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COMPARISON OF PHYSICAL AND CHEMICAL MEASUREMENTS OF SÉD STREAM IN VESZPRÉM AND HOLT-SEBES-KÖRÖS TOGETHER WITH SEBES-KÖRÖS IN BÉKÉS

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The most essential purpose of the modern society is that it's able to handle and find solution for environmental problems especially water pollution which is serious problem not only for present but future generation as well. As the load to our surface water has become more significant consequently a continuously increasing demand has been created for adequate water quality and quantity water. The Water Framework Directive is a long-term water policy of the European Union. Aim of WFD is the classification and protection of the water according to consistent viewpoints. Objectives of the researches are the identification and testing of the effects of the potential pollutants sources and critical sites in Séd (Veszprém) and in Sebes-Körös in Békés.

Keywords: Séd stream, Sebes-Körös, physical and chemical parameters, water classification

Introduction

Nowadays there is a reduction in Water Management. The most significant aspects are estimation of water in viewpoint of society and change of demands. Alteration of approach sustainability and ecological viewpoints are in priority question furthermore water management, environment and nature protection. Regional development are also significantly important to be integrated. These are legalized by European Union. Entire water policy has been installed in 2000 its run under the directive of Water Framework Directive.

Water Framework Directive (WFD) provides the solution and WFD is one of the most significant manifestations of water management [2]. The WFD (2000/60/EC) was created as a long-term water policy of the European Union. Member States are required to achieve good ecological and chemical status in all bodies of surface water by 2015 [1]. It provides a framework for Member States and to be applied taking into consideration local features. The basis of implementing the WFD is the elaboration of the typology of water bodies [6]. Hungarian typology based on four parameters altitude, geology, structure and substrate of bed material and size of the catchment area. A further requirement of WFD Water Management Plan has to be submitted by all Member States. By 2009 standard Water Management Plan has to be developed for the whole territory of Hungary. In this project cooperation with neighbour countries are essential. This Plan should include arrangements for maintenance of good water condition and water monitoring.

Examination units have been defined in Water Management Plan according to this territory of Hungary has been divided into 42 units.

Séd situate in Veszprém county is included within category 1-13. This called Észak-mezőföld és Keleti-Bakony. Holt-Sebes-Körös just as Sebes-Körös in Békés county is included within category 2-14 [7]. This called Sebes-Körös *(Fig. 1)*.

The competent authority according to the instructions of the WFD in Hungary marked out monitoring sampling sites such as streams in Veszprém and in Békés. Two different area were appointed where polluted resources were investigated in point of view how they influence surface water according to WFD.

The most significant purpose of the project is to define water quality of Séd and Holt-Sebes-Körös just as Sebes-Körös. In the second place the most significant physical and chemical parameters of the streams were compared. The water capacity of Séd has been decreased year by year although the volume of incoming sewage water has been increased. In summer several parts of the stream became dry which means its favourable to enter the sewage water into dolomitic water.

Marshy areas can be found in large numbers in the area of Holt-Sebes-Körös and Sebes-Körös. Those areas that did not have permanent water cover but effected by the change in the level of groundwater went through salinization due to leaching of sodium ions [3]. Impacts of sewage and animal farms have to be taken into

consideration in these areas. Furthermore the effects of the human activities exercise also significant influence on the ecosystem.

