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ASSESSMENT OF WATER QUALITY AND PHYSICOCHEMICAL PROPERTIES OF THE ALA RIVER, SOUTH WEST NIGERIA

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ABSTRACT
The Ala River, a freshwater body flowing through Akure, southwestern Nigeria, faces growing anthropogenic pressure. The study provides a comprehensive evaluation of its physicochemical characteristics and overall pollution status to determine its suitability for domestic and ecological use. Surface water samples were obtained from five strategic locations, Ala Elefosan, Oke Ijebu, Fiwasaye, Araromi, and Isinkan using the grab sampling technique. Physicochemical parameters, including pH, turbidity, electrical conductivity (EC), dissolved oxygen (DO), biochemical oxygen demand (BOD), total dissolved solids (TDS), major ions, and nutrients, were analyzed following the APHA (2017) standard procedures. The Nemerow Pollution Index (NPI) was applied to assess contamination levels, and data were statistically evaluated using ANOVA. The pH (6.9–7.4) remained within WHO and NSDWQ guidelines, indicating near-neutral water conditions. However, elevated concentrations of BOD (14.04–25.03mg/L) magnesium (15.65–36.94 mg/L), potassium (14.6–46.4 mg/L), ammonia (2.5–2.7 mg/L), and nitrates (46.1 mg/L) surpassed permissible limits at all the five selected sites. NPI values further identified magnesium (at all sites except Ala Elefonsan) and nitrate (at Isinkan) as key pollutants. Although ANOVA results ($p = 0.987$) revealed no significant spatial variation, consistent exceedances highlight localized contamination hotspots. The study contributes original baseline data on Ala River water quality, offering scientific evidence for future monitoring and remediation strategies. While the contamination levels are not yet alarming, the study indicates the presence of pollutants that could pose long-term risks. Hence the need for improved wastewater control and policy.

Keywords: Ala River, Physicochemical properties, Nemerow Pollution Index, Akure, Urban runoff, Anthropogenic pollution

INTRODUCTION
Physicochemical properties are the physical and chemical characteristics of water that are measured to determine its quality and ecological status. These include temperature, pH, electrical conductivity (EC), turbidity, total dissolved solids (TDS), dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total hardness, and the concentrations of major ions such as nitrates, phosphates, chlorides, and sulfates (APHA, 2017; Bartram & Ballance, 1996). Monitoring these parameters provides crucial insights into natural processes, human and environmental influences affecting water systems.
To ensure water safety and ecological integrity, regulatory bodies such as the World Health Organization (WHO) and SON in Nigeria have established guideline values for various water quality parameters (WHO, 2017; NSDWQ, 2007). Deviation from these standards can pose serious risks to human health and biodiversity, particularly in regions where communities rely on untreated surface water for daily needs.
Modern water quality assessments increasingly combine physicochemical analysis with biological and emerging contaminant indicators, such as heavy metals, pathogens, and microplastics, to provide a holistic evaluation of water resources (Palaniappan et al., 2010). These assessments inform sustainable water management strategies, pollution control measures, and policy development aimed at achieving targets under the United Nations Sustainable Development Goal 6: ensuring availability and sustainable management of water and sanitation for all (UN, 2015).
Water quality assessment is essential for the classification of water bodies, identification of pollution sources, and determination of trends over time (Pesce & Wunderlin, 2000). These assessments are particularly critical in developing countries where unregulated discharge of wastewater, agricultural runoff, and improper waste management often compromise water quality (Olalekan et al., 2021).
Freshwater ecosystems are critical to the survival of human and ecological communities, providing water for drinking, agriculture, and recreation and supporting aquatic biodiversity. However, these systems are increasingly threatened by pollution, especially in rapidly urbanizing regions of the world. In Nigeria and other parts of sub-Saharan Africa, poor waste management practices, increasing urban runoff, and industrial discharges have contributed to the deterioration of water quality in rivers and streams (Olalekan et al., 2021; Adefemi & Awokunmi, 2010).
In Nigeria, rapid urbanization, industrial growth, and poor waste management have led to the degradation of many freshwater sources. One such water body is the Ala River, located in Akure, Ondo State, southwestern Nigeria.
The Ala River originates from the hills around the Idanre area and flows through various urban and peri-urban settlements in Akure before draining into the Owena River. Historically, the river served as a source of potable water and a site for agricultural irrigation and cultural practices. However, in recent decades, increased human-induced pressures including indiscriminate waste disposal, sewage effluents, agricultural runoff, and encroachment by informal settlements have significantly impaired its water quality (Ayeni et al., 2010; Obiora-Okeke et al., 2022).
Evaluating key physicochemical parameters such as pH, temperature, electrical conductivity, dissolved oxygen (DO),

