ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 09, Issue, 11, pp. 31334-31336, November, 2019

RESEARCH ARTICLE OPEN ACCESS

PHYSICAL-CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF WATERS FROM MOSCADOS STREAM IN MARINGÁ-BRAZIL

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ARTICLE INFO

Article History:
Received 17th August, 2019
Received in revised form
23rd September, 2019
Accepted 06th October, 2019
Published online 20th November, 2019

Key Words:
Horiba,
Monitoring,
Quality.

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ABSTRACT

Clandestine dumping of untreated sewage and occasional dumping of waste from works on water bodies is still common. These factors alter water quality and can cause eutrophication, which leads to non-compliance of some parameters in relation to the legislation. Due to these facts, the present study aimed to analyze the physicochemical and microbiological quality of the waters of the Moscados Stream in Maringá / Brazil. The monitoring was performed through the parameters conductivity, turbidity, dis-solved oxygen, temperature, pH, total solids, ORP (oxidation-reduction potential), biochemical oxygen demand (BOD), chemical oxygen demand (COD), heterotrophic bacteria, coliforms totals and Escheri-chia coli. To perform this study, four data were taken in the stream during periods of rain and drought, and samples were collected at three different points. For the parameters analyzed in loco, the Horiba multiparameter probe was used. Results were compared with existing Maximum Permissible Values (MAVs) as determined by CONAMA Resolution No. 357/2005. Thus, nonconformity was observed in some parameters. It was possible to witness several construction waste discarded in a stretch of the mar-gin, as well as several silted points.

Citation: ***Matheus Venturoso Kawano, Vanessa de Sibie Valério, Rafael Augusto Moreschi, et al.*** **2019.** "Physical-chemical and microbiological analysis of waters from moscados stream in Maringá-Brazil", *International Journal of Development Research*, 09, (11), 31334-31336.

INTRODUCTION

Water pollution is understood as the change in its characteristics caused by any actions, resulting in quality degradation, causing negative impacts on fauna and flora. According to Santos (2005) these changes may be caused by pedology in its multiple aspects, as it is responsible for regulating the amount of sediments and their respective chemical concentrations that can be carried to watercourses. Agriculture is of great importance as it contributes 46% of the sediments present in the watercourse. It is directly linked to livestock, as it contributes to compaction resulting in the emergence of erosive foci (PRATO *et al.,* 1989). Another very significant cause for water quality degradation is the lack or inadequate sanitation, resulting in undesirable discharge to water bodies by industries or residential sewage (Resende *et al.,* 2014). In the state of São Paulo, for example, at least 2000 areas have been or are being used for wastewater disposal, most of which have not been properly controlled or investigated (Zuquette *et al.,* 2002). In order to release effluents into water from any polluting source, directly or indirectly, it is necessary to comply with the conditions imposed by the National Environment Council (CONAMA), Resolution No. 430/2011 (BRAZIL, 2011). According to Von Sperling (2005), water incorporates various impurities due to its solvent properties and its ability to carry particles, and these define the quality of water. Therefore, it can be said that water quality is a function of natural conditions and of land use and

cover in the watershed, ie, it is the result of human activity and natural phenomena. Based on this situation, the present work had as main objective to make use of the Horiba U-52 multiparameter probe, to discuss aspects related to the water quality of the Moscados Stream in Maringá-PR, when it bypasses UNICESUMAR. . This study indicated whether the water body under analysis is undergoing degradation based on CONAMA n. 357/2005 (Brazil, 2005).

MATERIALS AND METHODS

Water samples were collected in four different months of the year, considering periods of rain and drought, in three different locations of the stream. Thus, the provisions of CONAMA Ordinance No. 357/2005 (Brazil, 2005) are established, which establishes a minimum of three samplings throughout the year. These points were demarcated by georeferencing with the aid of a GPS. For the determination of the parameters in loco, the Horiba multiparameter probe, model U-50, was used at the sample collection site for laboratory analysis. Among all parameters provided by the probe, the parameters chosen for analysis were pH, temperature (ºC), conductivity (mS / cm), salinity (%), total dissolved solids (mg / L), turbidity (uT), oxidation potential. -reduction, ORP, (mV) and dissolved oxygen (mg / L). The sampling points were strategically chosen to represent a better interpretation of the water quality of the Moscados Stream and to allow access to the point when most of the banks are extremely eroded and difficult to access. The Merlo Stream is known to be a tributary of the Moscados Stream in the section under analysis. Analyzes were also performed at Merlo Stream. Thus, samples were taken upstream of the water junction point of both streams in both streams and subsequently a sample was taken in the water mixture (Figure 1). At the time of analysis, care was taken to place the probe in non-shallow water due to the instability of information, thus placing it in deep water about 10 to 15 cm from the surface and lying as far as possible from waterfalls or waterfalls, as recommended by the National Guide for Sample Collection and Preservation (ANA-CETESB, 2011).