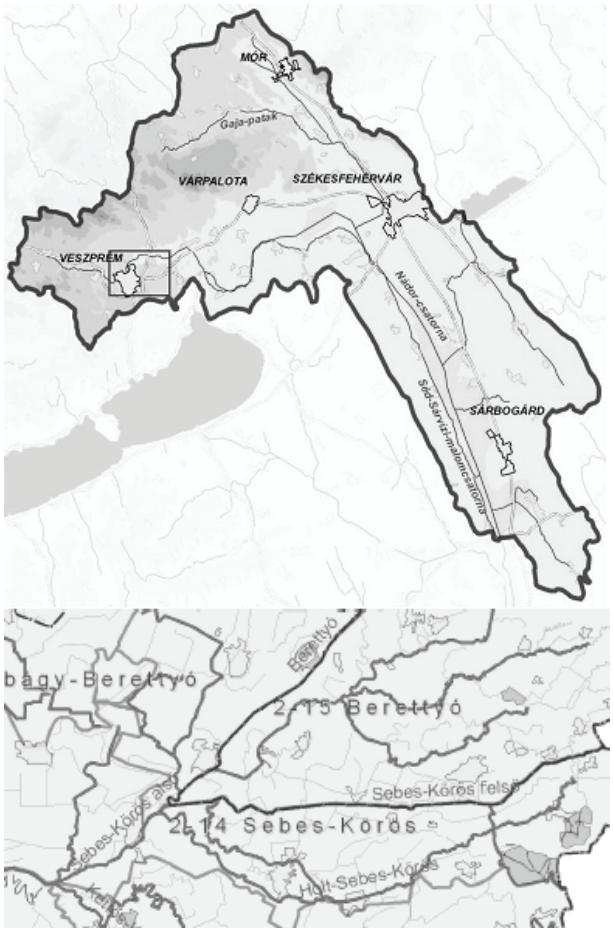

Figure 1: Catchment area of Séd and Sebes-Körös

According to the results of the examined water the followings were determined. Séd and Sebes-Körös are loaded by direct and diffuse pollutants. Water pollution comes from close gardens, cultivated lands, sewage water treatment plants where sewage and cleaned water contain high concentration level of nitrate, nitrite, ammonium ion and orthophosphate. An additional pollutant source is the urban drainage water.

Séd and also Sebes-Körös run through water bases so they have their effects on subsurface water. It is important to measure the pollutants regularly in order to be able to follow the quantity and quality of pollution tendency.

Material and methods

Séd stream runs through limestone area in Transdanubian region. Its length reaches the 70 km. Körös coming from the Transylvanian mountains has been forming the surface of the area for thousands years. According to typological categorization (WDF) Séd belongs to high altitude calcareous streams with coarse bed material while Körös area belongs to lowland calcareous medium sized streams with moderately fine bed material. Physical and chemical tests were taken three times at urban part of Séd in spring. At selection of the sampling sites the following direct pollution sources have been taken into consideration:

20 sampling site and 7 polluted locations were appointed along the stream that have strong effect to water quality. These polluted locations are spring-water, output pipe of Bus Service Station, output of urban drainage, output pipe of Sewage treatment, Békatói stream and branches. Two villages were marked (Okány and Mágor) at part of Holt-Sebes-Körös and three villages (Körösszakál, Körösladány and Komádi) at part of Sebes-Körös, where some important physical, chemical measurements [8] were taken three times in spring so far *(Fig. 2)*.

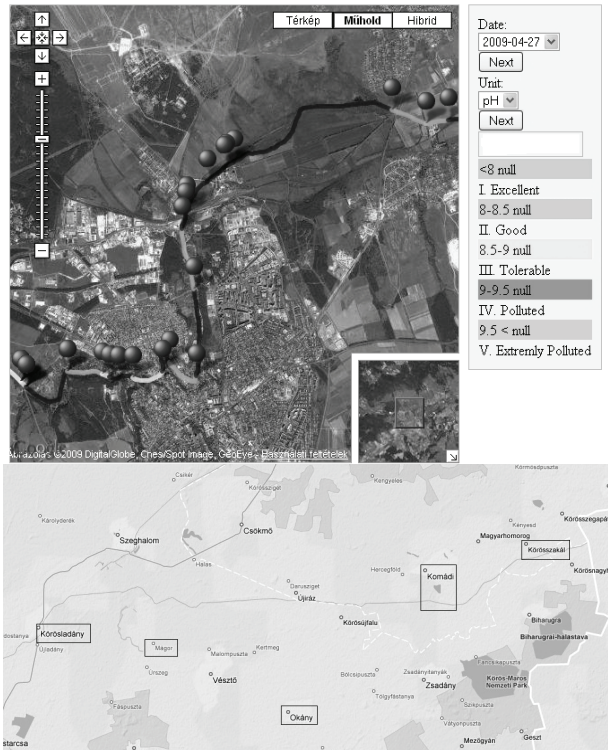

Figure 2: Sampling sites in Veszprém and in Békés

Calibrated and portable devices were applied to take outside measurements like temperature, pH-value, conductivity.