total dissolved solids (TDS), biological oxygen demand (BOD), nutrients (nitrate, phosphate), and heavy metals (e.g., lead, iron, zinc) helps in assessing the suitability of the water for various uses. (Fagbayide & Abulude, 2018)

This study was conducted to assess the water quality and physicochemical characteristics of the Ala River, with the objective of determining the extent of environmental impacts on its water quality. Statistical evaluation was performed using Analysis of Variance (ANOVA) at a 95% confidence level to ascertain significant variations in water quality parameters attributable to environmental influences. In addition, the Nemerow Pollution Index (NPI) was applied to evaluate the pollution status of the river and to identify specific parameters that exceeded recommended water quality standards. The study hypothesis postulated that environmental activities exert a significant impact on the water quality of the Ala River.

Assessing the physicochemical characteristics of the Ala River is critical for understanding the pollution dynamics, informing policy decisions, and developing sustainable water management practices. To restore the ecological and socioeconomic value of the Ala River, urgent attention must be paid to pollution control, urban planning, and public sensitization.

MATERIALS AND METHODS

Description of the study area

In Ondo State, Nigeria, the Ala River is a major watercourse that flows through the city of Akure, passing through areas such as Ala Elefosan, Oke-Ijebu, Fiwasaye, Araromi, and Isinkan. Due to its central location, the river has become a significant receptacle for municipal runoff, as well as various household and urban wastes that are indiscriminately discharged along its banks.

The Ala River serves various socio-economic and environmental functions within the Akure metropolis. It is used for small-scale irrigation, fish farming, domestic washing, and other household purposes. In several locations along the river, residents engage in minor fishing activities, and in some peri-urban areas, water from the river is diverted to supply earthen fish ponds (Olalemi & Ogundare, 2022). However, as a result of rapid urbanization, population growth, and poor waste management, the river has been subjected to substantial human and enviromental pressures. The unregulated expansion of residential and commercial structures along the riverbanks has led to the indiscriminate discharge of solid waste, sewage, and other effluents into the river channel (Olalemi & Akinwumi, 2022). During periods of heavy rainfall, surface runoff from adjoining roads, markets, and drainage systems carries large volumes of refuse and pollutants into the river, altering its physicochemical and ecological quality. Studies have reported elevated microbial and chemical contamination in different segments of the river, reflecting its role as a major sink for municipal runoff and a hotspot for pollution within Akure metropolis (Olalemi & Akinwumi, 2022; Butu et al., 2020).

Sample Collection

Surface water samples were collected from five distinct locations along the Ala River: Ala Elefosan, Oke Ijebu, Fiwasaye area, Araromi area, and Isinkan area. Sampling was conducted in the morning using the grab sampling technique. At each site, 5 liters of surface water were collected from a depth of 0–30 cm using pre-cleaned amber glass bottles to minimize photodegradation and contamination. Water was analyzed at the Federal University of Technology Akure chemistry laboratory. A total of 21 parameters were analyzed for various physicochemical properties of the Ala River following standard procedures. (APHA, 2017)

Analysis of Water Quality Parameters

Samples were analyzed for various physicochemical parameters as well as the pollution index in this study.

Physicochemical properties

Water samples were collected from five (5) different points namely: Ala Elefosan, Oke IJebu, Fiwasaye area, Araromi area, and Isinkan area. The samples collected were based on the points where the communities collect water for drinking, domestic work, and business purposes such as car wash.

Physical Parameters

A number of physical parameters were used to assess the quality of the Ala River among which includes color to taste for colorlessness, turbidity based on its ability to absorb light, in addition other test were carried to determine the odor, temperature, foam, Conductivity and total dissolved solids. The equipment/ device used to ascertain these parameters are presented in table 1.