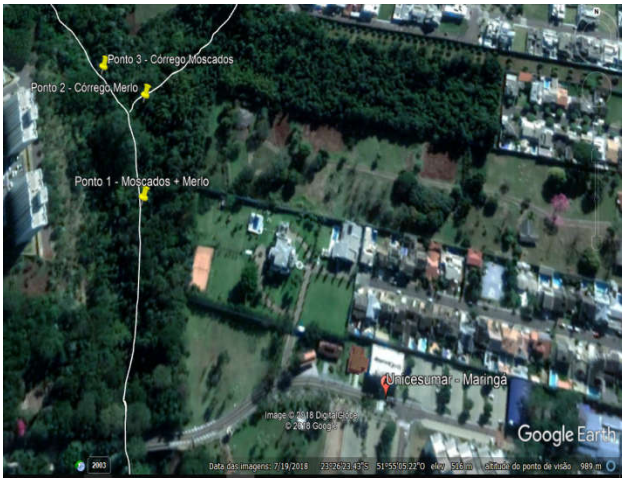

Figure 1. Points of analysis.

RESULTS AND DISCUSSION

CONAMA Resolution no. 357/2005 classifies freshwater into five classes: special class, class 1, class 2, class 3 and class 4 (Brazil, 2005). The Moscados Stream is classified in class 3, that is, as the resolution provides, the waters may be destined for human consumption, after conventional or advanced treatment; irrigation of tree, cereal and fodder crops; amateur fishing; secondary contact recreation and animal desedentation. The results obtained from the four stream runs were compared with the maximum allowable values (MAVs) of CONAMA resolution no. 357/2005, for the MAVs in the parameters analyzed. It was noted that in the rainy season 1, the stream level was very high, which made the analysis of points 2 and 3 impossible. Horiba mark at each point. Sampling point 1 corresponds to the mix of the waters of the Moscados and Merlo streams. Point 2 corresponds to samples from the Moscados Stream. Point 3 corresponds to the waters of Merlo Stream. CONAMA Resolution no. 357/2005, for Class 3 water bodies, points pH values between 6.0 and 9.0, thus, all pH results presented are within the recommended. It should be noted that at all points values are presented that indicate the almost total pH neutrality of the samples. However, during drought periods (Table 2) there is a greater variation in pH values. According to CONAMA Resolution no. 357/2005 the maximum allowable value (MAV) for total dissolved solids (SDT) is 500 mg / L, so it can be observed that none of the values exceeded the resolution MAV. The highest values occurred during the rainy season and this can be explained by the different rainfalls, and also the issue of the stream being quite silted up at some points. Measurement of this parameter is important for aquatic life in the body of water, as it causes damage to fish when too high. The suspended solids particles present in water produce turbidity.

This parameter is directly linked to the light that enters the water, ie the higher the turbidity, the less light in the body of water. Turbidity can be caused by several changes in the environment, such as erosion, plankton, discharge of untreated domestic or industrial effluents, among others. For this parameter, CONAMA Resolution no. 357/2005 establishes a MAV of 100 NTU. Note that the values, in all periods and points, varied a lot. But in both rainy and dry periods (Table 2) it did not exceed 12 NTU. For dissolved oxygen, CONAMA Resolution no. 357/2005 provides that the value for a class 3 body of water shall not be less than 4 mg / l. All values obtained range from 6 to 10 mg / L, therefore, meet the resolution, both in the dry and rainy periods. ORP (Oxidation Reduction Potential) is an essential parameter as it indicates whether water is oxidizing or antioxidant. In the values obtained in the Moscados Stream, the ORP ranged from 200 to 340 mV. It was noted that this parameter was higher in drought periods (Table 2). Another important parameter is the conductivity of water. This indicates the amount of minerals present in the medium. In the case of the analyzed streams, the conductivity ranged from 0.150 to 0.190 mS / cm. For this parameter there is no MAV in the mentioned legislation. In addition to the analyzes presented and performed in loco by the Horiba multiparameter equipment, laboratory analyzes were also performed on the parameters presented in Table 3. Regarding Biochemical Oxygen Demand (BOD5), according to CONAMA Resolution no. 357/2005, the MAV is up to 10 mg / L. This parameter refers to the amount of oxygen needed to degrade organic matter by microorganisms over a period of 5 days. It should be noted that the second rainy season surpassed the MAV of the resolution, which indicates that the respective bodies of water presented organic matter in high concentration, above the legislation. Escherichia coli (E. coli), according to resolution 357 belongs to the Enterobacteriaceae family, is extremely important as this bacterium indicates fecal contamination.

