

DATA ON THE ESTIMATION OF THE HYGIENIC BACTERIOLOGICAL CONDITION OF THE MAROS (MUREŞ) RIVER

FERENC CSÉPAI

Introduction

The actual bacteriological state of the surface, so called fresh waters - with its chemical and biological parameters - can change not only by means of abiotic factors along the river or its stretch. Extreme changes, which can damage the biosphere, can take place due to environmental effects, negative activities of people. Over the last 20 years there have been scores of publications in the international literature which have dealt with pragmatic chemical- microbiological investigations on surface waters. A lot of data was published in the Hungarian scientific literature dealing with the investigations on rivers and lakes (e.g. Estók, Andrik, Csépai, 1978; Hamar, 1976; Hegedűs, Fodré, Zsigó 1980; etc.).

In this study the author has tried to determine the hygienic bacteriological state of the river and its level of organic matter pollution, implied from the former, in the longitudinal stretch of the Maros by the means of point samples taken from relatively low waters. The results are tentative.

Materials and Methods

We took a total of 15 water samples on three occasions, each time from different sampling sites of the longitudinal stretch of the Maros from 5 to 25 August 1991. During transportation to the laboratory the samples were kept in sterile bottles. The samples were analysed on the day of arrival. The names of the sampling sites are shown in Table 5. For the purpose of investigation 500 ml water samples were taken. In the course of the laboratory investigations the author has determined the mesophilic total bacterial count, the numbers of coliform- and fecal-coliform bacteria, the number of fecal streptococci, the number of Clostridium and Salmonella bacteria. Only 350 ml water samples were available for the determination of Salmonella bacteria instead of 1000 ml. The bacteriological investigations were carried out on the basis of Hungarian standards in "The bacteriological investigation into the drinking water (1971)" and the "Methodological Guide (1977)".

In Table 2 (Hegedűs, Fodré, Zsigó 1980), Table 3 (Regional Environmental Laboratory, Szolnok, 1990) and Table 4 (National Institute of Public Health, Budapest, 1990) there are data from the literature relating to the Tisza and Maros rivers. The author's results are summarized in Table 5. Categories which mark the levels of contamination of water samples are indicated at the bottom of the tables.

Table 1. Limiting values of hygienic water qualification (Hungarian Standard)

Categories of water qualification		I Clear	II Moderate polluted	III Polluted	IV Strongly polluted
Hygienic bacteriological parameters	Units				
Coliform	count/ml	0-10	10.1-100	100.1-1000	>1000
Faecal coliform	count/ml	0-1	1.1-10	10.1-100	>100
Faecal streptococcus	count/ml	0-1	1.1-5	5.1-50	>50
Clostridium	count/40 ml	0-10	11-50	51-100	>100
Salmonella positivity in 1000 ml	%	0	<33	33	>33

In Table 1, the table of the National Institute of Public Health and the Hungarian Ministry of Health (Budapest, 1984) which is suggested for the hygienic qualification of surface waters can be seen. The author has made the bacteriological qualification of samples on the basis of this (Table 1).

Table 2. The mean values of results of hygienic bacteriological investigations by 12 samples for a year on the Maros and Tisza rivers in 1986

No. of samplig sites		1	2
Samplipng site		River Maros at Makó	River Tisza at Tápé
Hygienic bacteriological parameters	Units		
Mesoph. total bact. (37 °C)	1000*count/ml	20	31.6
Mesoph. total bact. (20 °C)	1000*count/ml	33.4	36.7
Coliform	count/ml	1000	222
Faecal coliform	count/ml	156	60
Faecal streptococcus	count/ml	15	10
Clostridium	count/40 ml	50	25
Salmonella positivity in 1000 ml	%	15.6	10
Categories of qualification		IV	III

Results and Discussion

It is mentioned above that the investigations carried out on the Maros River are tentative, because there are only limited data for estimating the real state of the Maros. Therefore the evaluation is somewhat strict because the small number of samples would not be enough to qualify on the basis of more than 10% of objectionable sample numbers according the qualification. The parameter which is in the most unfavourable category is the basis of the arrangement. It could be stated from the investigations that the mesophilic total count is relatively great in each of the 15 samples, it is significantly over the "expected" level in the "moderately polluted" category. The number of the coliform bacteria is above the value, which is characteristic of category II, except in sample N°1 and sample N°3. The number of the anaerobic sulfite reductive Clostridium bacteria is "satisfactory" only in the samples N°1-5, it is remarkably greater in samples N°6-15 (category III and IV). The

number of fecal coliform bacteria is above the upper limit of category II in samples 5, 10, 11, 14 and the number of fecal streptococci is above category II only in sample N°14.

