

CHANGES OF SOME PHYSICO-CHEMICAL AND SAPROBIOLOGIC CHARACTERISTICS IN THE LOWER COURSE OF THEISS IN THE PERIOD 1980—1986

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(Received November 16, 1988)

Abstract

The researches of the lower course of the river Theiss in the period 1980—1986 point to certain changes in the physico-chemical and saprobiologic characteristics of water, in relation to earlier data. The erection of the dam at Novi Bečej and on the Danube (Djerdap) has slowed down the lower course of the river Theiss. During the research, changes in the oxygen regime have been noticed. The average values of diluted oxygen decreased by 7%, and the values of BOD₅ increased by about 10%. Regarding other parameters, the concentration of ammonium ion increased, especially in the winter months. The saporobity index according to Pantle—Buck up to the year 1983 was mainly within the limits of betamezosaprobity, while in recent years points to transition towards betaalfa-mezosaprobity.

Introduction

The physico-chemical and saprobiologic researches of the lower course of the river Theiss have been performed for almost thirty years (MARIĆ, PUJIN 1962, STANOJEVIĆ, PUJIN 1973, PUJIN, STANOJEVIĆ 1979) according to which the Theiss was characterized as a relatively clean river, suitable for diverse use, and by its saprobiologic characteristics, mainly as a water of betamezosaprobic type (STANOJEVIĆ, PUJIN 1979, PUJIN *et al.* 1984). However, recently the results point to certain changes of physico-chemical and saprobiologic characteristics of the water in relation to previous periods. Therefore, the aim of this work is to show these changes.

Materials and Methods

The research includes the period 1980—1986 on the localities: Martonoš, Padej, Novi Bečej, Žabalj and Titel. The following parameters were taken in consideration: the quantity of oxygen diluted in water (O₂ mg · dm⁻³), water saturation with oxygen (O₂ %), the chemical utilization of O₂ through KMnO₄, BOD₅ and ammonium ion (NH₄ mg · dm⁻³). These analyses were performed by standard methods in use nowadays in such researches. The saprobiologic characteristics were determined on the basis of saporobity index according to Pantle-Buck.

Results

The quantity of oxygen diluted in water varies by season, year, and locality. Judging from the mean values, these variations are not so pronounced. They are more expressed at extreme values, especially the minimal ones. The mean values are mainly within the limits sufficient for normal life of organisms. In summer these values are the lowest, in spring and autumn slightly higher and in winter the highest (Fig. 1).

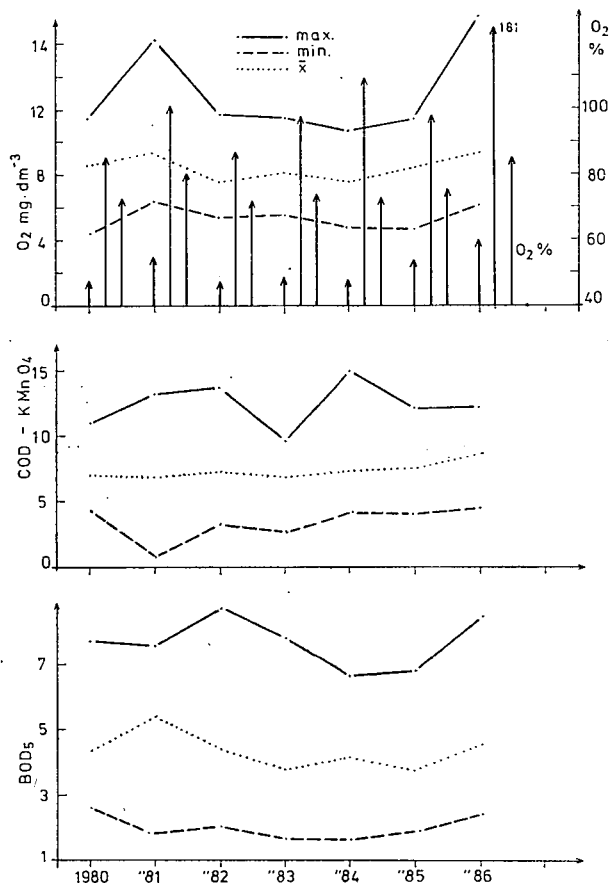


Fig. 1. Variations in the basic chemical parameters in the water of lower Tisa (1980—1986)

The differences are evident also in relation to localities. At Martonoš in spring and summer the values are more even and lower, in autumn and winter the values rise, then decrease and again slightly vary. Characteristic is the fall at Žabalj in all seasons. The same can be said for Bečej. The saturation of water with oxygen at N-Bečej and Žabalj is considerably lower as compared to other localities (Fig. 2). The oxygen content in the investigated period was in the limits of 3.2—16.5 $\text{mg} \cdot \text{dm}^{-3}$, with a minimal saturation of 35%. According to previous reports, the minimal saturation was about 70% (STANOJEVIĆ, PUJIN, 1973).

