RESEARCH REGARDING THE BACTERIOLOGICAL PARAMETERS OF MUREŞ RIVER WATERS

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Abstract. The study followed the microbiological charge of Mureş River on a flow of 10 km above and 10 km below Târgu Mureş city.

There were water samplings in January, April, July and October from seven points, respectively: above Târgu Mureş (P1), city entrance (P2), city - Libertăţii quarter (P3), Cristeşti above purification station (P4), Cristeşti below purification station (P5), 8 km below the city (P6) and 10 km below the city (P7).

From the samples there were done the following microbiologic determinations: total coliforms number, fecal coliforms number, fecal streptococcus and sulphites-reducing bacteria.

The determination was performed in accordance with STAS 3001/1991 and the results interpretations were done in accordance with the Order of Ministry of Waters and Environmental Protection number 1146/2002. After the research we reached the following conclusions:

- In all seven sampling points between 10 km above and 10 km below Târgu Mureş city there were determined coliforms germs, enterococcus and sulphites-reducing bacteria during all seasons.

- The lowest number of bacteria was recorded in sampling point no. 1, situated at 10 km above the city and the highest number at sampling point no. 2, from city entrance.

- The level of values recorded at the city entry point is explained by one recreational area and also by the release of used waters from a mink farm.

- It is obvious the seasonal evolution of bacteria from the four determined groups, with lower values during winter, slightly higher during spring and higher during summer and autumn.

- The sulphites-reducing bacteria are present in all the analyzed samples but in sensible reduced number than the other groups.

- According to the ratio between fecal coliforms bacteria and fecal streptococcus, the fecaloid pollution of Mureş River waters is of human nature during summer in sampling point 3 (inside the city), of animal nature in point 1 and mixed in the other sampling points.

INTRODUCTION

The water, the environment where the life began, has an overwhelming importance for the life sustain on the Earth nowadays.

The microorganisms pollute at different levels all the natural waters – lakes, streams, rivers, seas, oceans and underground waters.

Rain waters, relatively pure, passing through atmosphere space charged with microorganisms, collect them and discharge them in the natural reservoirs, finally contaminating it [5].

The density and the nature of microbial flora vary in accordance with the nature of the water. In streams, rivers and lakes, the density varies in accordance with distance from pollution centers, used water release point or the season the sampling was performed.

The water sanitary quality is rated considering the presence or the absence of pathogenic microorganisms, or the occurrence of such event.

As a potential carrier of pathogenic microorganisms, the water can put on risk the health and life of consumers [4].

MATERIALS AND METHODS

We have searched the microbiological charge of Mureş River for a year. In this regard, there were water samplings in January, April, July and October from seven points, respectively: above Târgu Mureş (P1), city entrance (P2), city- Libertăţii quarter (P3), Cristeşti above purification station (P4), Cristeşti below purification station (P5), Ungheni, at 8 km below the city (P6) and Vidrasău, at 10 km below the city (P7).

From the samples there were the following microbiologic determinations: total coliforms number, fecal coliforms number, fecal streptococcus and sulphites-reduction bacteria [2].

The microbiological parameters were determined in accordance with STAS 3001/1991 [6] by multiple tubes method, using different mediums and incubation periods. In this way, for total coliforms were used mixture of lauryl sulphate simple and double concentrated as medium and also lactosis-eozines and blue metilen (GEAM), the incubation being achieved during 24 hours at 37 °C; for the fecal coliforms McConkey medium, incubation 24 hours at 44 °C; for fecal streptococcus mixture of sodium azide, incubation 48 hours at 37 °C , and for sulphites-reduction bacteria from *Clostridium* gender, liquid medium in anaerobiosis, incubation for 48 hours at 37 °C [1, 3].

Results interpretation was performed in accordance with the MAPM Order 1146/2002 [7].

RESULTS AND DISCUSSIONS

The results of total coliform germs are presented in table no 1.

Table no. 1

Total coliforms germs from Mureş River waters

Sampling point	Determined values (nr./dm^3)			
	Winter	Spring	Summer	Autumn
P1	200	600	12000	3800
P2	550	810	160000	28000
P3	360	830	92000	21000
P4	550	810	54000	14000
P5	810	750	28000	22000
P6	600	940	18000	6200
P7	750	930	28000	5600
LMA in acc. with	I. 5000/ dm^3			
Ord. MAAP 1146/2002	II. 100000/ dm^3			

Analyzing the results from this table, we can notice the presence of total coliform germs in all the samples from the seven collection points.

The lowest value was recorded in P1 (10 km above Târgu Mureş) during winter, and the highest value was recorded in P2 (city entrance) during summer (160,000/ dm^3 of water).

High values were recorded in the samples from entrance and exit of the city, especially during summer and autumn time. The number of total coliforms was 13 times higher during summer and 7 times higher during autumn in P2, comparing with P1. Also, taking as reference the maximum admitted limits from the MAAP Order 1146/2002 for class I of quality, we recorded overvalues by 2.4 – 32 times in all the collection points during summer, and by 1.1 – 5.6 times higher in samples from P2-P7 during autumn.

We can notice that at the city entrance the river water is rather clean from the fecaloid pollution point of view, the effect of urban settlement affecting the water quality up to 10 km below the city, in P7 sampling point, where the ratio of total coliforms germs is pretty high, even lower than the value recorded in the city.

The high values recorded in P2 during summer and autumn can be explained by the recreation activities above the dam, and also because at this point there are released the used waters from a wolverine farm, 200 meters above the dam.