Table 1: The Equipment Used To Access Physical Parameters

PARAMETER	EQUIPMENT/DEVICE
Colour	Platinum cobalt (visual comparision)
Odour	Wide mouth glass stoppered bottle
Taste	Tasting
Turbidity	turbidity meter
Conductivity	conductivity meter
Temperature	mercury bulb thermometer (Glaswekwertein model).
Total dissolved solids	conductivity meter

Table 2: Physicochemical Parameters, Analytical Methods, Instruments, Permissible Limits Used For NPI, And Sampling Design For The Ala River

Parameter	Unit	Analytical Method (APHA, 2017)	Instrument/Equipment	Permissible Limit for NPI (Li)	Standard Source
Temperature	°C	In site measurement	Mercury bulb thermometer	Ambient (25–30)	NSDWQ / WHO
pH	–	Electrometric method	Digital pH meter	(6.5-8.5)	NSDWQ / WHO
Turbidity	NTU	Nephelometric method	Turbidity meter	5	NSDWQ / WHO
Electrical Conductivity (EC)	µS/cm	Conductometric method	Conductivity meter	1000	NSDWQ
Total Dissolved Solids (TDS)	mg/L	Gravimetric/Conductometric	Conductivity meter	500	NSDWQ / WHO
Total Suspended Solids (TSS)	mg/L	Gravimetric method	Filtration unit, oven	30	NSDWQ
Dissolved Oxygen (DO)	mg/L	Winkler iodometric method	DO meter	≥6.0	NSDWQ
Biochemical Oxygen Demand (BOD_5)	mg/L	5-day incubation method	Incubator, DO meter	6	NSDWQ
Alkalinity	mg/L	Titrimetric method	Burette, titration set	100	NSDWQ
Total Hardness	mg/L	EDTA titration	Titration apparatus	150	NSDWQ
Calcium (Ca^{2+})	mg/L	EDTA titration	Atomic absorption/EDTA setup	75	NSDWQ / WHO
Magnesium (Mg^{2+})	mg/L	Calculation from hardness	Atomic absorption spectrophotometer	20	NSDWQ
Sodium (Na^{+})	mg/L	Flame photometry	Flame photometer	200	NSDWQ / WHO
Potassium (K^{+})	mg/L	Flame photometry	Flame photometer	10	NSDWQ
Chloride (Cl^{-})	mg/L	Argentometric titration	Titration apparatus	250	NSDWQ / WHO
Sulphate (SO_4^{2-})	mg/L	Turbidimetric method	Spectrophotometer	100	NSDWQ
Nitrate (NO_3^{-})	mg/L	UV spectrophotometric method	UV–Vis spectrophotometer	45	WHO / NSDWQ
Phosphate (PO_4^{3-})	mg/L	Ascorbic acid method	Spectrophotometer	5	NSDWQ
Ammonium (NH_4^{+})	mg/L	Nesslerization method	Spectrophotometer	0.5	NSDWQ / WHO
Bicarbonate (HCO_3^{-})	mg/L	Titrimetric method	Titration apparatus	250	NSDWQ

All measurements were conducted in triplicate at each sampling point, and mean values were used for statistical and Nemerow Pollution Index (NPI) analyses. Sampling was carried out during both the dry and wet seasons to account for seasonal variability in water quality. The exact permissible limits (Li) presented in the table were adopted for NPI computation following the method described by Swati and Umesh (2015). All instruments were calibrated prior to analysis, and standard reference solutions were used where applicable to ensure analytical accuracy.

Assessment of Extent of Physicochemical Pollution of the Ala River

The Nemerow's Pollution index (NPI) was used to determine the pollution index of the Ala River by adopting the method described by Swati & Umesh (2015)

$$NPI = \frac{Ci}{Li} \quad (1)$$

where C_i is the observed concentration of the *i*th parameter and L_i is the corresponding permissible limit.

Each value of NPI shows the relative pollution contributed by single parameter, it should be less than or equal to one. NPI values exceeding 1.0 indicate the presence of impurity in water and require some form of treatment to use as precaution.

Hypothesis

NPI values ≤1

NPI values >1

If Water parameter NPI value> 1

i. It indicates its presence in surplus amount or concentration
ii. The particular parameter has the potential of contributing pollution to the water bodies studied.

