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WATER QUALITY OF THE TISZA RIVER AND THE ALPÁR BACKWATER

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Abstract

Authors review the hygienic water quality of the Tisza backwaters at Csongrád and Alpár on the basis of the results of studies performed over a period of seven years. The characterization of the sampling sites in given by means of dendrogram prepared on the basis of the Czekanovski similarity index.

The obtained results are as follows:

— The water quality of the Tisza river at Csongrád has become III., at places IV. class "Strongly polluted" in the recent years. During the course of the past seven years the water quality had fallen by one class, the causes of which are the great sewage-burden of the Tisza river and the building of the water barrages which changed the microbiological relations of the river's water.

— The water quality of the backwater at Alpár was of I., II. class, only rarely "polluted" in the majority of the study periods. The cause of the favourable water quality is that the backwater is not burdened considerably with sewage.

Authors demonstrate their results on Figures and summarize the isolated salmonella serotypes in a Table. They call attention to the preservation of the backwater's water quality as well as to the more enhanced protection of the Tisza's water by means of comparative microbiological studies.

Introduction

Several researchers have dealt with studies on the Tisza river during the past decades. The Tisza river and its tributaries have been investigated by PAPP (1961, 1964, 1965) who had determined that the river is subjected to rather considerable pollution at the mouth of the Sajó as well as at the regions below the cities Szolnok and Szeged.

At the Tisza reaches at Szeged, the places marked for bathing were studied by VETRÓ (1966) and he found the hygienic water quality to be favourable.

In the longitudinal section of the Tisza river the first detailed survey — extending both to bacteriological and biological parameters — was that performed by DEÁK (1975). On the basis of the results of their studies carried out in 1971—72 they called attention to the fact that the Tisza II. River Barrage being built at that time will probably change the microbiological relations of the river.

On the basis of his complex study results on the 1974—75 water quality of the Tisza river and its tributary currents, DEÁK (1982) demonstrated a rise in the average and maximum values of the bacteriological parameters indicating faecal pollution, however, this did not cause a fall in grade of the water quality compared to the results of 1971.

Hygienic bacteriological investigations of the surface waters in Csongrád county have been performed at the Public Health Station since 1975. The obtained results have been reported on in several publications (HEGEDŰS 1979, 1980, 1981, 1983, LANTOS 1982).

Authors joined the Tisza-research programme in 1975, during the course of which bacteriological studies were also started regarding the backwater of the Tisza not sampled yet.

The hygienic bacteriological relations concerning the backwater at Mártély and Körtvélyes have already been reported on (HEGEDŰS 1982).

The results of bacteriological investigations in respect to four backwaters of various utilization are comprised in a paper under publication (HEGEDŰS, under publication).

The present study gives a comparison of the water quality of the Alpár backwater and the Tisza section at Csongrád, with special regard to hygienic water quality problems, the majority of which were caused by the activities of man.

Materials and Methods

The Tisza section at Csongrád (246,0 riv. km) in current line and the Alpár backwater at the village Alpár were generally sampled monthly.

The water samples were taken by dipping about 20 cm below the surface, following which the samples were taken to the laboratory in cool condition and processed on the day of sampling or within 24 hrs the latest.

The hygienic bacteriological studies were performed on the basis of the standards "Methodological Guide" (1977) and "Bacteriological investigation of the drinking water" (1971), published by the Water Hygienic Department of the National Institute of Public Health. The study results were evaluated according to the end values of the Plan of Sectoral Normalization No. Eü. Sz. — OVHSZ 141 T/1972.

The detailed description of the study methods, the end values of the hygienic water qualification as well as the hydrography of the Tisza reaches at Csongrád county are found in the paper by HEGEDŰS, FODRÉ and ZSIGÓ (1980) published in volume XV. of the periodical TISCIA.

In this same volume, the publication of FEKETE and his co-workers contains the detailed description and physiognomy of the Alpár backwater.

Results and Discussion

The results of the bacteriological investigations performed between 1977—1983 are the followings.

At the Csongrád sampling site of the Tisza river a continuous fall in the water quality could be determined during the course of the seven years, on the basis of the changes in the coliform number/ml values.

From 84 water samples the coliform number surpassed the value above 100/ml in 42 cases, meaning that the Tisza river's water was "polluted" and "strongly polluted", respectively, in 50% according to this parameter (Fig. 1).

The hygienic quality of the Tisza river's water was particularly unfavourable in the year 1982, when the coliform bacterium number was below 100/ml only in two water samples and even orders above 1000/ml became frequent.