Table 1. Results of the analyzed parameters

Parameter	Rainy Period 1			Rainy Period 2		
	Point 1	Point 2	Point 3	Point 1	Point 2	Point 3
T (°C)	24.7	-	-	20.95	20.62	21.29
pH	6.9	-	-	6.83	6.67	7.03
ORP (mV)	266	-	-	243	202	224
Condutividade (mS/cm)	0.195	-	-	0.159	0.203	0.189
Turbidity (NTU)	11.6	-	-	10.8	3.1	6.9
OD (mg/L)	6.7	-	-	8.09	9.97	9.51
TDS (g/L)	0.127	-	-	0.101	0.132	0.132
Salinity (%)	0.01	-	-	0.01	0.01	0.01

Table 2. Results of the analyzed parameters

Parameter	Drought Period 1			Drought Period 2		
	Point 1	Point 2	Point 3	Point 1	Point2	Point3
T (°C)	21.82	21.39	22.14	20.94	20.57	21.34
pH	7.57	7.59	7.35	6.74	6.51	6.91
ORP (mV)	362	344	343	235	185	217
Conductivity (mS/cm)	0.184	0.183	0.183	0.194	0.19	0.189
Turbidity (NTU)	3.6	2.3	4.4	5.6	7.5	5.7
OD (mg/L)	9.08	9.18	8.83	7.39	9.9	9.61
TDS (g/L)	0.12	0.118	0.119	0.126	0.127	0.123
Salinity (%)	0.01	0.01	0.01	0.01	0.01	0.01

Table 3. Results for microbiological parameters

Parameter	DBO5 (mg/L)	Heterotrophic Bacteria (UFC/100mL)	Total coliforms (UFC/100mL)	Escherichia coli (UFC/mL)
Rainy Period 1	2	1200000	10000	84
Rainy Period 2	19	4000000	790000	90
Drought Period 1	4	5000000	540000	20
Drought Period 2	5	1300000	250000	284

It can be found in the gut of homeothermic animals, such as humans and others. Thus, high values of this parameter indicate contamination by domestic effluents. E. coli can be determined in place of the Thermotolerant Coliform parameter according to limits established by the competent environmental agency (CONAMA). The MAV for E. coli is known to be 35000 CFU per 100 ml. It was observed that in the collection referring to drought period 2, the number of E. Coli amounted to 284 CFU / mL, which may indicate contamination due to wastewater discharge, however, it should be noted that the body d ' water meet in an urban area. The total coliform parameter, according to the resolution, has a MAV of 4000 CFU per 100 ml of water, so it can be seen that all periods exceeded the present value in the resolution. The microbiological quality of the water body is directly linked to the parameter of total coliforms, so it is compromised. For the parameter of heterotrophic bacteria values above 500 CFU per mL may interfere with microbiological analysis, thus, it is noted that in three periods we obtained values above the MAV.

Conclusion

The parameters analyzed by means of the Horiba probe are within the maximum allowable values by CONAMA Resolution no. 357/2005. However, some parameters, such as microbiological parameters, did not satisfy the MAV of current legislation. It should be noted that in the three sampling points, Merlo, Moscados and the mixture of both, extremely eroded and very residual margins were found, such as plastic bags and household objects. Parts of both streams were extremely silted. The path of both streams studied occurs in urban area. There was illegal disposal of solid waste from a construction company near the bottom of the valley that gives access to the streams. Thus, it is of utmost importance to constantly monitor these surface waters.

Acknowledgements: The authors thank the Funadesp Foundation for their financial support.

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