Alkaline and COD_{ps} were analyzed by titrimetry. The SO_4^{2-}, PO_4^{3-}; NH_4^+; NO_3^-; NO_2^- were analyzed by spectrophotometer [4]. Na^+; K^+; Ca^{2+}; Mg^{2+} concentrations were defined using AAS methods.

On the base of the results of field and laboratory measurements surface water has been qualified according to MSZ 12749:1993 standards (excellent, good, tolerable, polluted, extremely polluted) [5].

Results and discussions

Measurements taken on field

Examination of the temperature in spring (10–17 °C) meets expectation. *Fig. 3a, b* represents clearly the daily changeability of the temperature. The temperature measured at the output pipe of sewage treatment is higher than average temperature of the stream so it causes continuous heat load to certain sampling sites.

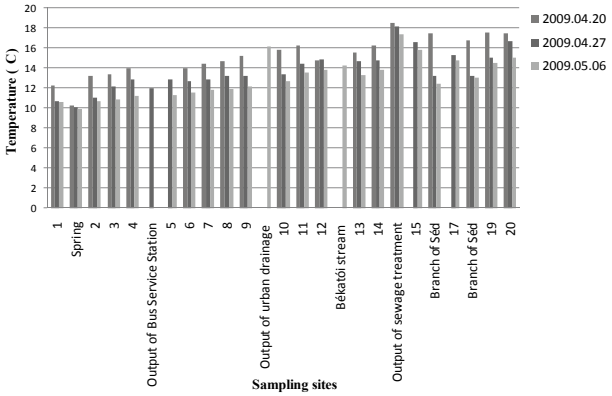

Figure 3a: Temperature values measured in Séd

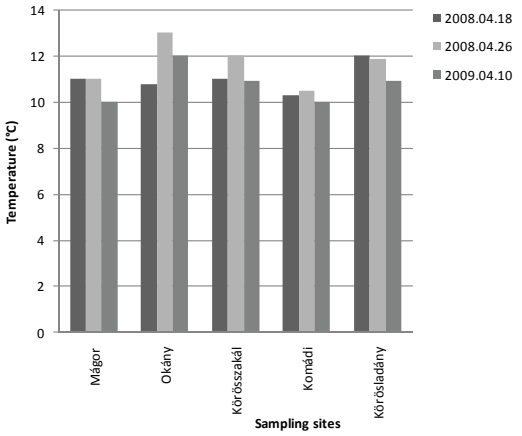

Figure 3b: Temperature values measured in Körös

Along downstream pH-level is between (7–9) so the water is defined as smoothly alkaline *(Fig. 4a, b)*.

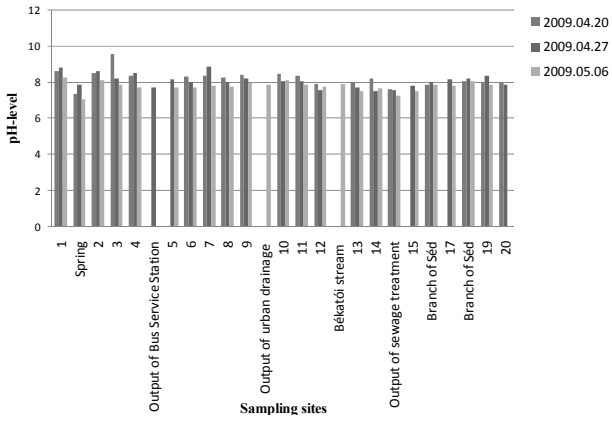

Figure 4a: pH-level in Séd

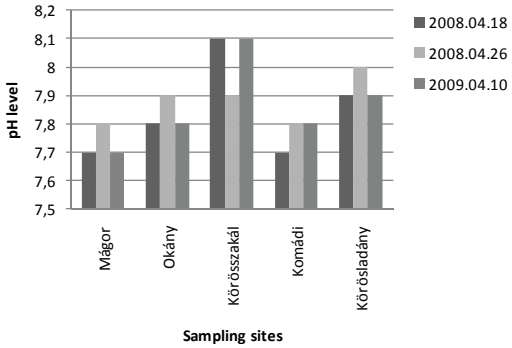

Figure 4a: pH-level in Körös

The tendency of conductivity in Séd was constant (800–900 µS cm^{-1}), extremely high values (1400 µS cm^{-1}) were taken at Békatói stream. Average value of the conductivity is 894 µS cm^{-1} so low values were measured at output side of bus service station (600 µS cm^{-1}) and in the cleaned water of sewage treatment (340 µS cm^{-1}) *(Fig. 5a)*. The tendency of conductivity in Körös was also permanent, but lower than in Séd (400– 600 µS cm^{-1}). The highest values (800 µS cm^{-1}) was measured in Mágor *(Fig. 5b)*.

