Research of the Ecological Status in the Waters of the River Sitnica-Kosovo

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***Abstract*—The most potential pollutants of the river Sitnica with phenols, heavy metals, and other physicochemical indicators are Kishnica Mine, Ferronikel, surface coal mines, Kosovo Energy Corporation, landfill with industrial waste in Mitrovica, landfills and urban discharges, etc. The purpose of this work is to investigate the degree of pollution and to determine the ecological status of the Sitnica River. Although the focus of our research is the phenol pollution of the waters of the river Sitnica. During our research we have analyzed physicochemical parameters with contemporary analytical techniques, applying the standard determination methods. The parameters that have been analyzed are temperature, electrical conductivity, oxygen saturation, total matter suspended, NH_4^+, PO_4^{3-}, SO_4^{2-}, Cl^-, pH, DO, BOD_5, COD, N-NH_4, NO_3^-, NO_2^-, PO_4-P, TP. The results obtained and presented in tabular form and compared with the reference values, reflect enormous pollution with phenols, at the maximum rate of 1.137 mg/L and other physicochemical pollutants. Based on the findings from the conducted experiments, the water of the river Sitnica is categorized in waters with a poor ecological status.**

***Index Terms*—Ecological status, KEC, phenols, physicochemical parameters, Sitnica River, urban and industrial discharges**

I. Introduction

The Sitnica River is the third largest river in Kosovo in terms of size and water flow. This river originates in the mountains of Zhegovci and is formed by the streams Matica, Sazllina, and Shtime. From the source to its meeting with the waters of the Ibr River, it passes through steep terrain, in a plain of 90 km, with an area of 3.129 km^2 and a water flow of 9.5 m^3/s.

By the way, as a result of industrial activities and urban discharges near the river Sitnica, these waters continue to be polluted to a disturbing degree.

Water quality is an important factor in judging environmental changes, which are strongly associated with social and economic development. The evaluation of water in developing countries has become a critical issue in recent years, especially due to the concern that fresh water will be scarce in the near future. In general, the quality of water is equally important as the quantity. Therefore, water quality is considered an important factor in judging environmental changes, which are strongly associated with social and economic development [1].

Water plays a vital role in the existence of life and various sectors of the economy, such as agriculture, livestock production, forestry, industrial power generation, fisheries, and other creative activities [2].

With the growth of the population and commercial and industrial activities, surface water has received a large number of pollutants from a variety of sources [3]. The development of human communities and the increase in irresponsible use of water resources have deteriorated river and lake water quality [4].

The entrance of phenolic compounds into the aquatic environment results from natural, industrial, domestic, and agricultural activities. Their presence may be caused by the degradation or decomposition of natural organic matter in the water, the disposal of industrial and domestic wastes into bodies of water, and runoff from agricultural lands [5].

In addition to heavy metal pollution from the Kishnica Mine, located near Prishtina and Ferronikeli, another potential polluter is the Kosovo Energy Corporation (KEC), which uses coal as a raw material for electricity generation. Exploitation, processing, and utilization as coal fuel by KEC, located near the river Sitnica, has polluted its waters and permanently pollutes them with phenols, heavy metals (Pb, Cd, Cu, Zn), and other pollutants [6]. Kosovo is among the countries with the highest degree of pollution in Europe. Currently, the main sources of pollution are Kosovo's power plants. According to the present data, coal resources in Kosovo are estimated at about 10.5 billion tons. Almost entirely, this coal is being used for the production of electricity in Kosovo's power plants. Monitoring revealed that only one of the five units of the power plant "Kosova A" emits 25 tons of dust and ash per hour.The emissions level is about 74 times above the European standards. Particular environmental problems represent ash landfill, not only for the microlocality where it's located but even far away, including Prishtina. Chemical gamma-spectroscopical analysis of dust and particles showed that they contain several toxic elements (As, Pb, etc.), and radionuclides (238U, 235U, 226Ra, etc.), which endanger plant, animal, and human health in the vicinity of power plants. Currently, about 700,000 citizens inhale the mixture of toxic gases released from power plants "Kosova A and B". An indicator of this pollution is the level of public health in Kosovo, specifically the number of deaths of newborn infants [7].

