

QUALITY OF THE WATER OF RIVER LEBNITSA - SW BULGARIA INTENDED FOR AGRICULTURAL IRRIGATION AND LIVESTOCK BREEDING

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Abstract: The water from the river Lebnitsa, Kyustendil region, SW Bulgaria during the performed monitoring was determined as moderate clean. Water partly in some areas is not suitable for irrigation of agricultural crops and for livestock breeding. Turbidity, foaming, high carbonate content and values of electrical conductivity, total dissolved solids and salts slightly above the typical for this type of water of mountain rivers of the region were found. Some indicators for clean water are missing. The amount of coliforms is high. In order to use water for irrigation and livestock breeding, it is necessary to be established and eliminate the sources of water pollution first.

КАЧЕСТВО НА ВОДАТА НА РЕКА ЛЕБНИЦА - ЮЗ БЪЛГАРИЯ, ПРЕДНАЗНАЧЕНА ЗА НАПОЯВАНЕ И ЖИВОТНОВЪДСТВО

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Резюме: Водата от река Лебница, област Кюстендил, ЮЗ България при извършения мониторинг е определена като умерено чиста. На места водата не е подходяща за напояване на селскостопански култури и за животновъдство. Установени са мътност, пенообразуване, високи стойности на карбонатност и електропроводимост, общо разтворени вещества и соли малко над характерните за този тип вода на планинските реки в района. Количеството колиформи е високо. За да се използва водата за напояване и животновъдство, е необходимо първо да се установят и премахнат източниците на замърсяване на водата.

Introduction

The Lebnitsa River, Kyustendil region is a left tributary of the Bistritsa River. It originates north of Bozhderitsa hill in the Osogovo Mountains at 1300 m above sea level. It flows along a rocky trough in a steep valley, gradually expanding. South of the village of Gyueshevo changes its direction to North-East and enters into the Kamenichko field. It flows northeast of Dolno Selo village. Its length is 13 km, an average slope of 40‰. The catchment area is green with *beech* and *pine* in the mountainous area. In the valley there is a deposit of lead-zinc ore [1]. The Lebnitsa River is of economic importance, it is a source of water for irrigation of agricultural crops in the valley and water for breeding of farming animals. It is the main water source for the float factory and landfills of the lead-zinc deposit. The boundaries of the Kamenichko field are marked by the foothills of the Osogovo, Lisets and Chudinska mountains and have a hilly relief. Within it there are internal valley hills, which rise by 110-120 m above the valley field. It is drained by the rivers Bistritsa and Lebnitsa. The

Kyustendil valley is located along the valley of the Struma River between the Zemen and Skrino gorges and is surrounded by the Osogovo, Lisets, Zemenska and Konyavska mountains. Its average altitude is 550 m [2]. The aim of our project is collecting data about the quality of the water of Lebnitsa for irrigation of agriculture and framing.

Materials and Methods

We applied the method for measuring on spot ("in situ"), on field with grab samples, because the benefits of that method are the high degree of authenticity, propriety and accuracy of the studies. We used digital (electronic) devices during the execution of the study because of their capabilities for fast, easy and precise measurement of the studied parameters on field.

The total radioactivity and the radioactivity of the water and sediment are measured with Geiger counter "Radex" RD1503 ($\mu\text{Sv/h}$).

Conductivity meter "SensoDirect 150" was used for determination of water acidity (pH), water temperature ($t, ^\circ\text{C}$), electrical conductivity (EC, $\mu\text{S/cm}$), total dissolved solids (TDS, ppm), dissolved oxygen (O_2 , %), salt content (ppm).

For the study of the chemical parameters of the river water we used spectral photometer "Lovibond MD-600". With this instrument are determined: free, total and combined chlorine Cl, acidity (pH), cyanuric acid CYS, total alkalinity CaCO_3 , free, total and combined copper and iron Fe (mg/l).

Nitrate NO_3^- mg/l and nitrite NO_2^- mg/l content in the water are determined through colorimetric method with testing tapes with ranges 0-10-25-50-100-250-500 mg/l. The content of arsenic As is measured through a colorimetric method with testing tapes with ranges 0.005-0.0010-0.0025-0.05-0.1-0.25-0.5mg/l and reagent melodic acid. For determining the content of zinc Zn is applied method with testing tapes with ranges 0-4-10-20-50 mg/l and reagent sodium hydroxide. Manganese Mn is also measured through a colorimetric method with testing tapes with ranges 2-5-20-50-100 mg/l and reagent sodium hydroxide. The content of lead Pb is determined through colorimetric method with testing tapes with ranges 20-40-100-200-500 mg/l and reagent Blei-Test. Sulphates SO_4 are measured through colorimetric method with testing tapes with ranges 200-400-800-1200-1600 mg/l. Sulphites SO_3 are measured through colorimetric method with testing tapes with ranges 10-40-80-180-400 mg/l.