Table 3. The results of hygienic bacteriological investigations of the Maros and Tisza rivers (1990) Regional Environmental Laboratory (Szolnok). 1990. (Non published data).

River Maros at Makó

Date of sampling (1990)		05.02.	01.04.	04.06.	06.08.	08.10.	03.12.
Hygienic bacteriological parameters	Units						
Mesoph. total bact. (37 °C)	1000*count/ml	2.76	2.1	3.5	4.8	2.9	0.62
Mesoph. total bact. (20 °C)	1000*count/ml	12.3	4.5	7.3	6.9	4.9	13.2
Coliform	count/ml	160	7.8	35	2.1	1.1	160
Faecal coliform	count/ml	3.3	2.6	4.9	0	0.2	22
Faecal streptococcus	count/ml	35	0.3	0.4	0	45	34
Clostridium	count:40 ml	356	150	22	114	60	310
Categories of qualification		IV	IV	II	IV	III	IV

River Tisza at Tápé, above mouth of river Maros

Date of sampling (1990)		05.02.	01.04.	04.06.	06.08.	08.10.	03.12.
Hygienic bacteriological parameters	Units						
Mesoph. total bact. (37 °C)	1000*count/ml	1.1	1.69	0.72	11.2	3.7	0.45
Mesoph. total bact. (20 °C)	1000*count/ml	28	7.3	1.17	36	5.2	1.9
Coliform	count/ml	22	23	11	1.3	11	7
Faecal coliform	count/ml	7	7.9	4.9	0	0	2.3
Faecal streptococcus	count/ml	7.5	0.4	0.2	0.1	0.4	1.2
Clostridium	count:40 ml	121	37	32	52	3	79
Categories of qualification		IV	II	II	III	II	III

The author has tried to isolate the Salmonella bacteria from the obligate pathogenic bacteria as well, but there was considerably less water than necessary. As it was found there were Salmonella in seven of the 15 samples, and 4 different serotypes of Salmonella were identified (Table 5), it means that the occurrence and variety of the Salmonella bacteria, causing fever, diarrhoea and vomit, is very frequent. They seem to exist in the water continuously. Of the bacteria, shown in Table 5, the *S. typhi-murium* is frequent in the Hungarian surface waters. The other isolated Salmonella serotypes also exist in our country but their occurrence is relatively rare. For instance the *S. blockley* isolated from the samples N°9, 11 and 12 is almost a curiosity.

By means of analyzing the hygienic bacteriological states of the Hungarian stretch of the Tisza and Maros, written in the literature (Tables 2, 3 and 4), the author has tried to state the water quality of the Romanian stretch. The comparison of the rivers has been hampered by the fact that the Romanian samples were too little and the quality of the Tisza and Maros changes annually, seasonally and depends on the water output. All of the above mentioned information is needed to give a good bacteriological qualification. On the basis of the available results it may be stated that: The river Tisza, above the inflow of the Maros

(Tables 2, 3) is clearer in a greater proportion of the samples than the Hungarian stretch of the Maros (Tables 2, 3, 4). The more contaminated state of the Maros manifests itself in an earlier high *Clostridium* numbers, which indicates an intensive bacteriological decomposition. The reason for this is connected with the permanent organic matter load which can be proved indirectly by the bacteriological results.

Table 4. The results of hygienic bacteriological investigations of the Maros river at the mouth at Szeged (764 rkm -1990) National Institute of Public Health (Budapest). 1990. (Non published data).