These bacteria were only present in low number in the water of the Alpár backwater (Fig. 2). Values above 100/ml were only found in three water samples. Continuous rise was also experienced here during the course of the seven years, yet this did not cause a fall in class regarding hygienic water qualification (not resulting assessable fall in water quality). The maximal values were registered in the Summer

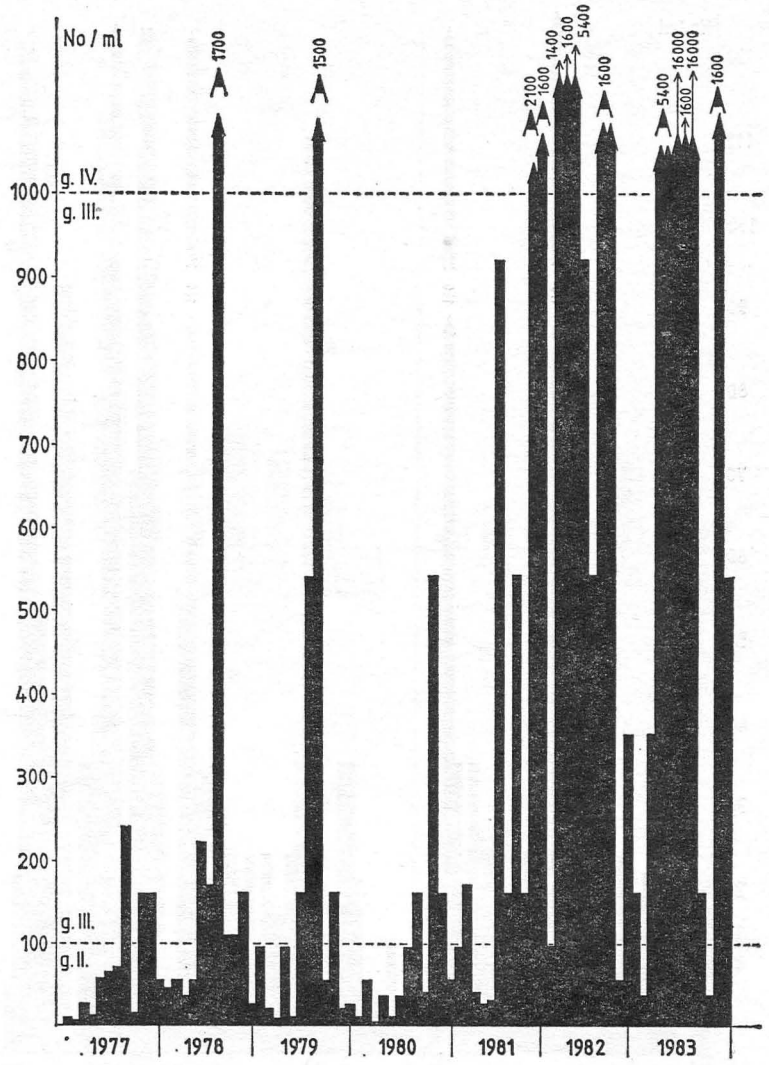

Fig. 1. Changes in coliform number/ml values in the water of the Tisza river at Csongrád.