RESULTS AND DISCUSSION

Water parameters were analyzed and results presented in tables

Table 3: Analysis of the Physicochemical Parameters Along Five Points of the Ala River

S/N	Test	NSDWQ Standard (Nigeria)	WHO Standard	Fiwasaye	Ala Elefonsan	Isinkan	Araromi	Oke Ijebu River
1	Temperature (^{0}C)	Ambient (25–30)	Ambient	28	30	29	30	28
2	pH	6.5–8.5	6.5–8.5	6.9	7	7.2	7.4	7.3
3	Turbidity (NTU)	5	5	0.1	0.3	0.2	0.4	0.6
4	BOD (mg/l)	6	<3	24.09	25.03	24.4	14.82	14.04
5	TDS (mg/l)	500	500	150	162	155	154	160
6	TSS (mg/l)	30	30	13.55	13.6	13.4	14.42	14.3
7	Dissolved Oxygen (ppr	≥6.0	≥5.0	6.1	6.2	6	6. 1	6.3
8	Dissolved Carbon (ppm)	Not specified	Not specified	36	38	38	40	36
9	Alkalinity (mg/L)	100	100–200	9	8	8	10	9
10	Total Hardness (mg/L)	150	≤300	4	4.5	4.5	5	4.5
11	EC (us/cm)	1000	1500	520.8	521.6	524.4	660.4	668.2
12	Na (mg/l)	200	200	34.4	20.3	46	26.8	30.7
13	Cl (mg/l)	250	250	58	30	40	32	35
14	Mg (mg/l)	20	150	36.94	15.65	30.4	20.6	25.25
15	Ca (mg/l)	75	75	13.55	13.6	13.4	14.42	14.3
16	SO_4 (mg/l)	100	250	0.034	0.123	0.135	0.012	0.016
17	PO_4^{3-} (mg/l)	5	0.1 (lakes)	2.39	2.5	2.44	1.48	1.4
18	HCO_3 (mg/l)	250	250	55	60	36	42	46
19	K^+ (mg/l)	10	12	46.4	16.5	14.6	41.2	15
20	N (mg/l)	10	10	2.24	2.35	2.28	2.4	2.27
21	NH^+_4 (mg/l)	0.5	0.5	2.6	2.7	2.5	2.5	2.55

The pH levels ranged from 6.9 in Fiwasaye to 7.4 in Araromi, with an overall mean of 7.2 during the study period. Dissolved oxygen (DO) concentrations varied between 6.0 mg/L in Isinkan and 6.3 in Oke Ijebu with a mean value of 6.0 ± 1.48 mg/L. Biochemical oxygen demand (BOD) levels ranged from 14.04 mg/L to 25.03 mg/L, with a mean value of 14.81 ± 1.22 mg/L.

Dissolved carbon dioxide concentrations ranged from 36 ppm to 40 ppm, with a mean of 38.9 ± 0.13 ppm. Free carbon dioxide levels had a mean of 1.0 ± 0.35 ppm. Conductivity values fluctuated between 520 µS/cm and 668.2 µS/cm, with mean values ranging from 520.8 ± 6.49 µS/cm to 668 ± 59.93 µS/cm.

Physical parameters such as temperature, odor, taste, and color were acceptable in both process and municipal water. Turbidity ranged from 0.1 to 0.6 NTU. Total dissolved solids (TDS) varied between 150 ppm and 162 ppm, with a mean value of 155 ± 2.13 ppm.

The mean concentration of total phosphate ion during the study period was 2.482 ± 0.126 mg/L, with monthly values ranging from 1.4 to 2.5 mg/L. Nitrogen levels ranged from 2.24 to 2.35 mg/L, with a mean of 2.58 ± 0.045 mg/L. Ammonia concentrations fluctuated between 2.5 and 2.7 mg/L, with a mean value of 2.53 ± 0.005 mg/L.

The analysis results indicate that BOD, potassium, and ammonia levels exceeded the recommended standards set by both the Nigerian Standard for Drinking Water Quality (NSDWQ) and the World Health Organization (WHO). Magnesium levels exceeded the NSDWQ standard but remained within the WHO acceptable limits.