Such enormous pollution has created a degradation of biodiversity, not only of river waters but also of the urban environment, on both sides of the river banks and throughout its flow. During our research, we have managed to conclude that in addition to the presence of heavy metals and other pollutants in these waters, as evidenced by numerous scientific studies, the toxicity of these waters has caused and continues to cause the presence, beyond reference values, of phenols, which are also our object of study.

Based on their toxicity, phenols are known to be derivatives of aromatic hydrocarbons, and based on their

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toxicity, they are included in the second group of poisons. Phenolic compounds are among the chemicals of major concern because they tend to persist in the environment over a long period of time, accumulate and exert toxic effects on humans and animals [8].

With the opening and commencement of work, in the 60s of the last century, of the Kosovo Energy Corporation (KEC), the opening and exploitation of coal from surface mines in the villages of Bardh and Mirash, as well as the processing of coal for the needs of power plants A and then B, enormous pollution of the environment in general, but also the waters of the river Sitnica in particular. Such permanent pollution with phenols and other pollutants, from the beginning until today, has influenced the extinction of fish and other living things, which were once the rare wealth of this river.

Phenols in the cells of the body, in most cases, penetrate through the skin and thus damage the central nervous system, liver, and kidneys, while the formation of methemoglobin in the blood prevents the penetration of oxygen into the body [9].

Also, 2,4-dimethyl phenol is classified as a chemical with the potential to induce carcinogenic effects [10].

Health risks associated with polluted water include different diseases such as respiratory diseases, cancer, reproductive system diseases, diarrheal diseases, neurological disorders, and cardiovascular disease [11].

The fact that once the waters of the river Sitnica were oligotrophic and, as a result of urban and industrial discharges, they turned into eutrophic polluted water, is an alarm bell for the dire situation in which they are, not only the waters of this river but also other environmental components.

II. Methodology

Based on the requirements of the scientific research methodology and to know as concretely as possible the situation in which the waters of the Sitnica River are, we have designed the monitoring network, which includes six sampling sites:

Sampling site S_1 is located in the village of Plemetin in the Municipality of Kastriot (Obiliq), at a distance close to the power plants "Kosovo A and B". Sampling site S_2 reflects the waters of the river Sitnica at the exit of the village Prilluzhë, Municipality of Vushtrri. Sampling site S_3 represents the waters of the river Sitnica in the village Pestovë-Vushtrri.

Sampling site S_4 presents the state of the waters of this river at the exit of Vushtrri. Sampling site S_5, presents the state of the waters of this river at the entrance of the city of Mitrovica, while sampling site S_6 presents the waters of the river Sitnica in Mitrovica, at a short distance before their mixing with the waters of the river Ibër.

In order to present the spatial position as accurately as possible, we have accompanied each sampling with coordinates presented in DMS (degrees, minutes, seconds) (see Table I and Fig. 1).

Other than the total suspended matter, which are the methods with analytical-gravimetric methods, other physicochemical parameters are the methods of using advanced analytical methods, such as potentiometric and spectrophotometric. Their potentiometric application involves this process: first the potentiometric probe is cleaned and rinsed with distilled water, then immersed in most of the water while the results are read on the digital apparatus. As far as the spectrophotometric methods are concerned, more than what should be placed in standards and homogenized is placed in the instrument and the analyte concentrations are digitally read. In tabular form (Table II), for each parameter separately, the determination methods, reagents, and analytical techniques—other instruments for analysis—are reflected.

In addition to phenols, which are also the object of our study, we analyzed physicochemical parameters in order to determine the ecological status of this river. While we have analyzed the parameters thanks to contemporary analytical techniques, applying the standard determination methods reflected in Table II and also accompanied by the relevant reagents.

For each parameter investigated, we performed the analysis at the Kosovo Hydro-Meteorological Institute (KHMI) in Prishtina. Physicochemical parameters are analyzed to determine the ecological status of the river Sitnica.