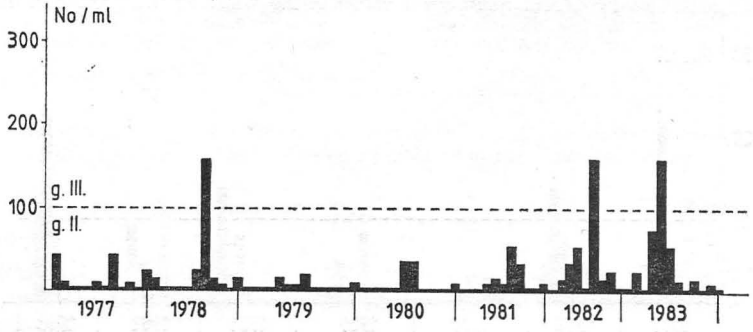

Fig. 2. Changes in coliform number/ml values in the backwater at Alpár

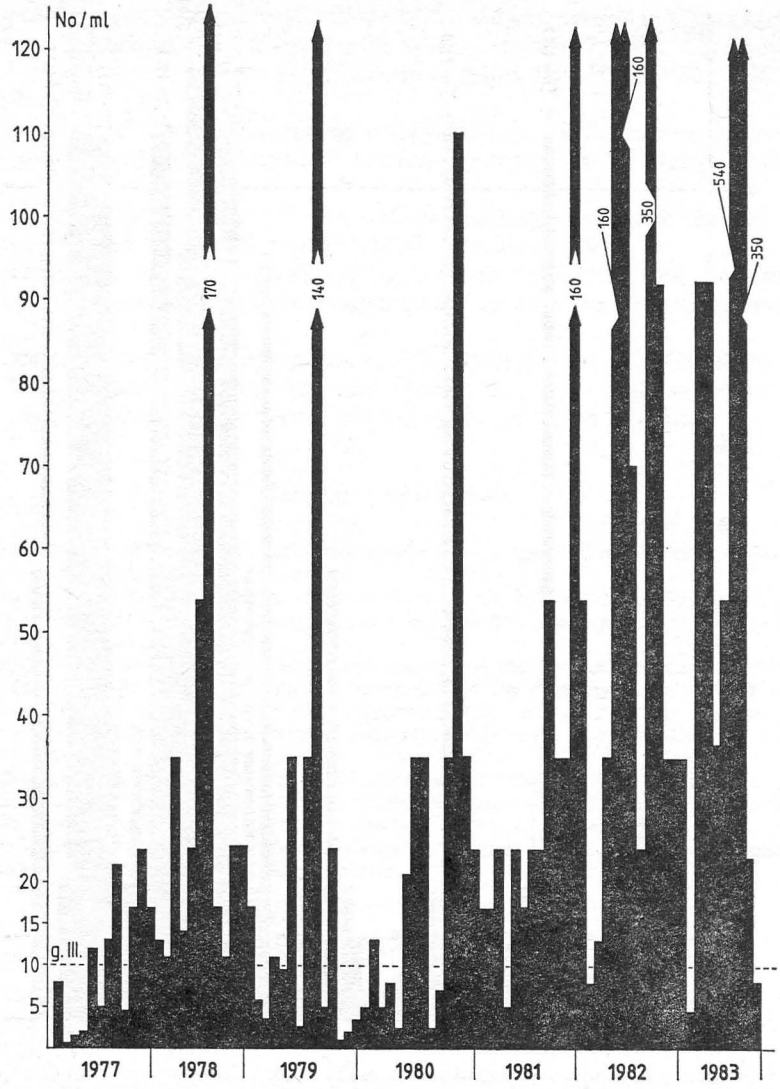

Fig. 3. Changes in faceal coliform number/ml values in the water of the Tisza river at Csongrád.

