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Sediment and Morphology Analysis of Orathupalayam Dam

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Abstract*: Water pollution is becoming a major environmental issue in the present days because of the large number of mushrooming industries in the country. Water pollution not only affect the water environment . It deteriorates the quality of the soil, aquatic life system etc .Industries located at the bank of the rivers totally destroy the water body like the industries situated o the bank of river Noyyal. The Noyyal river has been fully exploited and the soil condition in these areas seem to be very worst. This study focuses on the heavy metal analysis in the soil at Orathupalayam dam, which is built across Noyyal river near chennimalai town. The suitable remediation technique is suggested to make the dam fit for irrigation purposes.*

1. Introduction

The Noyyal River rises from the Vellingiri hills in the Western Ghats in Tamil Nadu, southeastern India and drains into the Kaveri River. The river's basin is 180 km (110 mi) long and 25 km (16 mi) wide and covers a total area of 3,500 km2 (1,400 sq mi). Noyyal contains two major dam Orathuppalayam (Near Chennimalai, Tirupur District) and Aathupalayam Dam (Near Vellakoil in Karur district) commissioned in the aim of irrigating about 20,000 acres of land in Tirupur and Karur districts. As of now Orathuppalayam dam stands decommissioned and acting as effluent tank for the Tirupur textile units.

2. Objectives of the study

To study the characteristics of the Noyyal river bed and Orathupalayam dam sediment

To Study the morphological changes of Orathupalayam dam using Remote Sensing and GIS

To assess the impact of textile and dyeing effluent on Orathupalayam dam sediment.

3. Materials and Methods

3.1 Selection of Sampling location

Six sampling locations are chosen in which two locations are at the upstream of the dam (S1 , S2) , two locations inside the dam (S3 , S4),(S5, S6)two locations at the downstream of the dam,one agricultural farm near the dam (S7) and one at the nearer village (S8).

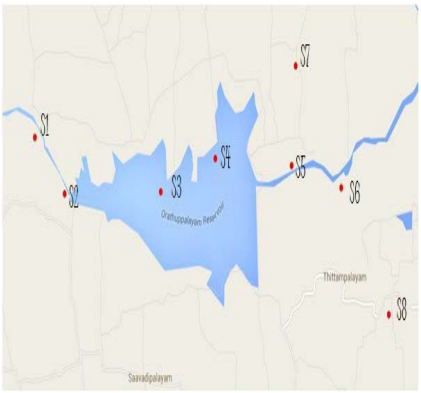

Fig 1 Sampling locations

Source : Google maps

3.2 Sample collection

The sediment samples are collected to a depth of 15cm using core sampler.Samples are collected in the day time in the months of December , February and April. About 250g of sediment samples are collected at every points. Totally24 samples have been collected.

3.3 Sample digestion for analysis (1)

Mix 360 ml of HF + 120ml of HNO_3 + 20 ml of $HClO_4$ .Take 0.5 g of sample + 20 ml of acid mixture .Heat overnight at 1200^0c in hot plate .Next day , add 10 ml HNO_3 and heat for 30 min. Make upto 100ml

3.4 Collection of satellite imageries

The images of Orathupalayam dam over the past years are collected from Google Earth. The images shows that the stream of the river Noyyal is getting narrowed in the successive years.

Fig.2 Satellite Image as on 23/11/14

Fig 2.Satellite image as on 15 /11/15
Source :Google Earth

4. Results and Discussions

4.1 Heavy metal analysis

The heavy metals in the samples are analysed using Atomic Absorption Spectrometer . The different elements found in the elements sample are presented in the following tables**.**

Table 1. Analysis results of Location 1

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.15	0.147	0.158	0.152	0.102
2.	Cr	65.92	66.12	64.12	65.39	35
3.	Co	12.7	12.35	12.98	12.68	11.6
4.	Cu	56.19	57.24	55.68	56.37	14.3
5.	Pb	10.10	10.25	10.87	10.41	17
6.	Mn	452.73	453.21	459.14	455.02	527
	Ni	37.46	38.14	36.26	37.29	18.6
8.	Zn	68.54	66.25	69.47	68.09	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

Table 2. Analysis results of Location 2

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.13	0.145	0.137	0.14	0.102
2.	Cr	60.12	61.66	63.24	61.67	35
3.	Co	13.7	13.28	14.65	13.88	11.6
4.	Cu	57.23	55.24	56.23	56.23	14.3
5.	Pb	11.12	11.28	10.97	11.12	17
6.	Mn	456.82	458.25	456.39	457.15	527
	Ni	38.12	38.57	38.97	38.55	18.6
8.	Zn	66.24	67.54	71.36	68.38	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

Table 3. Analysis results of Location 3

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.24	0.39	0.41	0.35	0.102
2.	Cr	64.53	65.21	68.68	66.14	35
3.	Co	16.8	17.21	18.36	17.46	11.6
4.	Cu	64.44	69.74	68.35	67.51	14.3
5.	Pb	15.76	15.98	15.63	15.79	17
6.	Mn	485.65	489.65	491.68	488.99	527
	Ni	42.09	42.58	45.24	43.30	18.6
8.	Zn	69.12	70.02	71.87	70.34	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

