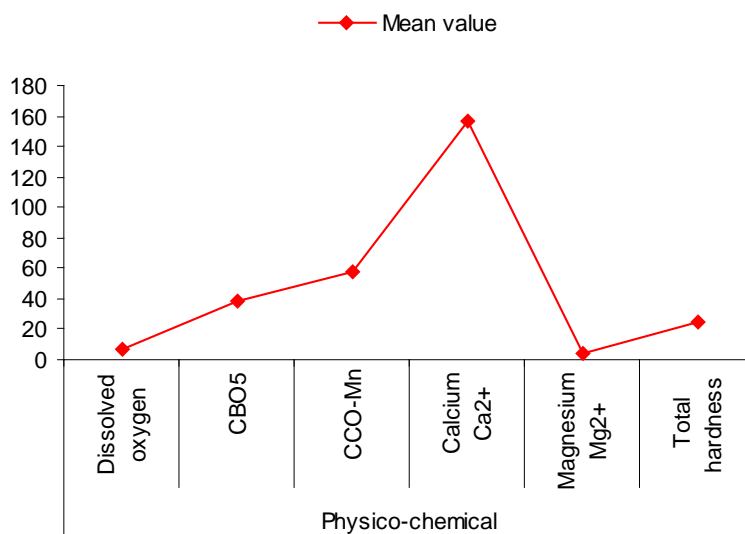


Fig. 1 Physico-chemical results (Dissolved oxygen, CBO₅, CCO-Mn, Calcium Ca²⁺, Magnesium Mg²⁺, Total hardness) of Visa river waters

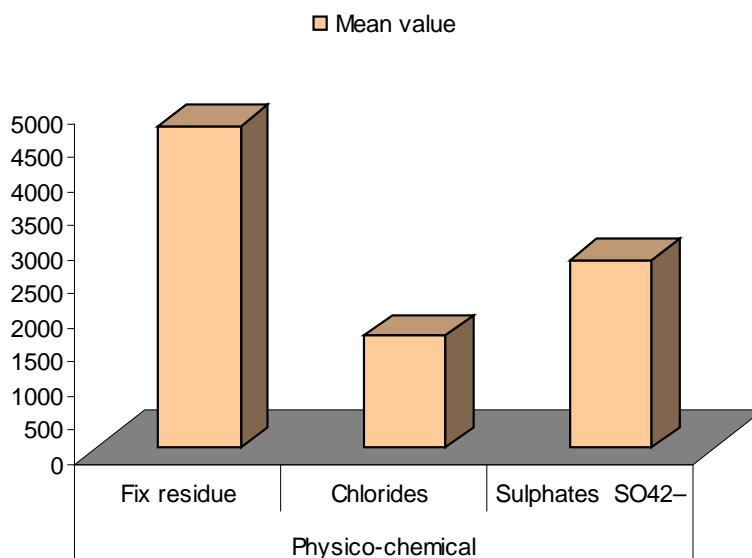


Fig. 2 Physico-chemical results (Fix residue, Chlorides, Sulphates SO₄²⁻) of Visa river waters

Downstream the Ocna Sibiului locality near the SPA place at the effluence of the river we detected high levels of bacteria (aerobic mesophilic bacteria, coliforms, fecal coliform, *Streptococcus faecalis* and *Escherichia coli*). The presence of these organisms either in summer or in autumn represents an indicator of a high water contamination with household waste waters.

The studied screening tests of the river quality show that there is not a direct impact of this river on agricultural lands. The river is highly contaminated by bacteria. There is a progressive deterioration of the river bed as a result of discharges of high quantities of saline

waters and sapropelic sludge coming from the balneal place.

The main factors involved in Visa river pollution are the affluence of tourists and household/industrial discharges from the Ocna Sibiului locality and also from the balneal place which lack a sewerage system and wastewater treatment plant. These could contribute to a river degradation along 4 km. For this length until Visa River meets its affluent Râura, the river bed is considerably enlarged on the right side generating a marsh zone which constituted previously a cultivated land. The actual situation is remediated by the presence of lacustrine basins for fish growth.