Date of sampling (1990)		03.01.	08.03.	13.06.	16.08.	10.10.	05.12.
Hygienic bacteriological parameters	Units						
Mesoph. total bact. (37 °C)	1000*count/ml	22.8	15.6	15	12	24	21
Mesoph. total bact. (20 °C)	1000*count/ml	20.4	66	18.8	21	27	36
Coliform	count/ml	14	160	170	24	35	700
Faecal coliform	count/ml	17	54	92	3.3	2.2	160
Faecal streptococcus	count/ml	0.9	19	2	80	8	21
<i>Clostridium</i>	count/40 ml	360	220	11	46	40	60
<i>Salmonella</i> serotypes (37 oC)	in 1000 ml	0	0	0	0	<i>S. enteritidis</i>	0
Categories of qualification		IV	IV	III	IV	III	IV

It follows from the earlier and present results (Tables 2, 3, 4 and 5) that organic pollution is entering the river continuously. It seems that this is the reason why the river cannot get to a more progressive period of self-purification. This is primarily due to the fact that whenever chemical and microbiological decomposition could take place, a subsequent contamination happens.

It may be established from the present investigations that the number of the mesophilic heterotrophic and fecal indicator bacteria are far above the "normal" value. This fact is connected with the organic matter load of fecal character, which is likely owing to the frequent occurrence of *Salmonella* bacteria.

From these facts it emerges that the self purification of the investigated stretch of the Maros River is rather slow. In the future it seems to be advisable to carry out more investigations in order to know the level and regularity of the pollution and to determine the self purification in time and in area as well.

Table 5. The results of hygienic bacteriological investigations of the Maros River (1991) Author's data.

No. of sampling sites		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hygienic bacteriological parameters	Units															
Mesoph. total bact. (37 °C)	1000*count/ml	8.5	26	3.5	9.5	1.5	1.3	4.8	5.1	3.9	4.6	2.1	2.5	4.2	16	1.5
Coliform	count/ml	4.7	350	3.4	160	170	350	3500	2400	1600	240	24	35	35	1600	13
Faecal coliform	count/ml	0	0.78	0.4	1.7	21	4.9	1.1	0.4	0.2	17	11	14	2.2	1.4	2.2
Faecal streptococcus	count/ml	0.8	1.1	0.7	0.9	0.6	0.8	2.5	0.6	0.7	2.1	1.5	0.9	0.8	6.8	1.3
Clostridium	count/40 ml	2	2	2	8	18	190	120	150	130	520	30	70	65	140	120
Salmonella serotypes (37 oC)	in 1000 ml	0	0	S. typhimurium	0	0	S. virchow	0	S. typhimurium	S. blockley	0	S. blockley	S. blockley	S. branden	0	0
Categories of qualification		I	III	II	III	III	IV	IV	IV	IV	IV	III	IV	IV	IV	IV

References

- Estók, B.-Andrik, P.-Csépai, F. (1978): Higiénés bakteriológiai vizsgálatok a Tiszán 1974-1976 között (Hygienic bacteriological investigations in the river Tisza between 1974-1976.). *Hidr.Közl.*12. 568-571.
- Felszíni vizek vízhygiénés minősítése. Módszertani levél. Országos Közegészségügyi Intézet. Egészségügyi Minisztérium. Budapest. Eng. sz.: 53.591/1984 (1984. dec.) (Methodological Guide to the hygienic qualification of surface waters. National Institute of Public Health and Ministry of Health)
- Hamar, J.(1976): Bacteriological and algological investigation of the bay at Abádszalók (Kisköre reservoir). *Tiscia* 11, 85-93.
- Hegeđűs, M.-Fodré, Zs.-Dobler, E. (1990): Bacteriological quality of the fresh waters in the Region of the Lower Tisza in the period 1977-1986. *Tiscia* 25, 21-29.
- Hegeđűs, M.-Fodré, Zs.-Zsigó, M. (1980): Hygienic bacteriological investigations in the Tisza reaches between Csongrád and Szeged (1975-1978). *Tiscia* 15, 35-44.
- Ivóvíz bakteriológiai vizsgálata. MSZ 22901-71. Budapest. (Bacteriological investigation into drinking water. Hungarian Standard.)
- Módszertani Utmutató a felszíni vizek higiénés bakteriológiai vizsgálatához. Országos Közegészségügyi Intézet. Vízhygiénés Osztály. Budapest.1977. (Methodological Guide to the hygienic bacteriological investigation of surface waters. National Institute of Public Health. Department of Water Hygiene).

F. Csépai, 5000 Szohok, Bálvány u.1., Hungary