Table 4. Analysis results of Location 4

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.27	0.31	0.35	0.31	0.102
2.	Cr	66.22	67.25	65.45	66.31	35
3.	Co	17.21	18.54	19.21	18.32	11.6
4.	Cu	67.12	66.54	63.25	65.64	14.3
5.	Pb	17.02	17.98	18.25	17.75	17
6.	Mn	492.43	495.21	497.65	495.1	527
	Ni	53.12	53.25	54.12	53.5	18.6
8.	Zn	69.32	68.79	71.24	69.78	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

Table 5. Analysis results of Location 5

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.18	0.21	0.195	0.165	0.102
2.	Cr	65.34	66.21	65.84	65.8	35
3.	Co	17.32	17.21	18.01	17.51	11.6
4.	Cu	67.19	66.54	69.21	67.65	14.3
5.	Pb	17.34	16.54	17.68	17.19	17
6.	Mn	494.23	495.68	493.25	494.39	527
	Ni	52.19	53.24	54.21	53.21	18.6
8.	Zn	69.47	70.01	71.04	70.17	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

Table 6. Analysis results of Location 6

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.21	0.24	0.32	0.26	0.102
2.	Cr	67.02	68.21	68.45	67.89	35
3.	Co	17.41	17.65	17.98	17.68	11.6
4.	Cu	67.12	69.21	68.25	68.19	14.3
5.	Pb	17.02	17.21	17.98	17.40	17
6.	Mn	494.64	495.01	492.31	493.99	527
	Ni	51.65	51.98	52.36	52	18.6
8.	Zn	68.98	70.36	71.25	70.2	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

Table 7. Analysis results of Location 7

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.18	0.14	0.22	0.18	0.102
2.	Cr	61.19	60.65	60.97	60.94	35
3.	Co	12.5	12.7	13.0	12.73	11.6
4.	Cu	64.23	64.51	66.21	64.98	14.3
5.	Pb	14.33	14	14.21	14.18	17
6.	Mn	471	472.3	472.6	471.97	527
	Ni	49.02	50.32	50.35	49.9	18.6
8.	Zn	56.98	56.14	54.23	55.78	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

Table 8. Analysis results of Location 8

S.no	Parameters	Dec (mg/Kg)	Feb (mg/Kg)	March (mg/Kg)	Average (mg/Kg)	Limiting element concentration (mg/Kg)
1.	Cd	0.93	0.95	0.99	0.96	0.102
2.	Cr	30.43	30.54	30.86	30.61	35
3.	Co	9.4	9.1	9.7	9.4	11.6
4.	Cu	12.2	12.5	12.8	12.5	14.3
5.	Pb	16.43	16.79	16.94	16.72	17
6.	Mn	321.12	321.58	321.97	321.6	527
	Ni	15.76	15.87	15.96	15.86	18.6
8.	Zn	47.65	47.62	47.81	47.69	52

*Source : Handbook of Geochemistry , Volume 2 ,Part 5

It is found that all the heavy metals are present above the limiting concentration. Over the years, these heavy metals in the soil retards the agricultural activities and it also affects the quality of the soil. Therefore some remediation steps have to be taken to save the orathupalayama dam and its nearby villages from pollution**.**

4.2 Morphological changes in dam

Table 9 Orathupalayam reservoir details

Year	Water Spread Area (hectare)	Reservoir level (Km)
1993	56.87	246.58
1994	55.21	246.410
1995	43.76	245.5
1996	39.67	246.200
1997	39.11	242.030
1998	36.45	243.250
Polluted water stopped at 4.00 p.m on 11.10.1998		
1999	34.87	246.37
2000	34.22	243.4
2001	32.67	245.24
2002	32.12	245.2
2003	32.55	243.39
2004	27.98	247.880
2007	23.76	237
2008	23.54	237.1
2009	24.14	237
2010	23.52	237.170
2011	23.47	237.3
2012	20.21	236.4
2013	19.08	236.32
2014	16.22	237.7

4.3 Impact assessment

The textile effluents from Tiruppur textile industries affected the health, environment and the agricultural activities. Table 10. shows the impact of Tiruppur textile effluents on agriculture.

Table 10. Current agricultural activities

Name	Village	Agricultural land (Acre)	Current status
Karuppaiah	Orathupalayam	7	Seasonal crops
Subramani	Orathupalayam	3	Coconut
Venkatachalam	Thammareddipalayam	5	Barren land
Parvathi	Thammareddipalayam	2	Barren land
Govindhan	Kodumanal	1	Corn
Manickam	Kodumanal	3	Coconut , Corn
Gomathy	Keeranur	3	Barren land
Mahalingam	Keeranur	1	Barren land

4.4 Suggestion for remediation

Many studies showed that phytoremediation can be done to remediate a site that is contaminated with heavy metals

Table 11.Hyperaccumulating plants

Plant	Metal
Dicotyledons Cystus ladanifer	 Cd Co Cr Ni Zn
Thlaspi caerulescens	Cd Zn
Arabidopsis halleri	Cd
Alyssum sp.	Ni
Brassica junica	Pb Zn
Betula	Zn
Grasses Vetiveria zizaniodes Paspalum notatum Stenotaphrum secundatum Pennisetum glaucum	Zn

The above mentioned plants can be used to remediate the Orathupalayam dam.

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