It is obvious the seasonal evolution of the total coliforms germs in all the sampling points, having minimal values during winter, slightly higher during spring, very high during summer and during autumn, pretty similar to the summer ones.

The ratio between the values recorded during summer and the other seasons vary as follows: 1.2 - 5.7: summer/autumn; 30 - 291: summer/winter; 19 - 198: summer/spring; the maximum values being always recorded in P2.

The recorded values for the fecal coliforms germs determined in the four seasons are presented in table no. 2.

Table no. 2

Number of fecal coliform germs and fecal streptococcus in Mureş River waters
I – winter; II –spring; III –summer; IV –autumn

Sampling point	Fecal coliform number (no./dm^3)				Fecal streptococcus number (no./dm^3)			
	I	II	III	IV	I	II	III	IV
P1	20	110	560	380	40	55	280	210
P2	82	170	13000	2800	94	83	5900	2100
P3	83	130	9200	2100	83	94	2100	1200
P4	130	140	5400	1400	81	98	2300	1400
P5	150	170	2800	2200	150	94	2700	1700
P6	61	80	1800	620	61	80	1800	620
P7	75	130	2800	560	82	94	2800	620
LMA in acc. with Ord. MAAP 1146/2002	Fecal coliforms				I 1000/dm^3			
	Fecal streptococcus				II 20000/dm^3			

As we can notice from the table, the fecal coliform germs were detected in all the sampling points, but in lower number than total coliforms.

The difference amongst the seven sampling points is obvious also in this case, the highest number of fecal coliforms being recorded in P2, disregard the season.

Using MAAP Order 1146/2002 we recorded higher values of 1.8-13 times during summer, in all the sampling points except P1, and 1.4 - 2.8 times in P2, P3, P4, P5 during autumn.

As for the fecal coliforms germs, we can also notice a seasonal evolution in all sampling points, following the same pattern, with lower values during winter, slightly higher during spring, higher during summer and closer to the summer ones during autumn.

The determinations regarding fecal streptococcus are presented in table no. 2. As we also noticed for the two categories previously introduced, we can notice the presence of fecal streptococcus in all the analyzed samples, with higher values from P2 samples.

The samples from the city entry point exceeded the average admitted limit from MAAP Order 1146/2002, 5.9 times during summer and 2.1 times during winter.

During winter and spring there was no sample to exceed the maximum admitted limit of 1000/dm^3 of water.

The nature of surface waters fecaloid pollution is set based on the ratio between fecal coliform bacteria (FC) and fecal streptococcus (FS). The value of this ratio higher than 4 indicates a human pollution source. When the ratio value is between 2 and 4, the pollution is mixed, with a major human component; the same is for the ratio 0.7-1, and for values under 0.7 the pollution is of animal nature.

According to this indicator, in our samples the human fecaloid pollution is recorded during summer in point P3 (inside Târgu Mureş city); the animal pollution is recorded only in winter time in P1 and the mixed pollution in the other cases (table no.3).

Table no. 3

Fecal coliforms (FC) versus fecal streptococcus (FS) ratio as a fecaloid pollution source indicator in Mureş River waters
FC/FS<2 = fecaloid pollution of mainly animal origin
FC/FS>2 = fecaloid pollution of mainly human origin

Sampling point	Ratio value			
	Winter	Spring	Summer	Autumn
P1	0,5	2,0	2,0	1,8
P2	0,9	2,0	2,2	1,3
P3	1,0	1,4	4,4	1,8
P4	1,6	1,4	2,3	1,0
P5	1,0	1,8	1,0	1,3
P6	1,0	1,0	1,0	1,0
P7	0,9	1,4	1,0	0,9

In the table no. 4 we can find the values of sulphites-reducing bacteria determination from Mureş River waters.

Analyzing the produced results, we can notice the presence of such bacteria in all the water samples, but in lower number than the other groups previously shown.

High values were recorded during summer in sampling points P2, P3, P6 and P7.

The difference amongst season does not follow the same pattern as for the previously presented germs. Indeed, the highest values were recorded during summer and the lowest during winter, but during spring we recorded higher values than the ones from autumn, except for the collection points above Cristeşti purification station (P5, P6 and P7).

The number of sulphites-reducing bacteria Mureş River waters

Sampling point	Determined values (no./dm^3)			
	Winter	Spring	Summer	Autumn
P1	36	55	74	20
P2	55	83	150	81
P3	20	55	100	94
P4	56	56	94	60
P5	55	81	75	60
P6	36	80	170	36
P7	20	54	100	55

CONCLUSIONS

- In all seven sampling points between 10 km above and 10 km below Târgu Mureş city there were determined coliform germs, enterococcus and sulphites-reducing bacteria during all seasons.
- The lowest number of bacteria was recorded in sampling point no. 1, situated at 10 km above the city, and the highest number at sampling point no. 2, from city entrance.
- The level of values recorded at the city entry point is explained by one recreational area and also the release of used waters from a wolverine farm.
- It is obvious the seasonal evolution of bacteria from the four determined groups, with lower values during winter, slightly higher during spring and higher during summer and autumn.
- The sulphites-reducing bacteria are present in all the analyzed samples but in sensible reduced number than the other groups.
- According to the ratio between fecal coliform bacteria and fecal streptococcus, the fecaloid pollution of Mureş River waters is of human nature during summer, in sampling point 3 (inside the city), of animal nature in point 1 and mixed in the other sampling points.

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