POLLUTION OF THE FIFTH CANAL ON THE CRNA RIVER IN THE REGION OF BITOLA

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Abstract

 Water is an irreplaceable natural resource. The main goal of this research is to see the pollution of the fifth canal on Crna River in the region of Bitola. As measuring points for sampling for this analysis are: measuring point 1 (Crna River near the village of Novaci), measuring point 2 (fifth canal exit of Bitola), measuring point 3 (fifth canal near the village of Kravari) measuring point 4 (fifth canal before flowing into the Crna River), measuring point 5 (Crna River before being mixed with water from the fifth canal), measuring point 6 (Crna River after mixing with water from the fifth canal) and measuring point 7 (Crna River near the village of Skocivir). Water samples were taken in May and November. To determine the water quality, the following physicochemical parameters were made: turbidity (by turbidimeter), suspended solids, total organic carbon, biological oxygen demand, and dissolved oxygen (determined with UV pastel).
From the results, it has been concluded that the highest pollution is in the fifth channel, measuring point 2 for the following parameters in May: turbidity (35.3 mg/L), total organic carbon (210.8 mg/L), suspended solids (77.5 mg/L, and in November164.0 mg/L). Of the measuring points of Crna River, the highest pollution is in measuring point 6 in November: biological oxygen demand (14.5 mg/L), and total organic carbon (13.7 mg/L). That is why it is suggested to purify the wastewater before it is released into the rivers.

Keywords: Crna River, fifth channel, pollution.

1. Introduction

The availability of safe and high-quality drinking water is a significant concern and responsibility for people worldwide. Water, essential for the survival of both humans and organisms, should be healthy, clean, and mineral-rich. Unfortunately, access to such water is increasingly scarce today (Gugitsev, 2008).
This research paper aims to assess the extent of pollution in the fifth channel of the Crna River in the Bitola Region, focusing on identifying critical points with the highest pollution levels.

2. Materials and methods

In recent decades, various methods for assessing water quality have been employed to characterize and evaluate river water (El Najjar et al., 2019; Liu et al., 2021).
The material analyzed in this research paper consists of water samples collected from the fifth channel and the Crna River. Rivers serve as crucial resources for irrigation, agriculture, hydroelectric power generation, and recreational activities (Cai et al., 2019; Karunanidhi et al., 2021). The sampling points for this analysis include: measuring point 1 (MM1 - Crna River near the village of Novaci), measuring point 2 (MM2 - Fifth Channel exit of Bitola), measuring point 3 (MM3 - Fifth Channel near the village of Kravari), measuring point 4 (MM4 - Fifth Channel before flowing into the Crna River), measuring point 5 (MM5 - Crna River before mixing with water from the Fifth Channel), measuring point 6 (MM6 - Crna River after mixing

with water from the Fifth Channel), and measuring point 7 (MM7 - Crna River near the village of Skocivir). Water samples were taken in May and November.

To assess the water quality of the fifth channel and Crna River, the following physicochemical parameters were measured: turbidity (using a turbidimeter), suspended solids, total organic carbon (TOC), biological oxygen demand (BOD), and dissolved oxygen (measured with a UV spectrophotometer).

3. Results and discussion

Turbidity is one of the physicochemical parameters used to assess water quality. According to Blazhevska (2019), turbidity is often considered the first visible indicator of water quality.
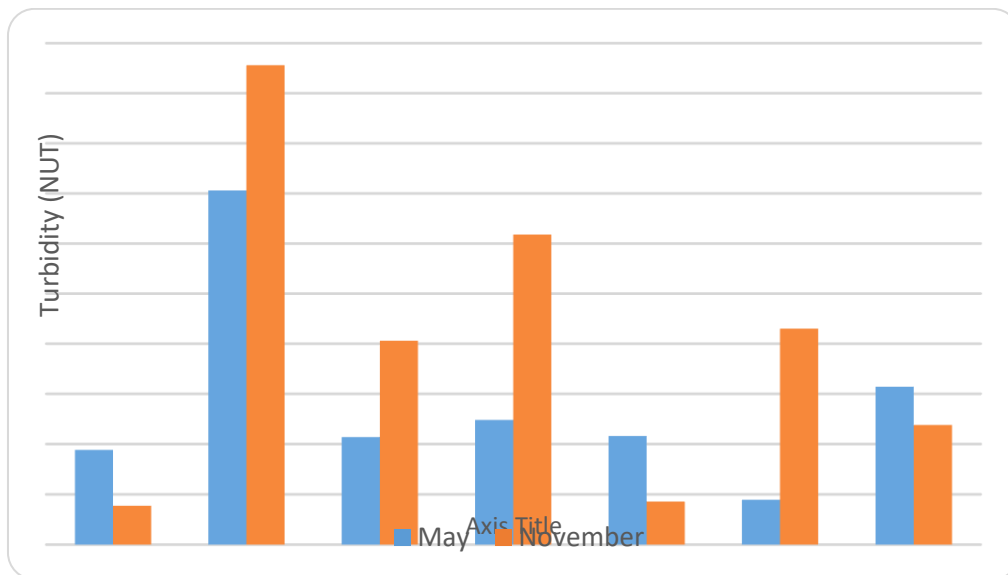