The reason of the different values of conductivity is due to different bed material (calcareous or salinated).

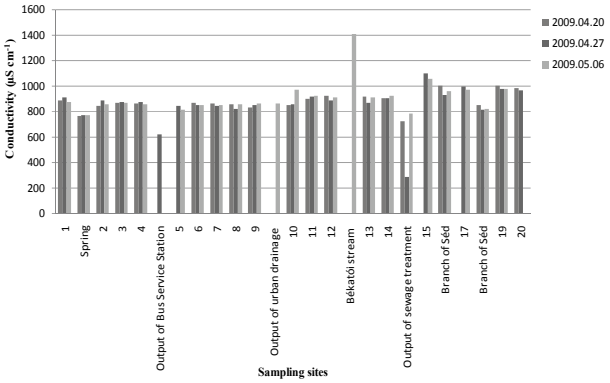

Figure 5a: Changeability of the conductivity in Séd

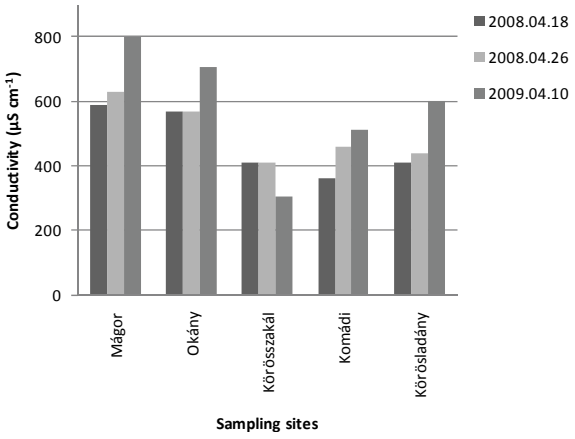

Figure 5b: Changeability of the conductivity in Körös

Measurements taken in laboratory

The ammonium ion concentration was measured between 20–250 µg l^{-1}. *Fig. 6a* shows the high concentration values taken in Békatói stream (760 µg l^{-1}) and central urban drainage in Veszprém (1900 µg l^{-1}).

Fig 6b shows the highest concentration values measured in Vésztő-Mágor (1010 µg l^{-1}) due to direct pollution [8].

