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Paper Mills Pollution Hazards on Ground and Surface Water Bodies of Adjoining Areas of Hasdeo River Champa, C.G. (India)

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Abstract: ***Paper and pulp industrial wastes are associated with the nutrients, undesirable materials and heavy metallic elements. We have taken extensively study of GW and SW in and around of Hasdeo river, in which Madhyabharat paper mills effluents being continuously discharged. For this purpose, we have chosen eight different sampling spots: Four SW and Four GW respectively. Water samples were collected from Oct'2012 to Mar'2013; for the period of six months in pre-cleaned jerry canes and subjected for analysis of physicochemical, phenol and selected heavy metals like Fe, Cu, Zn and Mn by standard methods as per IS Procedures. The experimental results were interpreted by the statistical means. The result were found beyond the desirable and upper limit for EC (1258 µS/cm), Turbidity (94 NTU), TSS (245 mg/L), DO (3.38mg/L), COD (140 mg/L), Phosphate (0.26 mg/L), Sodium (612 mg/L), Potassium (12 mg/L), Iron (0.865 mg/L), Cu (0.03 mg/L), Manganese (3.63 mg/L) and phenol (0.29 mg/L). On the basis of these selected water parameters, the WQI were found in the ranging of 99.840 at (MS_3) to 100.733 (MG_4). These elevated values of these parameters are of great concern to public health, when the water from these sources are consumed by people without treatment.***

Keywords: Water quality, Paper Mill, Physico-chemical parameter, Statistical value and Public health.

1. Introduction

Blue planet, earth is the only one on which life, as we know it, exist. Life on this planet is dependent on many facts like an ambient temperature, water and food. The natural resources with some energy are available on the earth planet, are necessary requirements of all life forms. The earth's environments are consisting the lithosphere, the hydrosphere and the atmosphere. Water covers >5% of the earth surface including underground. In lithosphere biotic: living things and abiotic components; nonliving things are occurs. In last three decades, owing to huge industrialization, the natural sources are lost and gradually creating adverse effect on living system [1-2].

Pulp and Paper industry is one of the largest and most polluting industries in the world. In India, there are 666 Pulp and Paper mills, in which 632 are agro-residue and recycled fiber based unit [3-5]. In whole process of this industry consume high amount of fresh water bagasse, straw, jute, bamboo as basic raw material for making paper and chemicals such as sodium hydroxide, sodium carbonate, sodium sulphide, sodium bisulphide, elemental chlorine, chlorine dioxide, calcium oxide, hydrochloric acid etc are utilized. The paper mill effluents are characterized by dark brown colouration, absorbable organic halides and toxic pollutants by which water quality deteriorated [6-9].

2. Materials and Methods

2.1 Profile of the Study Area

Geographically the study area; Madhyabharat paper mills and its adjoining area in Champa town (C.G.) is located 22.05°N to 82.65°E longitude with 253 meters mean sea level. The average temperature and rainfall of the investigation area is 49°C and 1152.1 mm respectively. The study field geologically make by metamorphic stone of archen age. In spite of MPCL, other industries like Prakash Steel Industries Limited, CSPGCL etc. are successfully conducted. We have taken extensively study of water monitoring of Hasdeo river, on which the Madhyabharat

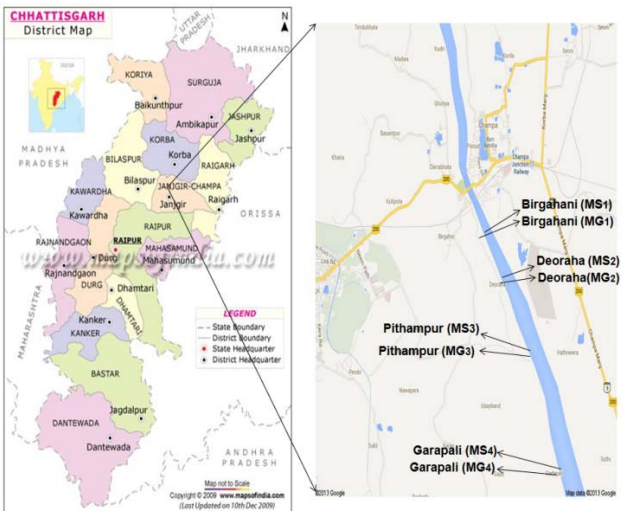

Figure 1: Location of study area

paper mills effluents are regularly discharged. In this paper we have focused the analytical results of different physicochemical quality and some selected metallic elements with phenolic compounds of study field for six months; Oct' 2012 to Mar' 2013.