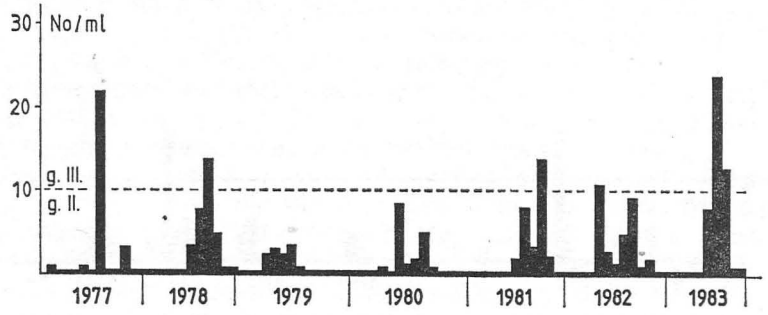

Fig. 4. Changes in faecal coliform number/ml values in the backwater at Alpár

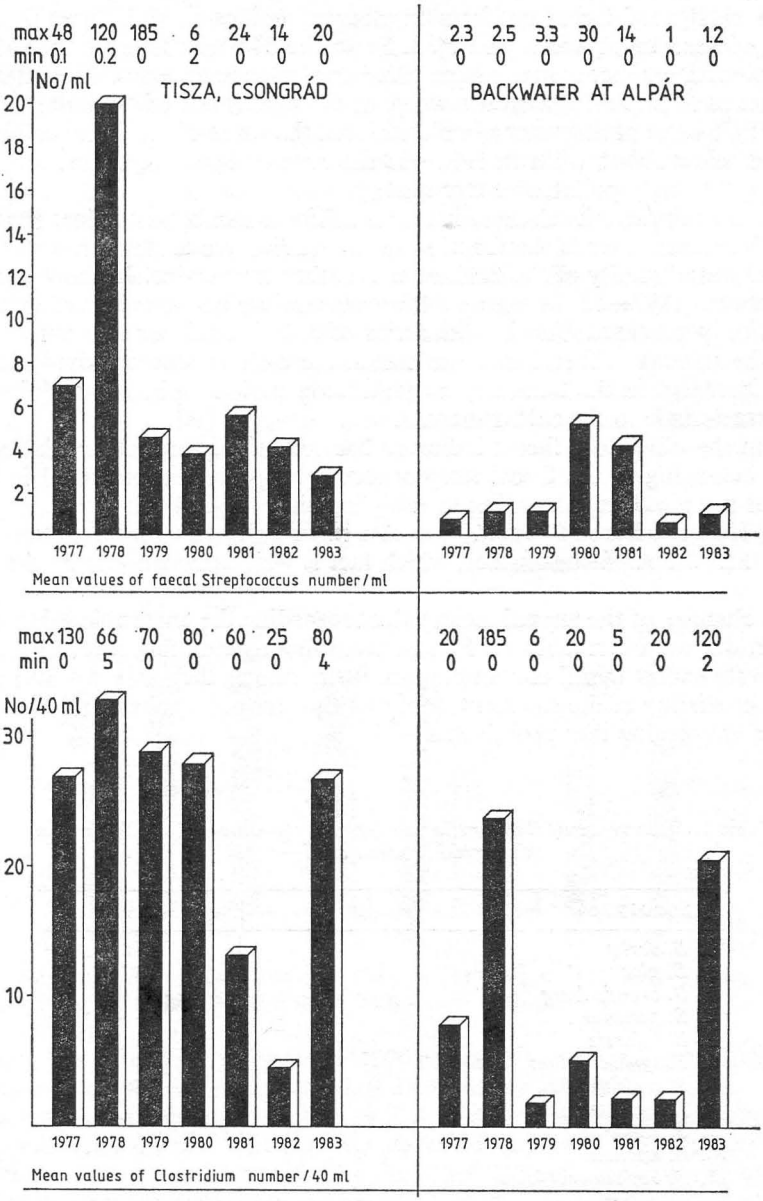

Fig. 5. Mean values of faecal *Streptococcus* number/ml and *Clostridium* number/40 ml. Mean values of *Clostridium* number/40 ml at the Alpár backwater

and late Autumn periods, which probably indicated the increased heterotrophic decomposition.

The changes in the degree of faecal pollution in surface waters are shown by the obligatory faecal indicator bacteria; the faecal coliform- and the faecal streptococcus bacteria.

The change of faecal coliform number/ml values in the Tisza river's water at Csongrád can be observed on Fig. 3. From the 84 water samples the value of the faecal coliform number surpassed the 10/ml end value in 69 cases. This unfavourable result means that the Tisza river's water at Csongrád was of "polluted" quality in 84%. In 1978 none of the water samples showed the value of the faecal coliform number to be below 10/ml, while in 1982—83 the orders above 100/ml became frequent, indicating "strongly polluted" water quality.

Fig. 4. comprises the changes in faecal coliform number/ml values for the water of the Alpár backwater in the function of the studied years. According to this parameter the water quality of the backwater is rather favourable. In the water samples taken between 1977—83 the faecal coliform bacterium number showed values above 10/ml in only six cases. Viewing the series of data it could be determined that the changes in amount of faecal coliform bacteria also show seasonal dynamism. Their number increased in the Summer, early Autumn periods, while the minimal values were characteristic to the colder months.

From the obligatory faecal indicator bacteria, the quantitative relations of the bacteria belonging to the faecal streptococcus group are demonstrated in the form of annual mean values, according to sampling sites (Fig. 5).

The Tisza reaches at Csongrád was also more polluted with faecal streptococcus bacteria than the Alpár backwater, which fact is well demonstrable by the maximal values.

The changes of the annual mean values regarding the anaerobic sulphyte-reducing Clostridia are observable on Fig. 5. according to sampling sites. These bacteria may indicate earlier faecal contamination, furthermore, they may get into the water area by the stirring of the sediment, too, and they may also mean that the anaerobic processes are coming into prominence.