TABLE I: Sampling Points and Their Coordinates.(WGS84)

ID	Sampling point	Length	Width	Sea level, m
S1	Plemetin	42°42'24.10"N	21°2'17.82"E	528.52
S2	Prelluzhë	42°43'31.52"N	21°01'16.08"E	524.26
S3	Pestovë	42°46'58.80"N	20°59'28.95"E	517.55
S4	Vushtrri	42°49'25.00"N	20°57'18.00"E	511.45
S5	Mitrovicë entrance	42°52'24.28"N	20°52'50.89"E	502.31
S6	Mirtovicë exit	42°54'1.86"N	20°52'27.18"E	499.26

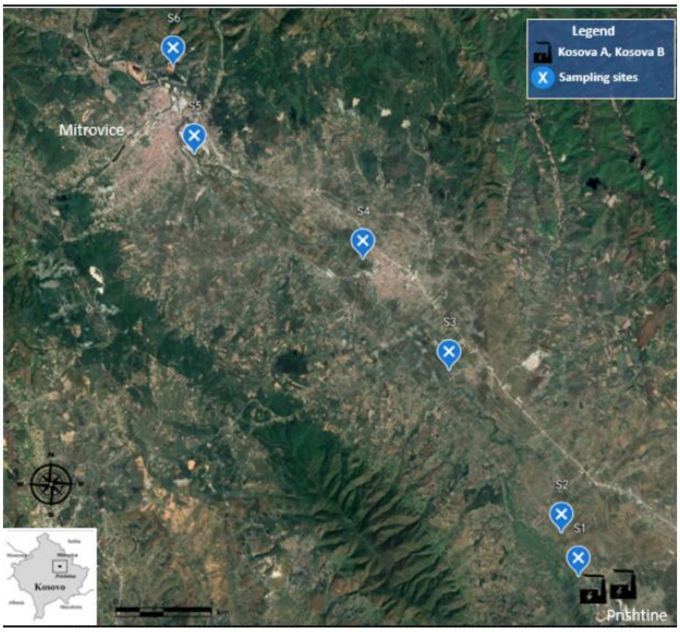

Fig. 1. Map of sampling sites.

III. Results and Discussion

The water samples, at the designated sampling sites, were taken on the opposite side of the river flow and placed in the sterilized 1L bottles intended for water samples. We marked the bottles with the water samples in correlation with the sampling site and transported and stored them in refrigerated conditions (4°C).

Due to the fact that we determined the physicochemical parameters on the same day of their receipt, it was not necessary to preserve them. While, the methods, devices (equipments), reagents, range, and detection limits, for each parameter separately, are reflected in Table II.

In order for the results to be as transparent and accurate as possible, we took the analyzed water samples during June and September 2021. The results obtained for the physicochemical indicators are presented in Tables III and IV. Also in Fig. 2. are also presented in the form of Graphs of the main quality parameters of the Sitnica basin, in the months of June and September 2021