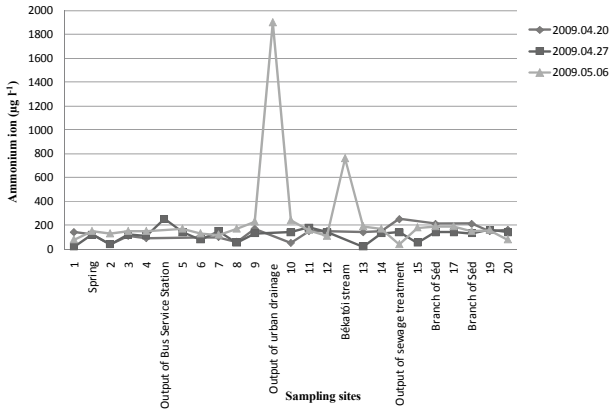

Figure 6a: Concentration of ammonium ion in Séd

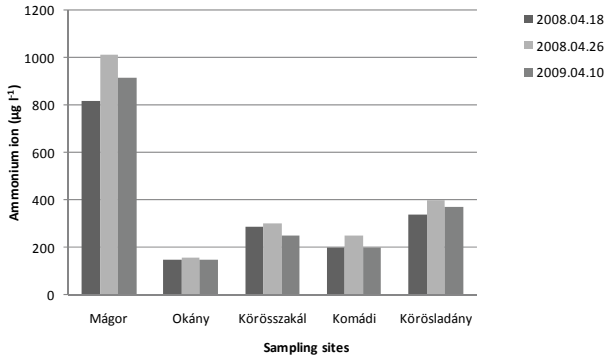

Figure 6b: Concentration of ammonium ion in Körös

Nitrate concentration level has been increased (3,4–5,2 mg l^{-1}) continuously in the town. Its level is higher inside the town than outside of the town. In Séd and Vésztő-Mágor extremely high concentration level (14,4 mg l^{-1}, 10 mg l^{-1}) were measured from cleaned water of sewage treatment *(Fig. 7a)*.

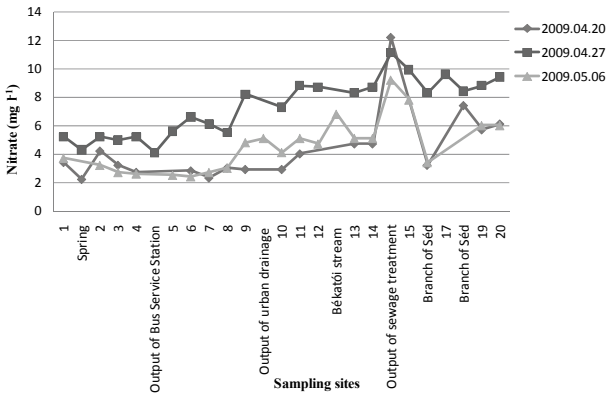

Figure 7a: Range of nitrate concentration in Séd

In case of Vésztő-Mágor always higher nitrate concentration was measured 10 mg l^{-1} than other sampling sites 2–6 mg l^{-1} *Fig. 7b*.

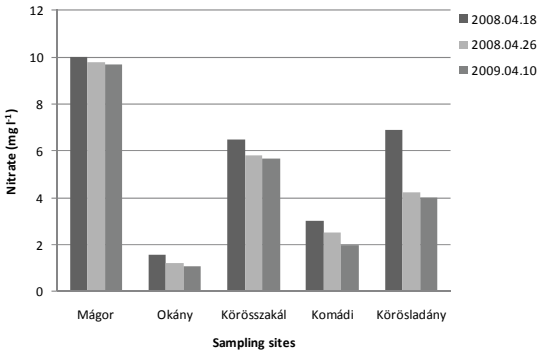

Figure 7b: Range of nitrate concentration in Körös

The level of the orthophosphate concentration in Séd in Veszprém was changed between 50–100 µg l^{-1} but high concentration level was taken at urban drainage (790 µg l^{-1}) and output pipe of sewage treatment (690 µg l^{-1}) that caused by heavy raining. High concentration (1020 µg l^{-1}) was measured at Békatói stream *(Fig. 8a)*.

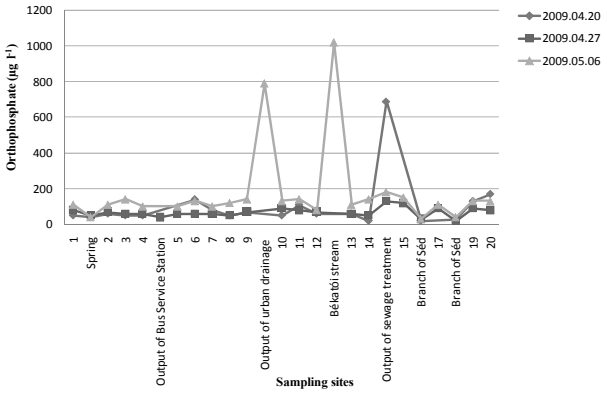

Figure 8a: Orthophosphate concentration in Séd

High concentration (600 µg l^{-1}) was measured at Sebes-Körös stream (Körösszakál) *(Fig. 8b)*.

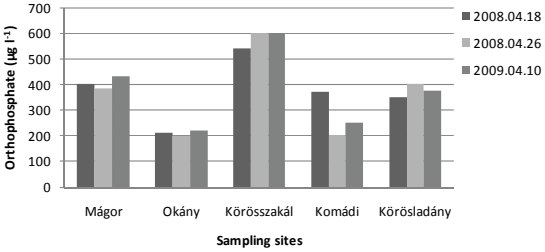

Figure 8b: Orthophosphate concentration in Körös

The average orthophosphate concentration level in Körös is higher than in Séd because of fertilizer and animal husbandry.