The mean values of oxydability through KMnO_4 also point to seasonal and local variations (Fig. 1. and Fig. 2). As it can be seen in the report, the mean values are over $5 \text{ mg} \cdot \text{dm}^{-3}$ and show that the Theiss in its lower course is considerably loaded with matters of organic nature. High values are in the year 1985 and 1986. With regard to seasons, evident are lower values in autumn, uneven in spring and winter. This load is very high at Novi Bečej, Žabalj and Titel.

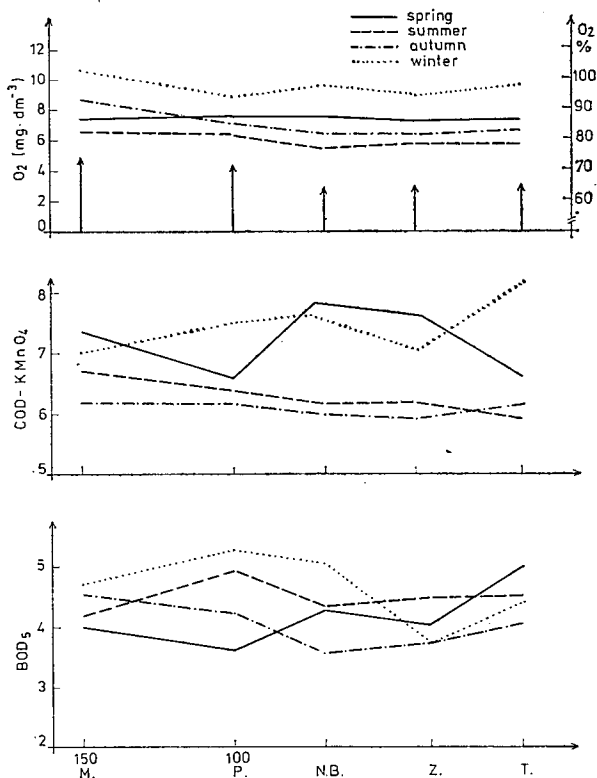


Fig. 2. Seasonal and localities variations of the basic chemical parameters in the water of lower Tisa (mean values 1980—1986)
M — Martonoš, P — Padej, N.B. — Novi Bečej, Ž — Žabalj, T — Titel

The biologic oxygen demand (BOD_5) also points to the aggravation of water quality. While in the period 1968—1970 the values were about 2.1—3.8 (STANOJEVIĆ, PUJIN, 1973), in the investigated period these values appear mainly as minimal (Fig. 1. and Fig. 2), while the mean values are below $4 \text{ mg} \cdot \text{dm}^{-3}$, but many times also above. In the investigated period, the values were between 1.2—10.2 $\text{mg} \cdot \text{dm}^{-3}$. The values are uneven locally and seasonwise. The comparison of these values with diluted oxygen and saturation O_2 , confirm that the increase of organic load corresponds to a reduced quantity of diluted oxygen. Some deviations from this natural law can be explained by the influence of some other factors important for the oxygen regime, first of all hidrologic ones (small quantity of water, slow flow).

Considerable aggravation is reflected in the concentration of ammonium through ammonium ions. The ascertained values in the investigated period were 0.5—5.7 $\text{mg} \cdot \text{dm}^{-3}$ and point to a periodical pollution of the lower course of the Theiss (Fig. 3). These values are higher in the entrance profile at Martonoš, than at others (Fig. 4). Ammonium in the summer period makes 2—6% of the total nitrogen content and in winter even somewhat higher than 30%. Following the changes in the average values of ammonium on one side and nitrates and nitrites on the other, it could be concluded that the process of ammonium oxydation into nitrites is evident in the section Martonoš—Padej (ammonium is decreased, nitrite increased). Downstream of Padej, in the process of further oxydation the nitrite content slightly decreases, while the nitrate content slightly increases. The influence of pollutants at Novi Bečej is manifested by a slight increase of ammonium at N. Bečej. The nitrite content was considerable, especially in the years 1985 and 1986, with evident maximum in winter. An evident increase of nitrogenous matters, especially in the last two years, points to pollutants such as communal waste waters, industrial-agricultural waters, the waters from cattle farms and the application of fertilizers.