TABLE II: METHODS, REAGENTS, EQUIPMENT'S, MEASUREMENT RANGE AND DETECTION LIMITS

Parameters	Method	Reagent	Equipment	Range	Detection Limits
Temperature	DIN 38404-C4	Temperature Sensor	Potentiometer	−25... +130 ℃	−25
Conductivity	ISO 7888:1985	Electroconductivity Sensor	Potentiometer	0.1–19.99 mS/cm	0.1
pH Value	ISO 10523:2008	pH-Sensor H^+	Potentiometer	−2.0... +20.0	−2.0
Dissolved Oxygen	ISO 5814:2012	Dissolved Oxygen Sensor	Gravimetry - classical analysis	0.01–45.0 mg/L	0.01
Total Suspended Solids	EN 872	Filtration-Gravimetric	Spectrophotometer	0.01–200g/L	0.01
Chemical Oxygen Demand	ISO 15705:2002	Potassium Dichromat Ammonium ferosulphat	Potentiometer	10–150 mg/L COD	10
Biochemical Oxygen Demand	ISO 5815-2:2003	Dissolved Oxygen Sensor	Spectrophotometer	0.01–45.0 mg/L	0.01
Nitrate	DIN 38405-9: 2011	2,6-Dimethylpheno	Spectrophotometer	0.10–25.0 mg/L NO_3-N	0.1
Ammonia	ISO 7150-1	Indophenolblau	Spectrophotometer	0.20–8.00 mg/L NH_4-N	0.2
Nitrogen	ISO 11905-1:1997	oxidative digestion with peroxodisulfate	Spectrophotometer	0.5–15.0 mg/L N	0.5
Phosphate	ISO 6878:2004	Phosphormolybdenblau	Spectrophotometer	0.05–5.00 mg/L PO_4-P	0.05
Total Phosphorous	ISO 6878:2004	Oxidation mit Peroxodisulfat / Phosphormolybdenblau	Potentiometer	0.05–5.00 mg/L P	0.05
Sulphate	APHA 4500-SO42- E	Bariumsulfat, turbidimetrisch	Potentiometer	5–250 mg/L SO_4	5.0
Chloride	ISO 9297	Silver nitrate titration with chromate indicator	Potentiometer	0.1–125 mg/L Cl	0.1
Phenol	ISO 6439:1990	Aminoantipyrin extraktiv	Potentiometer	0.025–5.00 mg/L C_6H_5OH	0.025

TABLE III: RESULTS OF PHYSICOCHEMICAL PARAMETERS, JUNE 2021

Parameters	Unit	Reference values	S1	S2	S3	S4	S5	S6
Water temperature	0C	22*	18.4	18.5	18.9	18.0	17.5	16.6
Conductivity	µS/cm	1000*	737	637	632	694	687	679
pH	-	**	7.69	7.78	7.99	7.71	7.81	7.60
Dissolved oxygen (DO)	mg/L	**	7.19	6.980	7.710	6.830	7.430	2.42
Total suspended solids	mg/L	25*	6.6	5.6	3.9	12.1	2.4	86.0
Chemical oxygen demand (COD)	mg/L	**	20.4	10.4	18.6	28.0	18.1	38.4
Biological oxygen demand (BOD5)	mg/L	**	12.3	9.9	16.7	16.0	10.6	22.5
Nitrates	mg/L	**	3.1	1.1	5.5	6.4	6.9	0.5
Ammonium	mg/L	0.05*	1.226	1.351	1.752	1.907	2.608	3.809
Ammonium nitrogen (N-NH4)	mg/L	**	0.954	1.051	1.363	1.484	2.029	2.963
Total nitrogen (TN)	mg/L	-	2.063	1.644	3.177	3.488	3.970	3.856
Phosphates	mg/L	0.4*	0.643	1.354	0.778	0.421	0.209	0.112
Orthophosphate phosphorus (P-PO4)	mg/L	**	0.210	0.441	0.254	0.137	0.068	0.037
Total phosphorus (TP)	mg/L	**	0.554	0.719	0.721	0.585	0.365	0.667
Sulfates	mg/L	150*	24.8	31.5	33.5	26.7	14.2	11.1
Chlorides	mg/L	200*	4.97	5.12	4.81	4.58	3.88	3.19
Phenols	mg/L	0.01*	0.198	0.253	0.695	0.354	0.433	0.595

Explanations for the signs used in the table:

The symbol (∗) represents Directive 75/440/EEC for surface waters intended for the production of drinking water. [12]

Whereas, the symbol (∗∗) represents MESP-AI 16/2017-Administrative Instruction "Classification of Surface Water Bodies". [13]

The symbol (-) represents the absence of reference values.

Final results for parameters such as temperature, smell, electrical conductivity, oxygen saturation, total suspended matter, ammonia (NH_4^+), phosphates (PO_4^{3-}), sulfates (SO_4^{2-}), chlorides (Cl^-), and phenols are compared with the reference values of Directive 75/440/EEC corresponding to surface waters intended for the production of drinking water.