Figure 1: Turbidity Values in May and November for Water from the Fifth Channel and Crna River

From Figure 1, it can be concluded that the turbidity values are highest in May (35.30 NUT) and November (47.80 NUT) at MM2. In the water from the Crna River, the highest turbidity was found at MM6 (21.50 NUT). MM6 is the measuring point where wastewater from the fifth channel is discharged, potentially contributing to the elevated turbidity levels.

According to research by Jovanov (2012) on the Treska River, the highest turbidity values were recorded along the river in the Kicevo Region, reaching a maximum value ranging from 1.77 to 178 NTU. The high turbidity values were attributed to the presence of communal wastewater. Figure 2 displays the suspended matter values in the test samples analyzed.
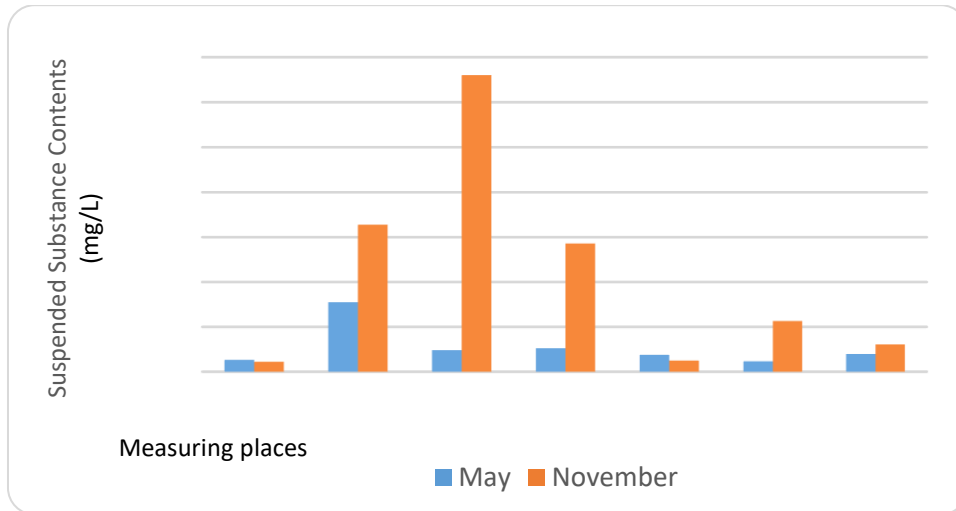
Figure 2: Suspended Substance Contents in May and November for Water from the Fifth Channel and Crna River.

Figure 2 indicates that the highest values of suspended substances in the water from the fifth channel were observed at MM3 (330.0 mg/L) in November and at MM2 (77.5 mg/L) in May. According to the results of the analyses of suspended matter in the water from the Crna River, the highest value was found at MM6 (56.5 mg/L) in November. This increase in suspended matter is likely due to erosive soil processes contributing to sedimentation. In May, there is an increase in suspended matter at MM7 (19.8 mg/L), likely due to the river's passage through mountainous terrain, which does not facilitate sedimentation of organic or inorganic particulate matter.