Fig. 3. Variations of ammonium ions NH_4^+ $\text{mg} \cdot \text{dm}^{-3}$ in the water of lower Tisa (1980—1986)

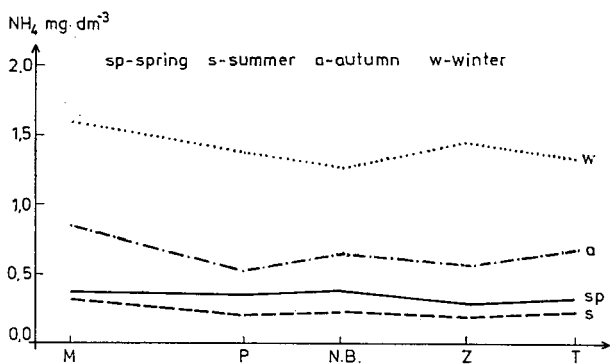
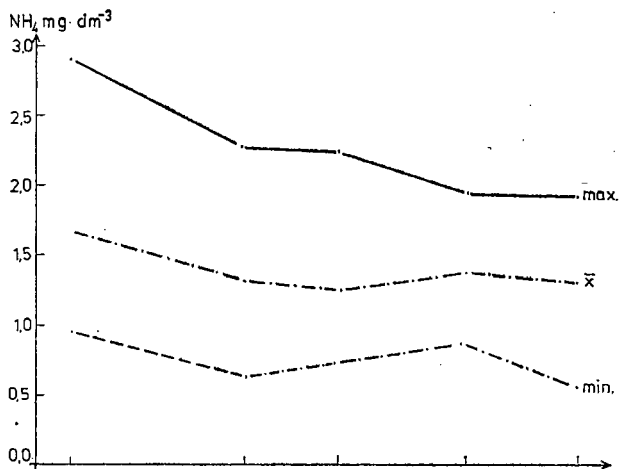


Fig. 4. Localities and seasonal variations of ammonium ions (NH_4^+ $\text{mg} \cdot \text{dm}^{-3}$) in the water of lower Tisa (mean values 1980—1986)
 M — Martonoš, P — Padej, N. B. — Novi Bečej, Ž — Žabalj, T — Titel

Saprobilogic characteristics according to Pantle—Buck also point to certain deterioration of water quality in the last years (Table 1).

Tabl. 1. Saprobity index according to Pantle—Buck in the lower course of the Theiss (1980—1986)

Years Localities	1980	1981	1982	1983	1984	1985	1986
MARTONOŠ	2.15	2.30	2.20	2.30	2.40	2.50	2.45
PADEJ	2.20	2.40	2.40	2.40	2.30	2.30	2.40
NOVI BEČEJ	2.25	2.25	2.25	2.60	2.50	2.50	2.50
ŽABALJ	2.20	2.40	2.40	2.40	2.40	2.45	2.45
TITEL	2.20	2.40	2.40	2.40	2.50	2.50	2.50

The saprobity indexes point from beta to beta-alfamezosaprobity, being a certain aggravation, related to earlier data (MARIĆ, PUJIN 1969, PUJIN, RAJKOVIĆ 1979). In particular seasons the saprobity index even points to alfa-mezosaprobity, as it was the case in the spring of 1982 (PUJIN, RATAJAC 1983).

Conclusion

From the results of the investigations of the physico-chemical and saprobiologic characteristics of the lower course of the Theiss in the period 1980—1986 in the localities Martonoš, Padej, Novi Bečej, Zabalj and Titel, following can be concluded:

The quality of lower course of the Theiss has been aggravated especially in relation to oxygen regime, ammonium concentration and saprobiologic characteristics.

The average values of oxygen diluted in water are decreasing by about 7%, compared to earlier values and vary depending on the year, season and locality.