TABLE IV: RESULTS OF PHYSICOCHEMICAL PARAMETERS, SEPTEMBER 2021

Parameters	Unit	Reference values	S1	S2	S3	S4	S5	S6
Water temperature	0C	22*	19.1	19.3	19.9	20.8	21.0	21.2
Conductivity	µS/cm	1000*	689	549	545	598	592	573
pH	-	**	7.79	6.71	6.89	6.65	6.7	7.62
Dissolved oxygen (DO)	mg/L	**	5.15	6.017	6.647	5.888	6.4	4.20
Total suspended solids	mg/L	25*	10.5	4.8	3.4	10.4	2.1	0.2
Chemical oxygen demand (COD)	mg/L	**	29.6	9.0	16.0	24.1	15.6	15.1
Biological oxygen demand (BOD)	mg/L	**	16.8	8.5	14.4	13.8	9.1	12.4
Nitrates	mg/L	**	11.5	6.9	4.7	5.5	5.9	4.9
Ammonium	mg/L	0.05*	2.614	1.165	1.510	1.644	2.248	1.018
Ammonium nitrogen (N-NH4)	mg/L	**	2.034	0.906	1.175	1.279	1.749	0.792
Total nitrogen (TN)	mg/L	**	5.367	1.417	2.738	3.007	3.423	2.525
Phosphates	mg/L	0.4*	1.547	1.167	0.671	0.363	0.180	1.642
Orthophosphate phosphorus (P-PO4)	mg/L	**	0.504	0.381	0.219	0.118	0.059	0.535
Total phosphorus (TP)	mg/L	**	0.975	0.619	0.622	0.505	0.315	0.882
Sulfates	mg/L	150*	48.6	27.2	28.9	23.0	12.2	38.7
Chlorides	mg/L	200*	9.80	4.41	4.15	3.95	3.34	3.46
Phenols	mg/L	0.01*	0.087	0.117	0.307	0.128	1.137	0.151

Explanations for the signs used in the table:
The symbol (∗) represents Directive 75/440/EEC for surface waters intended for the production of drinking water. [12]
Whereas, the symbol (∗∗) represents MESP-AI 16/2017-Administrative Instruction "Classification of Surface Water Bodies". [13]