Dissolved oxygen is one of the most crucial parameters for water quality, as it is essential for the survival of aerobic organisms. According to Mulev (2003), the concentration of dissolved oxygen, along with water temperature, significantly influences the metabolic activity of aquatic organisms.
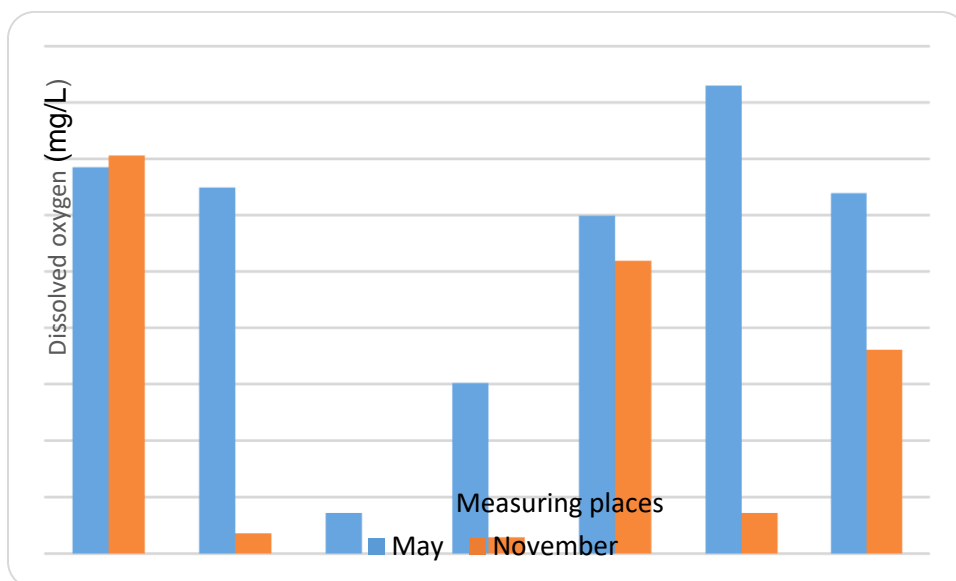

Figure 3: Dissolved Oxygen Content in May and November for Water from the Fifth Channel and Crna River

From Figure 3, it can be concluded that the minimum amount of dissolved oxygen was observed at MM3 in May (0.72 mg/L) and in November at the same measuring point (0 mg/L). In waters with a high organic load, oxygen levels are reduced and consumed during the decomposition of

organic matter (Blazhevska, 2019). According to the results obtained from measuring dissolved oxygen in the water of the Crna River, the minimum value was found at MM6 (0.72 mg/L), where the fifth channel flows into the Crna River, bringing along significant organic pollution." According to Adebayo (2009), a study exploring the As a River in Nigeria found that the high dissolved oxygen content is associated with the river's distance from the city and minimal organic pollution.

According to the Decree on water classification, measuring points 2, 3, and 4 falls into Class IV, measuring point 6 falls into Class III, while measuring points 1, 5, and 7 are classified as Class II.

Biological oxygen demand (BOD) is closely correlated with the quantity and composition of organic matter in aquatic ecosystems and the biological activity of microorganisms (Rosca et al., 2020). Chart 4 shows the BOD values in the fifth channel and Crna River.
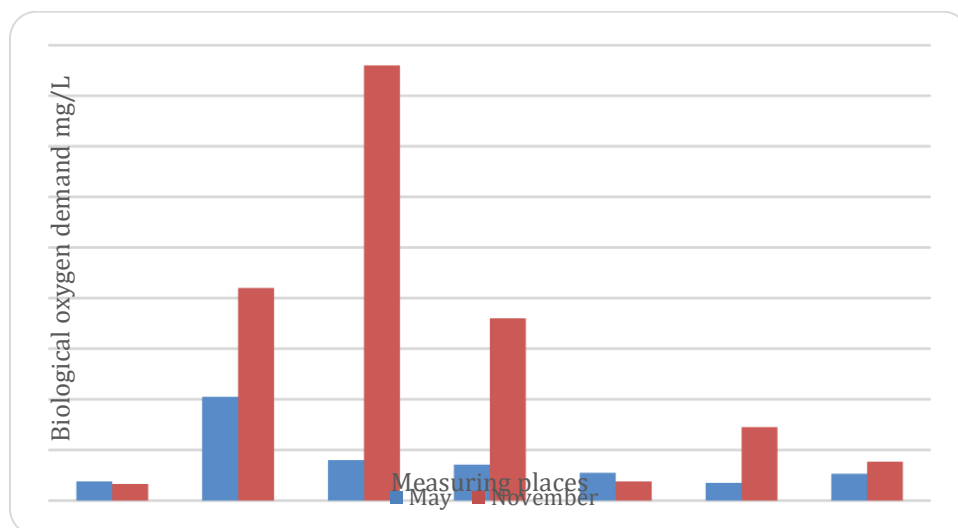

