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Research Article

PHYTOPLANKTON BASED BIOMONITORING ON HUNGARIAN UPPER-TISA*

ATTILA IMRE[1,2]

[1]Upper-Tisza Environmental Inspectorate, Nyíregyháza
[2]St. Stephan's University, Gödöllő
Nyíregyháza, Bazsalikom u. 22. 4405
Hungary

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Abstract

Phytoplankton based biomonitoring in Hungary actually includes its numbers, also saprobiological investigation and measurement of chlorophyll-*a*.

Saprobiological analyses showed us 199 different described planktonic forms (including Ciliata, Bacteria, Flagellata apochromatica and Mycophyta), which were dominated usually by Diatoms. Other periods are characterised by equalized domination between phylla of algae.

The highest numbers of algae were registered usually in summer season and the chlorophyll-*a*'s level showed explicit correlation with it. Classification on the content of chlorophyll-*a* must be corrected by a seasonal factor, according to changeable light conditions.

Saprobity at every sampling places in all sampling time was showed the second or the third class of water quality, with only one exception at Záhony

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INTRODUCTION

The purpose of this article to show actual situation of using algae for monitoring Hungarian rivers i.e. in our laboratory.
The ways of phytoplankton based investigation are regulated by Hungarian standards and laws and no more.

It is very sorry for the Hungarian hydrobiolgists, that there is only a few amount of practically used biomonitoring methods in Hungary. Actually just saprobiological investigation on the base of plankton, determination of algal amounts and measurement of chlorophyll-*a* have been practiced regularly and there are made attempts to introduce the investigation on base of macroscopic invertebrates. Algae are used in some laboratories for toxicological test too, but it's not typical.

The water quality has been determined till this day as the number of algae and the content of chlorophyll-*a* qualify the content of inorganic nutrients as one way. Other way is the using saprobical results to determine content of organical materials in the water.

The relations between different phytoplanktonic elements aren't used officially, but used by scientists in their works.

MATERIAL AND METHODS

In our laboratory we make saprobiological analyses on planktonic basing on non-filtrated surface samples. The same samples were used to determine the numbers of algae and chlorophyll-*a* content in the water too.
We took samples from 4 sampling points on the river regularly every two weeks as it's prescribed by Hungarian law and standards In this work we show the results from analyses of two year monitoring, *i.e*. 2001 and 2002. The total amount of investigated samples is 208.

Felföldy (1974) writes that saprobity is: an ability of ecosystems to decompose organical materials. It could be described by determination of chemical demand for oxygen and by determination of saprobity grade analyzing the aquatic communities eg. the algae. In Hungary the using of Pantle-Buck (1955) index is the most common and preferred. Felföldy (1987) made a difference between saprobity and saproby, specifying this as a quickness of previous ability which is saprobity.

Dévai *et al*. (1992) elaborated a new ecological system for determination of water quality. In this system the saprobity is the part of dynamic typology correlated with living nature. So in their opinion the saprobic-typology is used to describe the supplement of water in organic material as food for organisms.

Felföldy (1987) in his work gave us connection between saprobity grade and biochemical oxygen demand.

VITUKI (Institute for Research of Aquatic Sciences) (1996) recommended the next parameters to describe saprobity level: oxygen level, COD ($KMnO_4$), COD ($K_2Cr_2O_7$), BOD5 and PB-index.

So the hydrobiologists, who work in laboratories like us, have to do this last one, I mean to analyse the phytoplankton and calculate this PB-index.

Usually it depends on analyzing conserved samples using microscopes with inverse system called Utermöhl. In our laboratory we use Leica DMIL, which can be treated as one of the best. The samples are conserved by Lugol-solution. The other problem if we meet a difficult species, which identification we have use a special preparation or/and immersion, then we will take out from the sample the problematic individuum to make preparation and use classical system microscope as prescribed. The maximum of magnification used by us in this work is 1000x.

Other useful thing in using inverse microscopes, that we can make quantitative analysis, too.

Determination of amount of algae

To determine the whole amount of algae, probably the best way is to use the method by Utermöhl (1958). Only one problem with this method, that we need have a special microscope with "inverse" system. The essence of this method is that we measure conserved but not compressed samples, pouring them to special chamber. The chamber's speciality depends on its bottom glass, which thickness is like to thickness of usual cover glass used in microscopy.