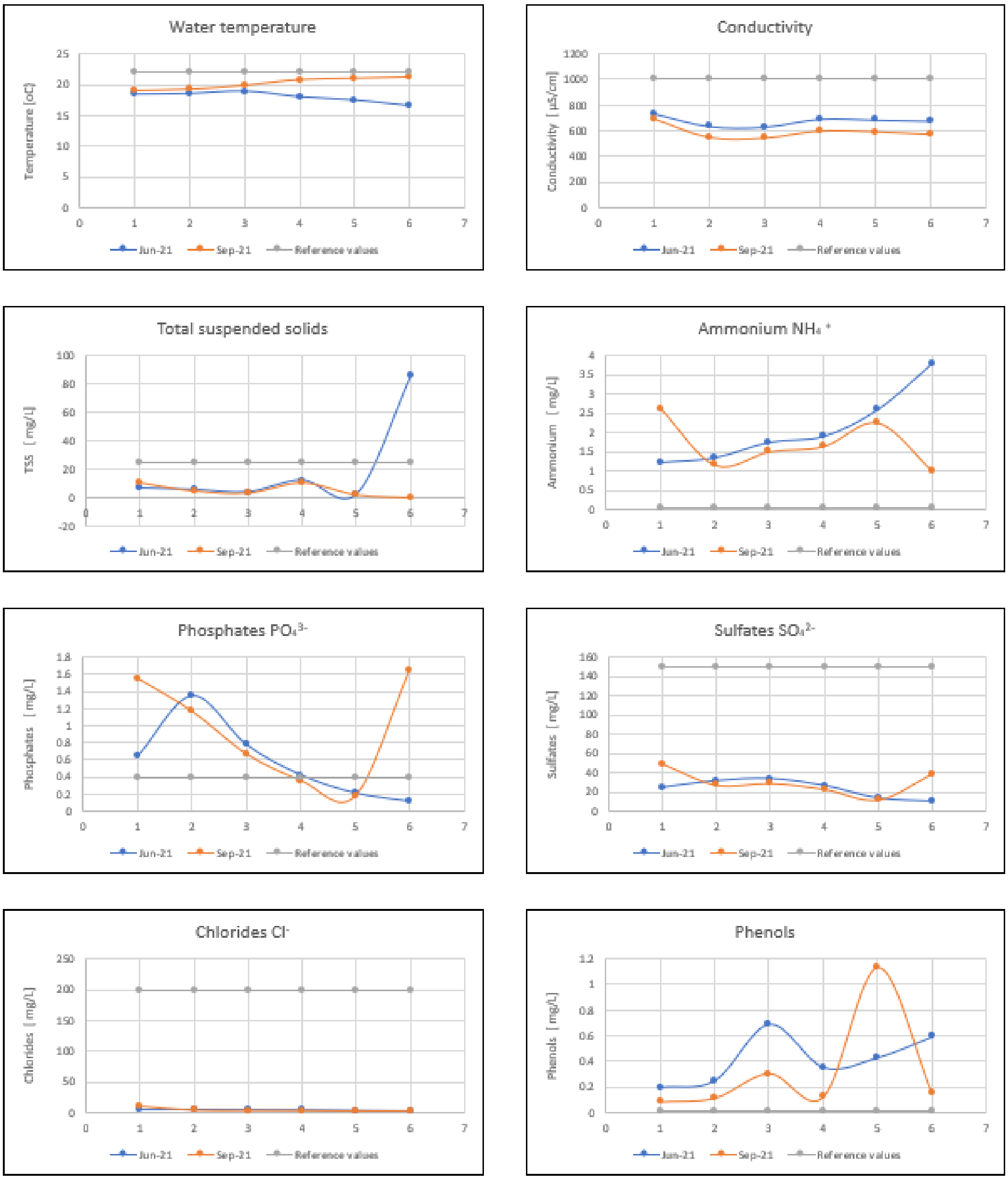

Fig. 2. Graphs of the main quality parameters of the Sitnica basin, in the months of June and September 2021.

TABLE V: PHYSICOCHEMICAL PARAMETERS FOR DETERMINING THE ECOLOGICAL STATUS OF THE RIVER

Type*	Status	pH	Dissolved oxygen DO	BOD_5	COD	Ammonium NH_4-N	Nitrates NO_3^-	Nitrogen Total NT	Orthophosphate PO_4-P	Phosphorus Total PT
T_1	G	7.0–8.6	>8.0	<1.50	<4.0	<0.10	<1.50	<2.0	<0.05	<0.09
	Md	<7.0; > 9.0	8.0–7.0	1.50–5.00	4.0–7.0	0.10–0.20	1.50–3.00	2.0–3.5	0.05–0.10	0.09–0.15
	P	<7.0; > 9.0	7.0–5.0	5.00–6.00	7.0–12.0	0.20–0.80	3.00–6.00	3.5–10.0	0.10–0.20	0.15–0.30
T_2	G	7.0–8.6	>7.0	<4.0	<4.0	<0.10	<1.00	< 1.5	<0.05	<0.10
	Md	<7.0; > 9.0	7.0–6.0	4.0–6.0	4.0–7.0	0.10–0.25	1.00–2.00	1.5–3.0	0.05–0.10	0.10–0.20
	P	<7.0; > 9.0	6.0–5.0	6.0–8.0	7.0–12.0	0.25–0.70	2.00–5.00	3.0–10.0	0.10–0.20	0.20-0.40

MESP-AI 16/2017*-Administrative Instruction "Classification of Surface Water Bodies"
Type*-T1-Small Mountain River and Medium River; T2 - Small, medium, and large Lending River
Status G-Good; Md-Moderate P-Poor