Figure 4: Biological oxygen demand in May and November for Water from the Fifth Channel and Crna River

From Figure 4, it's evident that the highest BOD values in the water of the fifth channel were recorded at MM3 (86.0 mg/L) in November, attributed to the elevated organic load from fecal water at this measuring point. In contrast, the lowest BOD value in the water of the Crna River was found at MP1 (3.3 mg/L) in November, indicative of reduced anthropogenic impact. However, the highest BOD value was observed at MP6 (14.5 mg/L) in November, likely due to the significant organic matter released through the channel into MP6.

According to the Water Classification Ordinance, MP2, MP3, and MP4 are classified in the fifth class, while MP6 is classified in the fourth class. The classification of the remaining measuring points varies.Total organic carbon (TOC) in water serves as an indicator of the presence and quantity of organic matter, and it contributes to the formation of new organic compounds (Ivancev-Tumbas 2009).
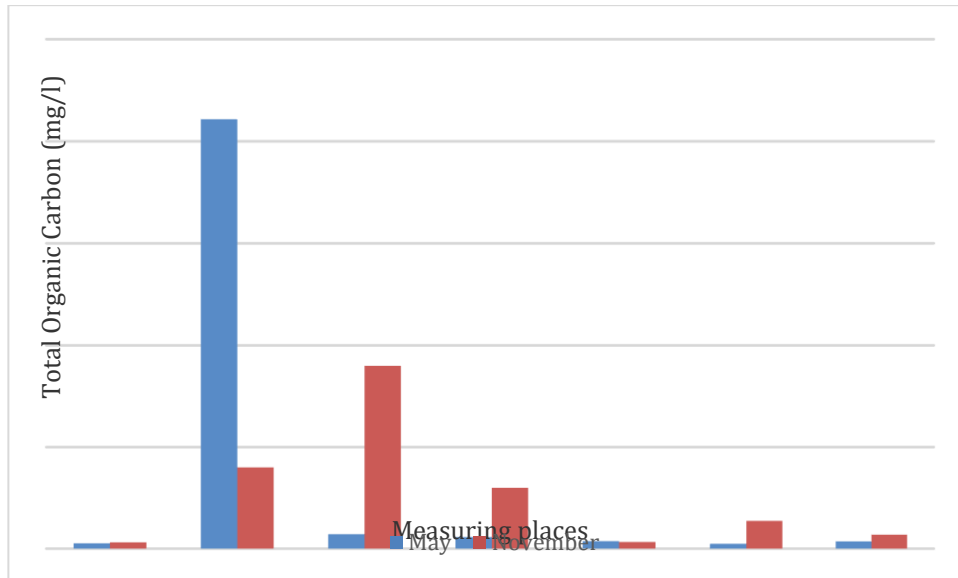
Figure 5: Total Organic Carbon Content in May and November for Water from the Fifth Channel and Crna River

Biddanda et al. (2001) suggest that the aquatic ecosystem's quantity of dissolved organic carbon varies depending on nutrient levels. In November, the highest value of this parameter (90 mg/L) was found in the water from the fifth channel at MM3, attributed to the high content of waste substances discharged into the channel. Whereas in the water of Crna River, MM6 has the highest value (13.7 mg/L) where the load of organic matter is the highest.

According to the Ordinance on water classification, measuring points 2, 3, and 4 fall into Class IV, measuring point 6 falls into Class III, while measuring points 1, 5, and 7 are classified as Class II.

4. Conclusions

By summarizing the results obtained, the following conclusions can be drawn:

The highest turbidity values were determined in the water from the fifth channel, and lower values in Crna River.

The determined values of the suspended substances, according to the measuring points, coincide with the values for water turbidity.

Of the obtained values for the amount of dissolved oxygen, the greatest representation was determined at the measuring points of the Crna River, and the smallest amount of oxygen was recorded in the fifth channel.

BOD is closely related to the organic matter present in the water from the fifth channel and Crna River and the activity of microorganisms.

Recommendation

This research paper provides guidance for the immediate installation of a treatment plant that will treat industrial wastewater and municipal wastewater entering the canal.

Education of the population plays a crucial role in emphasizing the importance of water quality, both for hygienic and sanitary purposes and environmental protection.

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