Hungarian laboratories dependent on Environmental Inspectorates have this type of microscopes. In our laboratory we have two of them, one Leica-DMIL and another NIKON-Inverse.

The maximum of magnification used by us is 630x for this type of work.

Measurement of chlorophyll-*a*

Chemical way to measure the chlorophyll-*a*'s amount is one of the simplest chemical measurements done in hydrochemical laboratories. To this measurement we use samples taken as the same way as for other algological investigations.

Samples have to be stored without conservation in cold place until measuring of them.

The first step is the filtration, which means that known amount of investigated water is fitrated throughout a glassfibre filter.

Next step is to extract the chlorophyll-*a* collected on the filter by ethanol. Earlier in Hingary we used in practice methanol for extraction, but this material is highly toxic, that's why Hungarian norm came to be changed, for using ethanol.

After extraction the extractum is taken to measure it's light absorbance two times by two wavelength: 665 and 750 nm spectrometrically. Once the pure extract is measured, but for the second time measurement it comes to be treated by HCl-acid. The meaning of this process to by-pass disturbing parameters like feofitin-a, and other foto-pigments (Szilágyi 1982).

Using of determined parameters

Two of these parameters are used to classify the water quality. Saprobity is assigned to parameters describing oxygen regime. Amount of chlorophyll-*a* is assigned to parameters describing regime of phosphorus and nitrogen, which mean the main contents of productivity. The amount of algae is not used officially in the practice, but usually noted because its parallelism with water's content of chlorophyll-*a*. Hungarian standard for quality of surface water MSZ 12749 contains the table 1 for saprobity and chlorophyll-*a* content classification.

Table 1

Hungarian standard for quality of surface water MSZ 12749

Parameters of water quality	Dimension	excellent I. class	good II. class	bearable III. class	polluted IV. class	heavily polluted V. class
Saprobity (Pantle-Buck) index	-	1,8	2,3	2,8	3,3	>3,3
Chlorophyll-*a*	µg/l	10	25	75	250	>250

DISCUSSION

Saprobiological analyses showed us 199 different described planktonic forms (including Ciliata, Bacteria, Flagellata apochromatica and Mycophyta), which were dominated usually by Diatoms occurred in the highest numbers.

Other periods are characterised by equalized domination between phylla of algae.

The highest numbers of algae were registered usually in summer season and the chlorophyll-*a*'s level showed explicit but not strict correlation with it(Felföldy 1987).

The saprobity was ranging from 1,36 (oligo-beta-mezosaprobic) to 2,82 (alpha mezosaprobic).

The highest numbers of algae were 74,2 millions/dm^3 at Balsa sampling place in 25.06.2002. That's very interesting because the largest amount of chlorophyll-*a* which means 148,7 μg/l was registered at Záhony sampling place in 07.08.2002.

This paradox doesn't mean nothing, because as it's written in literature (Kiss 1998, Felföldy 1987), there is no strict connection between this number and the content of chlorophyll-*a*.

The water quality on base of chlorophyll-*a* was ranging between first and fourth class. Classification on the content of chlorophyll-*a* must be corrected by a seasonal factor, according to changeable light conditions the content of chlorophyll-*a* can grow up or fall down. In our case all of winter samples showed excellent quality.

The saprobity was ranging from 1,36 (oligo-beta-mezosaprobic) to 2,82 (alpha mezosaprobic). The highest value of saprobity index (2,82) was registered at Záhony, but the average saprobity didn't show bigger differences between sampling places. This highest value was the only one exception from the next statement: saprobity at every sampling places in all sampling time showed the second or the third class of water quality.

SUMMARY

Use of algae in practice for Hungarian environmental protection is so poor.

This practise is claimed the measurement of chlorophyll-*a*, determination of total numbers of algae and saprobiological analyses on planctonic base and calculation of Pantle-Buck-index. Others aren't necessary, because only two of them are used to classify the water quality.

Saprobity is assigned to parameters describing oxygen regime.

Amount of chlorophyll-*a* is assigned to parameters describing regime of phosphorus and nitrogen, which mean the main contents of productivity. The total number of algae is a complementary data to decide about conveniency of measured amount of chlorophyll-*a*.

So the biologists for their scientific works and for understanding the environment use the particular results of these above, but these are useless because

the bureaucracy, which officially is in position to decide about the water management and protection.

In my opinion other algological parameters can be useful in the future, when the European Water Resource Framework will be applicated in practice of water quality analysis in Hungary.

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