TABLE VI: COMPARISON OF PARAMETERS AND ASSESSMENT OF THE ECOLOGICAL STATUS OF THE SITNICA RIVER

ID	pH	DO	BOD_5	COD	N-NH_4	NO_3^-	TN	PO_4-P	TP	Final classification
June 2021										
S_1	7.69	7.19	12.3	20.4	0.954	3.1	2.063	0.210	0.554	P
S_2	7.78	6.980	9.9	10.4	1.051	1.1	1.644	0.441	0.719	P
S_3	7.99	7.710	16.7	18.6	1.363	5.5	3.177	0.254	0.721	P
S_4	7.71	6.830	16.0	28.0	1.484	6.4	3.488	0.137	0.585	P
S_5	7.81	7.430	10.6	18.1	2.029	6.9	3.970	0.068	0.365	P
S_6	7.60	2.42	22.5	38.4	2.963	0.5	3.856	0.037	0.667	P
September 2021										
S_1	7.79	5.15	16.8	29.6	2.034	11.5	5.367	0504	0.975	P
S_2	6.71	6.017	8.5	9.0	0.906	6.9	1.417	0.381	0.619	P
S_3	6.89	6.647	14.4	16.0	1.175	4.7	2.738	0.219	0.622	P
S_4	6.65	5.888	13.8	24.1	1.279	5.5	3.007	0.118	0.505	P
S_5	6.7	6.4	9.1	15.6	1.749	5.9	3.423	0.059	0.315	P
S_6	7.62	4.20	12.4	15.1	0.792	4.9	2.525	0.535	0.882	P

MESP-AI 16/2017-Administrative Instruction "Classification of Surface Water Bodies"
Explanations: status: DO = dissolved oxygen, BOD_5 = five-day biological oxygen demand, COD = chemical demand, TN = total nitrogen, TP = total phosphorus; G = good, Md = moderate, P = poor.

The results obtained and compared with Directive 75/440/EEC present the water condition of the Sitnica River.

Given the fact that phenols are our object of study, we initially focused on the degree of their concentration in these waters. The results obtained reflect a worrying situation in all six sampling sites, where the degree of concentration, in most cases, exceeds the allowable limit of 10–100 times.

Such enormous pollution, reflected in a table, is a consequence of industrial activity, not only of the Kosovo Energy Corporation (KEC), which uses coal as a raw material for the production of electricity, but also of other polluting sources: industrial, urban, and agricultural.

Regarding the presence of ammonia, the obtained results show concentrations beyond the reference values even with this indicator in all sampling sites for two months.

The maximum concentration of ammonia was recorded in sample S6 at the rate of 3.809 mg/L for the month of June and in S1 at the rate of 2.614 mg/L for the month of September.

In S1, S2, S3, S4, and S5 sampling sites, the results obtained for the month of June result in saturation beyond the oxygen reference values. The values obtained vary from one sampling site to another and reach a rate of 84.2-95.0 %. In September, with the exception of the S1 and S6 sampling sites, where we did not find exceedances, the degree of concentration of this indicator ranged from 72.6 to 81.9%.

We consider that the concentrations beyond the reference values, during the summer season (June–September) of these parameters, happened because of the low rainfall and the drought that reigned in this period and that, as a result, there was a significant drop in the water level of the Sitnica river. This phenomenon of the highest concentration of pollutants during the summer period occurred due to the decrease in the volume of water, while in the case when the water capacity is abundant, the concentration of pollutants is lower. This situation has changed due to the fact that the water level drops [14] at the peak of the summer, while the highest concentration of pollutants [15] emerges. The presence of phosphates, beyond the reference values, in the waters of this river varies as follows: from 0.421-1.354 mg/L during the month of June, and in September from 0.671–1.642 mg/L.

Unlike the indicators elaborated above, which resulted in exceeding the reference values, the presence of other indicators, such as temperature, conductivity, total suspended matter, sulfates, and chlorides, is in accordance with the allowed values.

Regarding the physicochemical parameters that determine the ecological status of surface waters (rivers), such as pH, DO, BOD_5, COD, N-NH_4, NT, PO_4-P, and TP, we relied on the Administrative Instruction, which is based on the Classification of Water and Surface Bodies of Kosovo-MESP-AI 16/2017 (see Table IV). The use of indicators is highly relevant when assessing the ecological status of a river bed and its evolution with time [16, 17]. The representative results for these indicators are presented in Tables V and VI.

The results of the analyses carried out (Tables III and IV) have shown that, in addition to dissolved oxygen, ammonia, phosphates, sulfates, chlorides and phenols, elaborated above, significant pollution of the water of the river Sitnica has also been caused by the presence beyond the allowed values of the physico-chemical parameters (PH, DO, BOD_5, COD, N-NH_4, NO_3^-, TN, PO_4-P, TP), through which the ecological status of rivers is determined.