Table 1. *Occurrence of Salmonella serotypes in the water of the Tisza river at Csongrád between 1976—1983*

Serotypes	Number
1. *S. derby*	17
2. *S. give*	13
3. *S. brandenburg*	8
4. *S. panama*	6
5. *S. infantis*	5
6. *S. typhi-murium*	4
7. *S. meleagridis*	3
8. *S. westhampton*	3
9. *S. hadar*	2
10. *S. anatum*	1
11. *S. bovis-morbificans*	1
12. *S. enteritidis*	1
13. *S. indiana*	1
14. *S. java*	1
15. *S. london*	1
16. *S. muenchen*	1
17. *S. mbandaka*	1
18. *S. paratyphi-B*	1
19. *S. saint-paul*	1
20. *S. thompson*	1
Total:	72

In the Tisza river the *Clostridium* number/40 ml values were also averagely higher than in the case of the Alpár backwater where higher values were only found in two years. These results were probably due to the washing in from the sediment.

From the enteral pathogens, it is the *Salmonella* bacteria which can be isolated the most frequently from the surface waters. From the Tisza river and the Alpár backwater 1000 ml water samples were concentrated for the detection of the *Salmonella* bacteria. During the study period the water of the Tisza river at Csongrád was strongly infected with *Salmonella* both in the utilized periods (V—VIII. months) and on the basis of the annual study series. The positivity % surpassed the 33% end value of tolerance, with the exception of the year 1981 (Fig. 6), therefore, bathing is not advisable in the water of the Tisza river at Csongrád. A summary of the isolated *Salmonella* serotypes in given is Table 1. During the course of the seven years 72 *Salmonella* bacteria were typified (classified according to types), belonging to 20 serotypes. The most frequent serotypes were the *S. derby, S. give* and the *S. brandenburg*. Till 1980 the S. derby was isolated the most frequently, then from 1981 to 1983 the *S. give* serotype became more frequent.

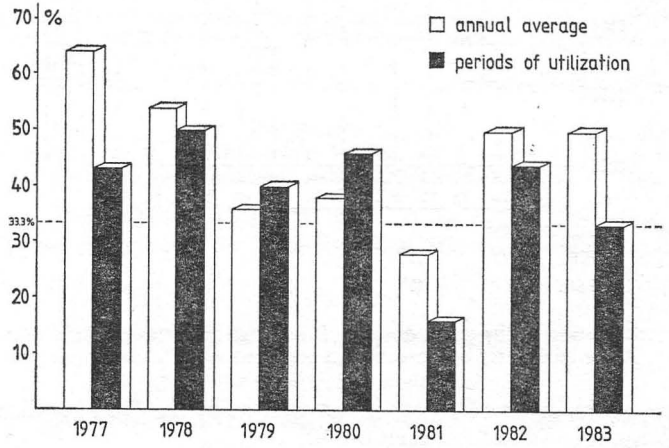

Fig. 6. Changes in Salmonella positivity in the water of the Tisza river at Csongrád. In annual average; in periods of utilization

During the past seven years, from 1000 ml water sample, bacteria belonging to the *Salmonella* genus were not isolated at all from the Alpár backwater.

As mentioned in the introduction, a dendrogram was prepared using the Czekanovski similarity index to characterize the water quality at the sampling sites and to register the changes occurring during the years (Fig. 7). The water quality of the Tisza river at Csongrád was labelled by "Cs", that of the Alpár backwater by the letter "A", indicating beneath the study years. It can be seen from the dendrogram that three groups were formed according to the water quality of the various years; a core in Csongrád, a core at Alpár and a mixed group. The Tisza river's water quality was rather similar in the years 1978—79 and 1981, the tight linkage of which was formed by the coliform numbers of the order of 100, the faecal coliform numbers of the order of 10 per ml and the faecal streptococcus numbers of lower value than 10.

The hygienic bacteriological water quality of the Alpár backwater was rather stabile between 1977—1981 and the independent group was formed by the coliform