The microbiological research for *coliforms* is done according to the method described in State Gazette BDS EN ISO/IEC 17025:2006 for research of river waters. The research is held by Test Chemical and Microbiological Laboratory at "RIOKOZ", Kyustendil. The volume of the samples 250 ml, column units KOE/100 m land standard validated methods BDS EN ISO 9308-1, temperature during the research 37°C in value and limit of the indicator 5000 (Protocols №455 and №456/25.08.2015).

For detecting of fish presence Portable radar was used (ultrasonic sonar for fish detection "Fish Finder" with monochromatic LCD display, single rayed, frequency 200 kHz, top depth 100 m, picture of the river bottom's terrain). The method of interview of fishermen and local people was used for figure up the presence of fish species *Salmo trutta* which is a bioindicator for clean water in this type of rivers (River passports, Bulgarian Ministry of Environment and water).

For the sedimentological examination of anthropogenic detritus was applied microscopic method of research which is used in geology for sediment rocks – binocular (stereo) microscope "CETI" (STAR-24-ED) with reflected white light and application for fluorescent light and a digital monocular microscope USB 2.0 DigiScope and a Digital Microscope with computer program Micro Viewer.

Data for accomplished environmental monitoring of the water and the sediment of river Struma and her right tributaries from the Kyustendil basin are submitted by [3, 4, 5].

Results and Discussion

As a result of the study, white-grey foam and turbidity was observed into the river water. Water had high turbidity some sediments were covered with black asphalts and there is some anthropogene microdetritite in the sediments. Acidity of the water was 8,1, which is normal for river type R3 water [6], total alkalinity is high >200 mg/l, EC, TDS and Salt and Cyanuric acid [7] have little higher values non-typical for mountain rivers. Generally, there is some human pollution of the water which is presented by alkaline chemicals, probably soap derivates (superficial-active substances) or faecal or farming waste water flows into the river, because microbiological study proved high content of *coliforms* 4580 CFU/g (Table 1). Content of the nitrite and nitrate is low. Fe, Cl, Cu, As, Pb, Mn, Zn is not much. This is the same for all studied parameters. Radiation of the background, water and sediment is little bit high, but all of them are in the frame of the normal. The results of the method of interview and observation of the river, including with instrument Fish Finder shown absent of the fish species – an indicator for clean water *Salmo trutta*. Almost well spread is the macro-zoo benthos *Trichoptera: Rhyacophila*.

Table 1. Measured parameters of the water of Lebnitsa River, Osogovo Mountain

Measured water parameter	Result
Acidity pH	8.1
Conductivity EC, $\mu\text{S}/\text{cm}$	475
Total Dissolved Solids TDS, ppm	323
Salt, ppm	227
Temperature of water t, $^{\circ}\text{C}$	10
Temperature of air t, $^{\circ}\text{C}$	17
Nitrite NO_2^- , mg/l	<10
Nitrate NO_3^- , mg/l	<10
Free Cl, mg/l	0.08
Total Cl, mg/l	<0,05
Combined Cl, mg/l	0,08
Cyanuric acid CYS, mg/l	11
Total alkalinity CaCO_3 , mg/l	>200
Free Cu, mg/l	0.1
Total Cu, mg/l	<0,05
Combined Cu, mg/l	0.1
Iron Fe, mg/l	<0,02
Dissolved oxygen O_2 , %	8.1
Arsenic As, mg/l	<0.005
Lead Pb, mg/l	<20
Manganese Mn, mg/l	<2
Zinc Zn, mg/l	<4
Sulphate SO_4 , mg/l	<200
Sulphite SO_2 , mg/l	<10
Anthropogene microdetritite, %	5
Radiation background, $\mu\text{Sv}/\text{h}$	0,18
Radiation of water, $\mu\text{Sv}/\text{h}$	0,20
Radiation of sediment, $\mu\text{Sv}/\text{h}$	0.20-0.33
Hardness, mg/l	43
Eh/Oxygen Redox Potential OPR	57
Microbiology: coliforms, CFU/g	4580
Fish <i>Salmo trutta</i> , kg/100m ²	<0.5
Trichoptera: <i>Rhyacophila</i> , num./m ²	7
Color, foam, smelt, taste	Partly turbidity, foam

Conclusion

The water from the river Lebnitsa, Kyustendil region, SW Bulgaria during the performed monitoring was determined as *moderate-yellow*, according to [8]. Water partly in some areas is not suitable for irrigation of agricultural crops and for livestock breeding. Turbidity, foaming, high carbonate content and electrical conductivity values, total dissolved solids and salts slightly above the typical for this type of water of mountain rivers of the region were found. There are asphalt products in the sediment and discarded building materials used to strengthen the banks. The amount of coliforms is high. In order to use water for irrigation and livestock breeding, it is necessary to eliminate the sources of water pollution first.

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