The ecological status of the water of this river is reflected (Table V) according to the months of June-September and sampling sites, with results as follows:

Sampling site S_1: In the month of June, except for pH, DO, and TN, all other parameters result in poor ecological status. Whereas, in the month of September, except for pH, which results in a good ecological status, all other parameters correspond to a poor ecological status.

The sampling site S_2: In June of the ecological level, it contains pH, NO_3^-, and TN that result in good ecological status. The other parameters result in poor ecological status. While in the month of September, they have pH and TN that result in a good-medium ecological status, the other parameters reflect a poor ecological status.

Sampling site S_3: In the month of June, there are pH, DO, and TN that result in good and medium ecological status. All other parameters result in poor ecological status. While in the month of September they have pH and TN, which belong to the middle ecological status, the other parameters reflect the poor status.

Sampling Site S_4: Both in June and in September, there are pH and TN, which reflect good to medium ecological status. Other parameters have poor ecological status.

Sampling site S_5: In June, except for pH, DO, and PO_4-P, which were characterized by good and medium ecological status, the other parameters resulted in poor ecological status. While in September, pH, TN, and PO_4-P reflect medium and good ecological status, the other parameters result in poor ecological status.

Sampling site S_6: In the month of June, pH, NO_3^-, and PO_4-P are characterized by a good ecological status, while the other parameters correspond to a poor ecological status. Whereas, in September, pH and TN reflect a good to medium ecological status, while other parameters result in a poor ecological status.

Such enormous pollution, with these parameters of the river Sitnica, puts the water of this river in the category of rivers with poor ecological status.

The results of the analysis have shown that in addition to the presence of pollutant indicators and elaborated above, significant pollution of the waters of the river Sitnica has caused the presence of pollutants beyond the values allowed by DO, BOD_5, COD, N-NH_4, TN, PO_4-P, TP. Such a situation with enormous pollution even with these parameters ranks the Sitnica River in the category of rivers with poor ecological status.

It is already known that the concentrations beyond the allowed values of nitrogen and phosphorus, especially in surface waters, affect the growth of high vegetation and algae, and water gives them an eutrophic character. Whereas, COD is an indicator that is used to measure the content of organic matter in water and urban and industrial waste [18]. The biological need for oxygen (BOD_5) represents the content of organic matter that can undergo microbiological degradation in the water sample under natural conditions [19]. The aquatic environment, where the presence of BOD_5 is high, is characterized by low oxygen content. Therefore, due to anaerobic conditions, living things cannot exist.

IV. CONCLUSIONS

Industrial discharges into the waters of the river Sitnica occur as a result of the exploitation of coal from surface mines in Bardhë and Mirash.

Discharges made during the process of electricity production from the power plants "Kosova A and B", then from the exploitation and processing of ores rich in heavy metals in the Kishnica and Feronikeli Mines in Drenas; leaks from the landfill, located at the entrance of Mitrovica and on the shores of the lower part of this river, are potential pollutants of Sitnica with phenols and other pollutants.

In addition to industrial discharges, the pollution of these waters also occurs as a result of urban discharges and leaks associated with chemicals and preparations used by agricultural activity.

Due to the enormous presence of phenols and other pollutants, the waters of the Sitnica River, which until the 1960s were clean and rich in fish and other aquatic life, and which thousands of inhabitants of some cities used and processed for drinking, were turned into unused water for drinking and without biodiversity.

It is already known that, not only in the developed countries of Europe but also in the developed countries of other continents, the main concern is the preservation and protection of the environment.

Therefore, before our state institutions, the preservation and care of the environment in general and surface water, in particular, remains a primary obligation. Within this obligation, there is a necessary and priority need for the planning and construction of plants for the treatment of industrial and urban discharge waters.

Such an action can and should be done to remove phenols and many other pollutants from the waters of the river Sitnica.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

All authors conducted the research; analyzed the data; wrote the paper, and all authors have approved the final version.

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