Table 4: Water Quality of Different Points of the Ala River

Parameter	NSDWQ Standard (Nigerian)	Fiwasaye	Ala Elefonsan	Isinkan	Araromi	Oke Ijebu River
pH	8.5	6.9	7	7.2	7.4	7.3
Ca^{+2} Ions	75	13.55	13.6	13.4	14.42	14.3
Mg^{+2} Ions	20	36.94	15.65	30.4	20.6	25.25
Chloride	250	58	30	40	32	35
Nitrate	45	34.4	20.3	46.1	26.8	30.7
Total Dissolved Solids	500	150	162	155	154	160
Electrical Conductivity	1000	520.8	521.6	524.4	660.4	668.2

Table 4 shows the values of parameters pH, Ca, Mg, chlorine, Nitrate, TDS and EC within the five points of the Ala River in addition to the NSDWQ standard respectively. These values were used to obtain the respective pollution index and the results displayed in Table 5

Table 5: NPI Values Of Various Points Of The Ala River

Parameter	Fiwasaye	Ala Elefonsan	Isinkan	Araromi	Oke Ijebu River
pH	0.811764706	0.82352941	0.8470588	0.870588235	0.858823529
Ca^{+2} Ions	0.180666667	0.18133333	0.1786667	0.192266667	0.190666667
Mg^{+2} Ions	1.847	0.7825	1.52	1.03	1.2625
Chloride	0.232	0.12	0.16	0.128	0.14
Nitrate	0.764444444	0.45111111	1.0244444	0.595555556	0.682222222
Total Dissolved Solids	0.3	0.324	0.31	0.308	0.32
Electrical Conductivity	0.5208	0.5216	0.5244	0.6604	0.6682

Table 5 shows the results of various parameter levels across the Ala River. All the NPI values of the various parameters were within the recommended NASDAQ standards except for magnesium ion at point Fiwasaye (1.847) and Isinkan (1.52), Araromi (1.03), and Oke Ijebu (1.2625). In addition, the NPI values of nitrate at Isinkan (1.024) exceeded the safety limit.

Table 6: ANOVA Analysis of The NPI of the Ala River

Source of Variation	SS	DF	MS	F	P-VALUE
Treatment	0.13108	4	0.03277	0.082018	0.987304
Error	11.98644	30	0.399548		
Total	12.11752	34			

Table 6 presents the ANOVA results for the Nemerow Pollution Index (NPI) across the sampling sites. The high p-value ($p = 0.987$) indicates that there is no statistically significant spatial variation in mean NPI values among the sites at the 95% confidence level.

Discussion

The temperature values observed of the Ala river at different points (28–30°C) align with findings from studies in tropical and subtropical freshwater ecosystems, where ambient temperatures significantly influence water quality. Elevated temperatures can exacerbate oxygen depletion, as noted by Li et al. (2023), which may lead to thermal stress on aquatic organisms.

The pH range (6.9–7.4) observed in this study complies with the WHO standard (6.5–8.5), indicating minimal risk to human health and aquatic life. Xu, et al., (2023) emphasized that pH levels within this range enhance the availability of essential nutrients for aquatic organisms. Deviations outside this range, however, can mobilize toxic metals like cadmium or lead, posing ecological threats.

The DO levels (6.0–6.3 ppm) reflect a moderately healthy aquatic environment. The study is consistent with findings by dos Santos et al. (2022), who shared similar values in minimally polluted river systems. However, localized reductions in DO, driven by elevated Biochemical Oxygen Demand (BOD), can impair aquatic biodiversity, particularly during warmer months when oxygen solubility decreases. Kim et al. (2022) highlighted that such seasonal dynamics require targeted management interventions to mitigate ecosystem stress.

The BOD values (14.04–25.03 mg/L) suggest significant organic pollution, which is consistent with studies by Qi et al. (2023). Elevated BOD indicates microbial activity linked to the decomposition of organic matter, which depletes oxygen and affects aquatic life. This aligns with observations from Fang et al. (2023), who identified similar correlations between high BOD and reduced water clarity in urban rivers.

Free carbon dioxide levels (36–40 mg/L) in the study suggest a balanced aquatic carbon cycle. Elevated carbon dioxide, as found in sites wsith reduced DO, aligns with findings by dos Santos et al. (2022), where nutrient pollution and organic matter decomposition increase CO_2 production.