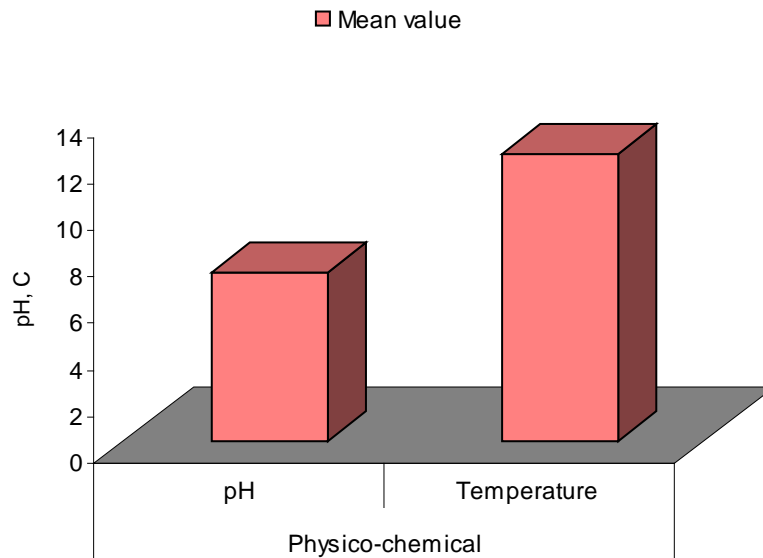


Fig. 3 Physico-chemical results (pH, Temperature) of Visa river water

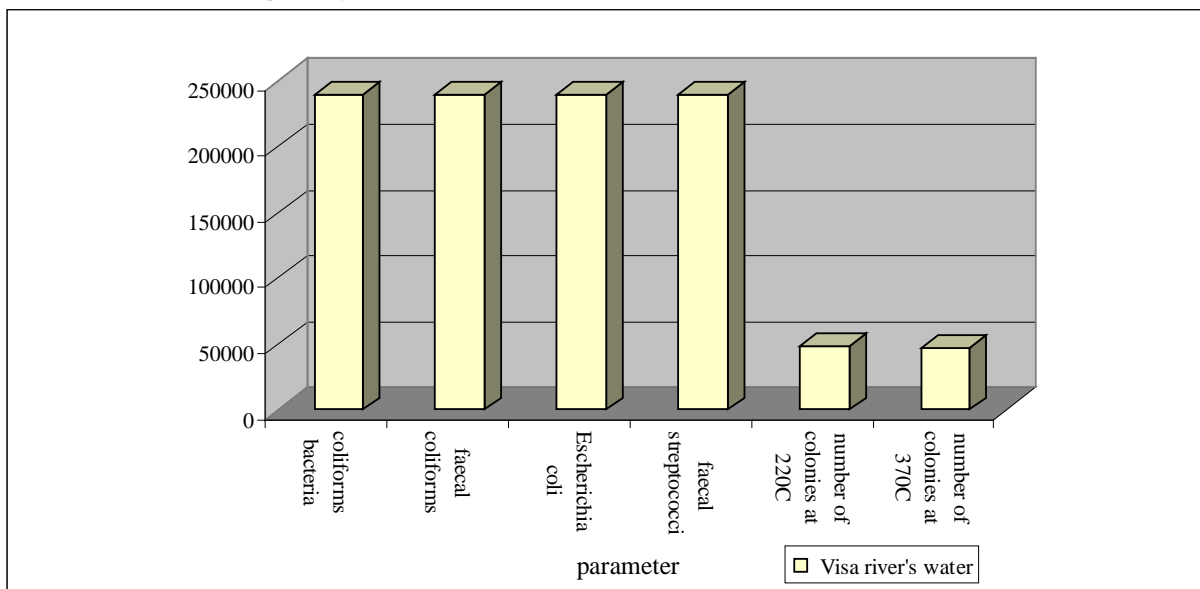


Fig. 4 Mean values of hygienico-sanitary parameters of Visa River waters

Regarding the elements of durable management of the zone, the objectives and proposed measures are established according to the type of utilization of different sub-zones of the reference zone. As the water quality is highly dependent on the home discharges in the river the first measure to be done is the treatment of household wastewaters before discharging, fitting out of a sewerage system and a wastewater treatment plant.

CONCLUSIONS

Organic pollution of Visa river (fig. 5) is due to household wastewaters discharges from the Ocna Sibiului locality which lack a sewerage system and a wastewater treatment plant.

The high degree of mineralization of the Visa River is due to its affluent River Fabricii abundant in salts and partially due to the discharges coming from the balneal resort.

The determined hygienico-sanitary parameters are extremely high indicating a significant bacterial contamination of Visa River in particular with coliform bacteria.

There is a great need for fitting out a wastewater treatment plant in either Ocna Sibiului or in the balneal place. Highly important is also solving the problem of the outlet and the utilization of saline water and sludge from the SPA place of Ocna Sibiului.

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Fig. 5 Visa River

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