Results of the measured 8 main ions have supported that Séd runs through calcareous and karstic base rock and Körös is in salinated area.

Maucha diagram represents the concentration level of the 8 main ions in Séd and Körös. *Fig. 9a* presents clearly

the high concentration of HCO^{3-}, Ca^{2+}, Mg^{2+}. Relative high concentration of Na^{+} was measured in Körös *(Fig. 9b)*.

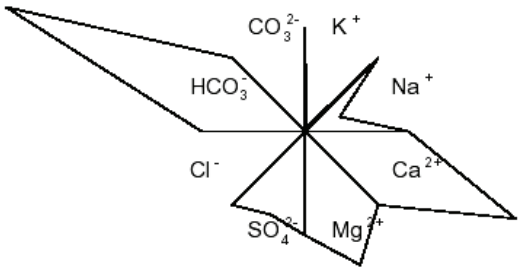

Figure 9a: Maucha diagram referring to Séd

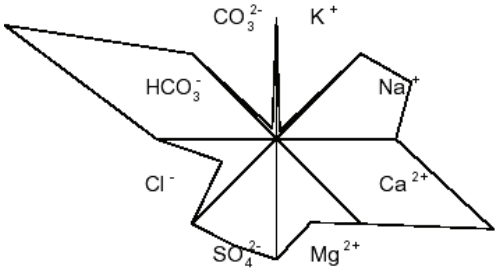

Figure 9b: Maucha diagram referring to Körös

Water classification

Categorization of surface water was performed according to Hungarian standards [5].

In point of conductivity the tested part of Séd can be classified as moderate stream. Békatói stream and Holt-Sebes-Körös at Mágor have been ranked as polluted stream according to water classification.

Ammonium ion concentration has been changed between good and tolerable. In Séd the most critical concentration level was indicated at output of urban drainage where the water quality was classified as polluted. The water in Mágor is different from the other points in Körös, due to pollutants caused by an animal farm and sewage treatment transmitted into freshwater. In most cases ion concentration of water in Okány is the lowest, because this point was situated far from the town. Water quality at Békatói stream Holt-Sebes-Körös in Mágor has been considered as moderate. In both cases polluted water have been likely emitted. In case of nitrate concentration good and tolerable categories were distinguished (inside the town and outside of the town). Furthermore excellent water quality was determined in Okány and Komádi and water quality measured at other sampling sites were ranked as tolerable [8].

Conclusion

According to measurement taken on field and laboratory the water quality of Séd and Körös is classified excellent and good [Okány; Bus Service Station] but in some cases water quality is categorized as tolerable [Körösszakál; Békatói stream]. Several parameters refer to direct flowing of sewage that requires further detailed measurements.

Six sampling sites are emphasised according to volume of pollutants. Bus Service Station and Sewage Treatment are the only public utilities that possess unique permission in case of water limit values. But some tests have approved that the water is loaded with pollutants emitted by above mentioned public utilities. Urban drainage should be also enhanced as contamination source as it takes pollutants to Séd. Finally Békatói stream is also stressed as a loading source. Orthophosphate and nitrate concentration in Békatói stream are rather high so this water is considered polluted stream.

The measurements taken in Mágor indicate high concentration level of ions (orthophosphate, nitrate and ammonium) and it refer contamination caused by local husbandry. In Körösszakál and Körösladány the measured data of orthophosphate is higher than the average value in the sampling point because sewage of the townships are transmitted into freshwater. The nitrite and nitrate concentration in water is lower than the values taken in the past. This is because the area is protected by regulation and the farm production is limited [8].

In conclusion in both cases the pollution resources originated from point sources such as sewage treatment, husbandry. These activities have significant effect on the quality of surface water. Further measurements are required that pollutants sources to be easily identified. Information about water quality in Séd and Körös are available at Local Governments. The critical polluted sites have been assigned so collective action plan have to be worked out based on WFD instruction.

ACKNOWLEDGEMENT

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