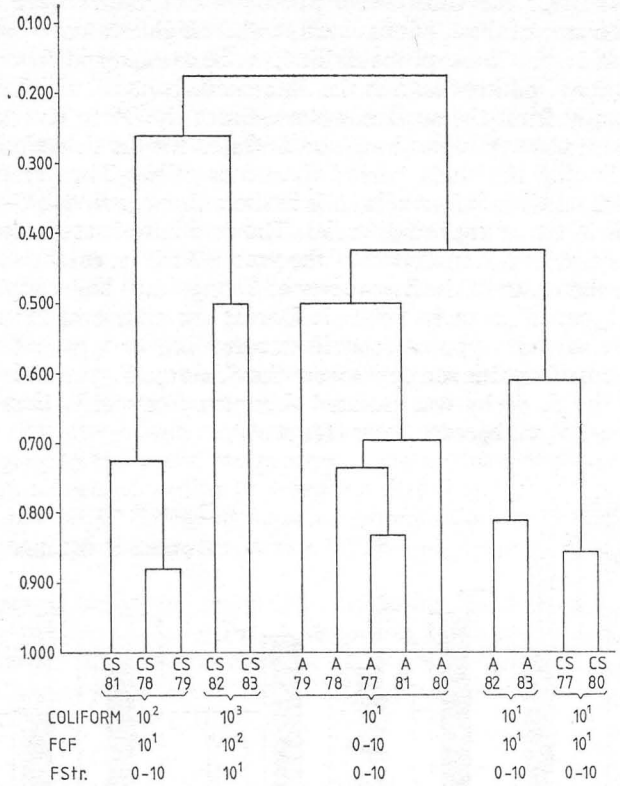

Fig. 7. Characterization of the water quality of the Tisza river at Csongrád and at the Alpár backwater by dendrogram prepared with "cluster"-analysis

number values of the order of 10 per ml as well as by the faecal coliform and faecal streptococcus number values between 0—10.

In the years 1977 and 1980 the coliform number was below 100/ml in annual average in the water of the Tisza river, i.e. of the same order as the 1982—83 years' water quality of the Alpár backwater. Therefore, these years and sampling sites formed the mixed core, producing a tight linkage.

As mentioned previously, the water quality of the Tisza river became polluted by the years 1982—83, which was characterized by the coliform numbers of the order of 1000, faecal coliform numbers of the order of 100, and faecal streptococcus numbers of the order of 10 per millilitre.

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A Tisza folyó és az Alpári holtág vízminősége

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Kivonat

A szerzők a hét éven át végzett vizsgálatok eredményei alapján a Tisza csongrádi és az Alpári holtág higiénés vízminőségét ismertetik.

A mintavételi helyeket Czekanovski hasonlósági indexe alapján készített dendrogrammal jellemzik. Eredményeik a következők:

— A Tisza folyó vízminősége Csongrádnál III. esetenként IV. osztályú „erősen szennyezetté" vált az utóbbi években. Az elmúlt hét év alatt egy osztállyal romlott a vízminősege, amelynek oka a Tisza nagymertékű szennyvízterhelése, a vízlépcsők megépítése, amelyek megváltoztatták a folyó vizének mikrobiológiai viszonyait.

— Az Alpári holtág vízminősége a vizsgálati időpontok többségében I. II. osztályú, csak ritkán „szennyezett". A kedvező vízminőség oka, hogy jelentős szennyvízterhelés nem éri a holtág vizét. Szerzők az összehasonlító mikrobiológiai vizsgálattal felhívják a figyelmet a holtág vízminőségének a megóvására, valamint a Tisza vizének fokozottabb védelmére.

Качество воды Тисы и Алпарской старицы

Гегедюш М., Каяри И.

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Сегед, ВНР

Резюме

На основании результатов 7-летних исследований авторы осветили гигиенические качества воды реки Тисы в Чонградской области и старицы Алпар. Пробы были взяты на основании сравнительных Цекановских индексов.

Были получены следующие результаты: качество воды старицы Алнар в богьшинстве местах I. II. кгассное, тогько изредка вода явгяется засоренной. Причиной благориятного состояния воды явгяется то, что эта старица не подвергается значитегьному засорению.

Путями сравнитегьных микробиогогических иссгедований авторами обращается внимание на необходимость улучшения качества воды старицы Алпар, а также на охрану воды Тисы.

Kvalite vode reke Tise i mrtvaje Alpár

Hegedüs Mária i Kajáry irén

Zdravstveno-epidemiološka stanica županije Csongrád, Szeged

Abstrakt

Autori, na osnovu rezultata sedmogodišnjih istraživanja, daju prikaz kvaliteta vode Tise u regionu Csongrád-a i mrtvaje Alpár, sa zdravstvenog aspekta. Uzorci su analizirani Čekanovskim dendogramom indeksa sličnosti.

Dobijeni su sledeći rezultati: Voda mrtvaje Alpár je u većini slučajeva po kvalitetu I i II razreda, samo je redje „zagadjena". S obzirom da se mrtvaja ne opterećuje značajnije otpadnim vodama, javlja se povoljni kvalitet vode.

Na osnovu rezultata uporednih mikrobioloških ispitivanja, autori ukazuju na potrebu očuvanja kvaliteta vode mrtvaje, kao i na znatniju zaštitu vode Tise.