The oxygen content in the investigated period was in the limits of 3.2—16.5 mg · dm⁻³, with minimal saturation of 35%.

The mean values of oxydability through KMnO₄(COD) were over 5 mg · dm⁻³, showing that the Theiss in its lower course is considerably loaded with organic matters.

The biologic consumption of oxygen (BOD₅) also shows the degradation of the water quality, the values being 1.2—10.2 mg · dm⁻³.

This aggravation is especially reflected in the concentration of ammonium, given through ammonium ion (0.5—5.7 mg · dm⁻³). Considerably high values fall in winter periods.

The saprobity index according to Pantle-Buck points to aggravation with values pointing more and more to beta-alfamezosaprobity.

The stated aggravations beside other factors, can be explained by the slowing of the river flow, due to hidrotechnical operations.

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A Tisza alsó szakasza fizikai—kémiai és szaprobitási értékeinek ingadozása az 1980—86-os időszakban

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Kivonat

A Tisza alsó szakaszán 1980—86-ban végzett kutatások a víz fizikai-kémiai és szaprobiási értékeinek ingadozását eredményezte. Lassult a lefolyás, hőmérsékletcsökkenés és kevesebb lebegőanyag volt megállapítható. Az oxigén háztartása is ingadozott. Míg az oldott oxigén állandóan 4 mg/l volt, addig az átlagos értéke 7%-kal csökkent. A telítettség 35—117%-os értékei szintén csökkenést, viszont a biológiai fogyasztás 5-ös értéke 10%-os növekedést jelent. A többi kémiai paraméterek közül az ammónia-ionok telítettsége növekedett, míg a pH, vízkeménység, alkáliság, P, Ka, Na ingadozása elenyésző. Pantle-Buck szaprobitási indexe alapján 1983-ig a betamezoszaprobitás, az 1983—86-os időszakban viszont az alfamezoszaprobitás volt jellemző.

Изменения некоторых физико-химических и сапробиологических характеристик нижнего течения р. Тиса в период 1980—1986. г.г.

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Резюме

Исследования нижнего течения р. Тиса в период 1980—1986. г.г. указывают на некоторые изменения физико-химических и сапробиологических характеристик воды по отношению к данным, полученным ранее. Эти изменения наблюдаются прежде всего в уменьшении расхода, температуры воды, а также паряще-плавучего материала. Изменения также наблюдаются и в отношении режима кислорода. Количество растворенного в воде кислорода всегда превышает 4 мг. л⁻¹, но средние значения уменьшаются на ок. 7%. Насыщенность воды кислородом была 35—117, что также является уменьшением, а значения БПК₅ увеличиваются на ок. 10%. Из остальных химических параметров необходимо обратить внимание на увеличение концентрации ионов аммония.

Почти неизменными являются значения рН, жесткости воды, щелочности, фосфора, калия и натрия.

Индекс сапробности по Пантле-Буку в периоде до 1983 года, в основном был в пределах бетамезосапробности, а в период 1983—1986 г.г. наблюдается переход от бета к альфа мезосапробности.

Promene nekih fizičko—hemijskih i saprobioloških karakteristika donjeg toka Tise u periodu 1980—1986

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Izvod

Istraživanja donjeg toka Tise u periodu 1980—1986. ukazuju na izvesne promene fizičko-hemisjih i saprobioloških karakteristika vode u odnosu na ranije podatke. Te promene se ogledaju pre svega u smanjenju protoka, temperature vode i smanjenju lebdećih materija. Takođe su konstatovane promene u kiseoničkom režimu. Količina kiseonika rastvorenog u vodi je uvek preko $4 \text{ mg} \cdot \text{l}^{-1}$, ali prosečne vrednosti opadaju za oko 7%. Zasićenost vode kiseonikom se kretala od 35—117%, što je takođe smanjenje, a vrednosti BPK_5 su u povećanju za oko 10%. Od ostalih hemijskih parametara posebno treba istaći povećanje koncentracije amonijum jona.

Skoro nepromenjene su vrednosti Ph, tvrdoće vode, alkaliniteta, fosfora, kalijuma i natrijuma.

Indeks saprobnosti prema Pantle-Buck-u u periodu do 1983 god. uglavnom se kretao u granicama betamezosaprobnosti, dok u periodu 1983—1986 ukazuje na prelaz od beta ka alfa mezosaprobnosti.