Hydrological Modelling of Catchments at Industrial Sector

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Abstract: In any nation industries are the major sources for the country economy and also the major source of employment for the people of any nation. Industries are also considered as prime reason for the developmental activities with huge employment potential at the other side the environmental conditions in and around the industries are degrading very rapidly due to the lack of proper supervision on disposal of industrial wastes along with the emissions releasing into the open atmosphere by few of the industries [9] without any concern of human health eventually over a period of time all the effluents and the emissions released into the open atmosphere without treatment shows dangerous consequences on the environment in the society. The major requirements of any industries starts with water only, as the water is prime element for the survival any living organism on the earth and also the water is the prime component for the development of any area but at certain areas the water both surface and ground water [11] sources have been contaminating due to the unethical and unscientific disposal of wastes into the open lands as well as into the nearby water bodies. when we emphasize the reason behind this specific activity we came to understand that improper maintenance of effluent treatment plants and the effluents releasing from them shows its severe impacts on nearby aquatic organisms [3], if the same water is used for domestic activities there will be a damage for human health and sometimes it may leads to the death of the individuals also. In the present study three locations were indentified around the boundaries [8] of catchment based on the entry of flow into the catchments and the samples were collected for three times in the study period of three months, all the samples were marked with labels and analysis [2] was carried out by using prescribed analytical procedures, the results were compared with surface water quality standards [1] specified by Central Pollution Control Board,1979 and the Bureau of Indian standards, 1982 to find out the hydrology of the catchment

Keywords: Catchments, Effluent, Environment, Hydrology, Industries, Treatment.

I. INTRODUCTION

Catchments are the water bodies where the water enters into it either by runoff or through rain fall depends on the existed geological conditions and topography of the soil along with climatic conditions prevailed over a period of time.

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Normally catchments are the major source of water for irrigation and domestic activities when they are situated in any area or near by the fields but if they situated nearby industrial sectors mostly they serves as source of effluent discharge, where more concentration is needed with respect to the aquatic ecosystem and also for the public health.

Sometimes the effluents releasing into the water bodies without treatment may show their long term consequences on environment [6] when they infiltrate into the ground which in turn leads to groundwater contamination, before the problem turns into more complex there should be a proper long term and short term policies to rejuvenate the ecosystem of the catchment by making strict implementation of industrial acts where the zero discharge policy's are set for effluents before they are releasing into the nearby catchments[12]. The present study was carried out at the catchment in the industrial sector of Guntur Municipal Corporation. The study was carried out within the duration period of three months where the samples were collected for three times, all the samples were collected by using a sterilized glass bottle at three corners of the catchment and then labelled with the description of sampling locations with date of collection. Standard analytical methods were employed to identify the concentration [8] of various parameters. Results were correlated with surface water quality standards specified by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982 to get the category of the catchment with respect to the effluents concentration.

II. OBJECTIVES

1. Identification of sampling locations to collect the samples from the catchment
2. Adoption of suitable methodology to conduct the test for parameters.
3. Correlation of the results with Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982
4. Preparation of guidelines to rejuvenate water quality of the catchment

III. METHODOLOGY

III.I Sampling Points:

1. Total three sampling locations were identified after collecting the data of possible ways of water entry into the catchments through runoff or by the discharges of nearby industries
2. Samples were collected for three times in the period of three month study period
3. All the samples were collected in a clean sterilized glass bottles
4. All the collected sample bottles were labelled and then sent for analysis.

III.II Water quality Analysis:

1. The analysis was carried out for the parameters like P^H, Electrical Conductivity, Alkalinity, Total Hardness, Turbidity, Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids, Dissolved Oxygen (DO), Chlorides and Biological Oxygen Demand (BOD) to find out the existed condition of the catchment.
2. By employing standard chemical analysis [5] procedures the entire above mentioned tests were conducted.
3. Three samples were collected from the identified points around the catchment
4. Analysis was done for three times for three months for all the three samples
5. The results were correlated with the standards prescribed by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982.

Table 1: Catchment water quality I cycle

S.NO	PARAMETER	Month I		
		Location 1	Location 2	Location 3
1	P^H	7.9	8	8.14
2	Electrical Conductivity	3800	3350	3850
3	Alkalinity	500	485	470
4	Total Hardness	910	920	910
5	Turbidity	44	38	45
6	Total Solids	3640	3380	3830
7	Total Dissolved Solids	3040	2680	3080
8	Total Suspended Solids	600	700	750
9	Dissolved Oxygen	3	1.5	2.8
10	Chlorides	640	730	725
11	Biochemical Oxygen Demand	2.5	110	150

All the units are in mg/l except pH, Turbidity (NTU) and EC (µmhos/cm)

Table 2: Catchment water quality II cycle

S.NO	PARAMETER	Month II		
		Location 1	Location 2	Location 3
1	P^H	7.25	8	7.4
2	Electrical Conductivity	3850	3830	3500
3	Alkalinity	540	530	535
4	Total Hardness	950	980	700
5	Turbidity	44	45	48
6	Total Solids	3820	3784	3480

7	Total Dissolved Solids	3080	3064	2800
8	Total Suspended Solids	740	720	680
9	Dissolved Oxygen	2.4	3.4	3
10	Chlorides	630	600	650
11	Biochemical Oxygen Demand	2	365	300

All the units are in mg/l except pH, Turbidity (NTU) and EC (μmhos/cm)