The conductivity values (520–668 μS/cm) in the rivers studied are comparable to findings by Qi et al. (2023), who noted similar ranges in freshwater systems impacted by urban and agricultural runoff. When Electrical Conductivity (EC) values in water exceed the recommended safety limits, it generally indicates high levels of salinity which can have implications depending on the water's use (e.g., drinking, agriculture, or industrial). Conductivity reflects ionic content, and elevated values may indicate anthropogenic pollution from fertilizers or wastewater. Proper monitoring and mitigation efforts, as recommended by Kim et al. (2022), are critical to prevent long-term salinization or nutrient imbalance.

The pH range of drinking water should far between 6.9 to 7.4 and municipal water pH is observed 7 to 7.5. So, it complied with the acceptance criteria of pH range & it was found to be healthy for human use. For Potable water, Dissolved carbon dioxide & Dissolved oxygen were found to be between 36 ppm to 40 ppm and 6.0 ppm to 6.3 ppm respectively. TDS of the water sample showed a range below 150 ppm & it complied with the given criteria of WHO standards. Minerals like Calcium, Magnesium, Chloride, Sulphate, HydroCarbonate, and Ammonia are essential for the body. Tests of these minerals were performed on potable water samples. The results complied with the given range of Tests for Minerals. Alkalinity & Total Hardness of potable water should be less than or equal to 100 mg/L and 300 mg/L respectively. Results were compiled with the given limits of both tests. Water Temperature may depend on the season, geographic location, and sampling time. As water temperature increases, it makes it more difficult for aquatic life to get sufficient oxygen to meet its needs. Thermal pollution can cause shifts in the community structure of aquatic organisms. The turbidity of the river ranges from 0.1 NTU to 0.6 NTU. Some are naturally highly turbid but human activities have increased the levels of suspended solids in many habitats. The river amount of Total dissolved solid recorded ranges from 150 ppm to 162 ppm. High value of suspended solid can lower the primary productivity of system by covering the algae and Macrophytes, at times leading to almost their complete removal. DO is the single most important gas for most aquatic organisms. If the amount of free oxygen goes below then 2.0 mg/l for a few days in the lake containing aquatic organisms, it would lead to the killing of most of the biota in the aquatic system. Higher values of free carbon dioxide generally coincided with minimum dissolved oxygen. Habited water is generally used by animals & birds & aquatic life. The

disturbance in this biological system & ecological system may affect the health of animals & birds & aquatic life. After physicochemical analysis, we found that the sample of habited water is free from pollution & ecologically balanced. Although the ANOVA results (p = 0.987) indicate no statistically significant spatial variation in mean Nemerow Pollution Index (NPI) values among the five sampling locations, this finding should not be interpreted as an absence of pollution in the Ala River. The lack of spatial significance merely suggests relative uniformity in pollution levels across sites, rather than compliance with water quality standards.
Notably, several individual parameters recorded NPI values greater than 1.0, particularly magnesium at Fiwasaye, Isinkan, Araromi, and Oke Ijebu, as well as nitrate at Isinkan, indicating localized parameter-specific pollution. These exceedances highlight contamination hotspots likely linked to site-specific anthropogenic inputs such as domestic wastewater discharge, agricultural runoff, and urban effluents along the river course.
Therefore, conclusions regarding the pollution status of the Ala River should emphasize parameter-level exceedances rather than relying solely on spatial ANOVA outcomes. Similar findings of localized physicochemical contamination have been reported in previous studies on the Ala River (Ayeni et al., 2010; Aiyesanmi et al., 2010), reinforcing evidence of ongoing anthropogenic pressure despite limited spatial variability

CONCLUSION
The present study evaluated the physicochemical characteristics and pollution status of the Ala River using standard water quality parameters and the Nemerow Pollution Index (NPI). Although statistical analysis revealed no significant spatial variation in mean NPI values across the sampling sites, several individual parameters exceeded recommended national and international guideline limits at specific locations. These parameter-specific exceedances indicate the presence of localized pollution rather than uniform compliance with water quality standards.
Elevated levels of biochemical oxygen demand, magnesium, nitrate, potassium, and ammonium suggest ongoing anthropogenic influences, likely arising from domestic wastewater discharge, agricultural runoff, and urban activities along the river corridor. While the overall pollution levels do not indicate severe or widespread degradation, the detected exceedances highlight potential long-term environmental and public health risks if left unaddressed.
Therefore, continuous monitoring, targeted pollution control measures, and effective enforcement of environmental regulations are necessary to prevent further deterioration of the Ala River and to safeguard its ecological integrity and suitability for human use.

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