Table 3: Catchment water quality III cycle

S.NO	PARAMETER	Month III		
		Location 1	Location 2	Location 3
1	P^H	7.4	8	7.6
2	Electrical Conductivity	3550	3455	3650
3	Alkalinity	550	480	520
4	Total Hardness	930	850	600
5	Turbidity	48	49	49
6	Total Solids	3500	3404	3610
7	Total Dissolved Solids	2840	2964	2920
8	Total Suspended Solids	660	640	690
9	Dissolved Oxygen	2.8	2.7	3.5
10	Chlorides	730	780	650
11	Biochemical Oxygen Demand	2.5	240	400

All the units are in mg/l except pH, Turbidity (NTU) and EC (μmhos/cm)

IV. RESULTSAND DISCUSSIONS

S.NO	PARAMETER	EXPLANATION
1	P^H	The P^H of the catchment is within the acceptable limits throughout the study period as per the surface water quality standards by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982.
2	Electrical Conductivity	When the Electrical conductivity is compared with surface water quality standards by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982 it is with is crossed the permissible limits.
4	Biochemical Oxygen Demand	The Biochemical Oxygen Demand of the catchment shows the characteristics of 'B' Outdoor bathing (organized) type water body as per the surface water quality standards by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982 it is with is crossed the permissible limits.
5	Turbidity	The turbidity level of the catchment is high and it is not acceptable proper treatment is highly required.
6	Dissolved oxygen	In the present study very low dissolved oxygen is noted when it is compared with surface water quality standards by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982 it is with is crossed the permissible limits indicates excessive algal growth in the catchment.

7	Total Dissolved Solids	The concentration of total solids is high when correlated with surface water quality standards by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982 it is with is crossed the permissible limits.
8	Chlorides	The concentration of chlorides is very high when it is compared with surface water quality standards by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982 it is with is crossed the permissible limits.
9		1. The water quality in the catchment is highly contaminated the concentration of other parameters like hardness, total solids, total suspended solids also not in the limits required high level treatment is required 2. The effluents from the industries must be monitored and should be zero discharge with respect to chemicals releasing into the catchments.

V. CONCLUSIONS

1. The hydrology of catchment is always dynamic as it is depending on the existed geological parameters along with effluents or runoff entering into the catchment.
2. The effluents [4] discharge from the nearby industries should be monitored regularly
3. Industries must follow the guiltiness of surface water quality standards by Central Pollution Control Board, 1979 and the Bureau of Indian standards, 1982
4. The catchments must be monitored periodically with respect to its water quality and the sanitary measures around the catchments.
5. The effluent treatment plants [10] must be designed as per the requirements with advanced technological innovations to reduce the intensity of the hazardousness of the waste water before it is releasing into the catchments.
6. Common effluent treatment plants must be encouraged if the industries are unable to maintain individual effluent treatment plants.
7. The staff quarters must be constructed in the industry itself to look after the discharge of effluents releasing into the nearby water bodies and proper precautions must be given to them in such a way to release the effluents with Zero chemical percentage.

REFERENCES

1. Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982)
2. Chemical Analysis of Water and Soil, Third Edition, by Dr. KVSG Murali Krishna.
3. Remediation of urban lake water and sediments" by M. Satish Kumar, Ambati Dattatreya Kumar, P. Srinivasa Rao, G. Venu Ratna Kumari published in International Journal of Recent Technology and Engineering, Volume No: 8. Issue No: 5, January 2020, pp 2338 – 2341, ISSN: 2277-3878.
4. Manivasakam.N., Physico chemical Examination of Water, Sewage and Industrial Effluents, Pragati Prakasham,p.234(2202)
5. Interpretation and correlative study of water simulation in surface water bodies: , by M.Satish Kumar, M.V Raju, S.Ramesh babu and M.saiva jagadesh kumar published in International Journal of Civil Engineering and Technology, Volume No: 8. Issue No:5, May 2017, pp 1206 - 1211, ISSN: 0976-6308.
6. Y. Anjaneyulu, Introduction to Environmental Science, Edition, B.S Publications, Hyderabad, 2004.
7. Water quality scenario in urban polluted lakes : A model study by M.Satish Kumar ,M.V Raju, Hepsiba palivela and G.Venu Ratna kumari published in International Journal of Civil Engineering and Technology, Volume No: 8. Issue No: 5, May 2017 pp 297 to 302., ISSN:0976-6316.
8. Brindha, k., & Elango,L.(2013),Environmental assessment of water quality in nagarjuna sagar reservoir, India. earth Resourses,1(1),PP.33-36,https://doi.org/10.12966/er05.05.2013.
9. Quality Characteristics of Ground Waters in Few Sources of Industrial Zone " by Hepsibah Palivela, B. Ravali, M.V.Raju, K.Maria Das, T.Ch.Anil Kumar , International Journal of Innovative Technology and Exploring Engineering, Volume No: 9. Issue No: 3, January 2020, pp 1134 – 1137
10. Text book on Environmental Engineering-I: Principles of water supply engineering by Satish Kumar Moparhi published by Lambert academic publishing with ISBN 978-613-7-45184-7.
11. Comprehensive index of groundwater prospects by using standard protocols – A model study, M.Satish Kumar M.V Raju., and Hepsiba palivela in International Journal of Civil Engineering and Technology, Volume No: 8. Issue No: 05, 2017 pp 521 – 526. ISSN: 0976-6316.
12. Anjaneyulu Y, Water resources pollution, Water quality management and monitoring, Proceedings of International conference on hydrology and water shed management Vol-II, 554-561.

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