2.2 Collection and Preservation

Water samples were collected on 15th date from Oct' 2012 to

Mar-2013 in precleanned glass and polyethylene bottle of 1L capacity separately. The collected water samples were stored in refrigerator at 4°C, while for metallic elements and phenolic compounds were preserved by adding of 2 ml conc. HNO_3 and orthophosphoric acid orderly.

2.2 Instruments

Temperature, P^H, EC, TDS, DO and Turbidity were measured by seven parameter analyzer, Fluoride, Nitrate, Sulphate, Phosphate by Spectrophotometer, Phenol by Colorimeter and Metallic elements by ICPAES.

2.3 Analytical Methods

At the period of collected water samples standard methods described in APHA [10], N. MANIVASKAM [11], NEERI Manuals [12], ISI standard [13] and WHO [14] etc.

3. Results and Discussion

The average values for physic-chemical quality, metallic elements and phenols are mention in Table-1, Statistical quality are depicted in Table-2, Correlation Matrix and WQI are displayed in Table-3 and 4 respectively.

- **P^H**: The P^H of natural water reflex by dissolution of atmospheric CO_2 and discharging of acidic compounds. Normally, P^H has no adverse effect on human health [15]. In our study period, ranges values covered from 6.1 at the sampling site MG_3, Feb'13 to 8.1 at the site MS_4, Oct'12, which indicates the water sources are slightly alkaline in nature due to continuous receiving alkaline components from industrial effluents.

Table 1: Average value of Physico-chemical and Metallic Element Analysis

Parameters / Sampling Spot	*MS1*	*MG1*	*MS2*	*MG2*	*MS3*	*MG3*	*MS4*	*MG4*
Temperature	25.050	25.083	25.050	25.167	24.960	25.083	25.033	25.183
P^H	7.477	7.292	7.713	7.202	7.353	7.082	7.602	7.362
Conductivity	1160.5	1105.667	1140.167	1084.833	1109.5	1010	1086.833	1038.833
Turbidity	18.167	12.167	83.167	24.333	14.667	10.167	45.833	6.167
TS	518.667	418.833	895.5	421.167	534.167	421.667	615.5	636.333
TDS	316	291.833	716.667	248.5	419	306.833	413.167	520
TSS	202.667	127	178.833	176	115.167	114.833	202.333	116.333
Alkalinity	523.833	618	563	667.5	340.833	482.833	124.833	338.167
Total Hardness	374.667	337.5	320.333	357.5	348.5	312.833	335.333	333.667
Chloride	148.838	154.858	594.292	494.082	237.120	194.635	73.575	264.970
Fluoride	0.902	0.993	0.832	0.812	1.028	0.927	1.072	0.927
Sulphate	388.5	267.667	439.167	292.333	226	219.500	349.667	276.833
D.O	5.868	4.740	6.715	4.870	5.943	4.488	5.447	4.317
BOD	3.690	4.348	4.598	4.477	4.558	4.805	3.652	4.798
COD	123.167	112	101.667	72	96.167	80	71.833	50.667
Nitrate	33.565	24.333	45.865	31.280	38.190	27.165	45.490	24.412
Phosphate	0.158	0.130	0.235	0.150	0.117	0.128	0.123	0.118
Sodium	271.333	404.667	320.333	550.333	262.333	469.5	257.5	447
Potassium	8	6.5	9.833	6.333	7.667	10	10.5	6.5
Calcium	113.995	108.285	100.915	120.885	101.930	110.535	108.123	95.745
Magnesium	22.905	21.930	15.945	10.910	14.913	25.852	11.047	15.623
Iron	0.256	0.442	0.157	0.364	0.145	0.367	0.213	0.302
Copper	0.018	0.019	0.017	0.019	0.019	0.019	0.022	0.021
Zinc	0.075	0.259	0.120	0.215	0.107	0.095	0.077	0.104
Manganese	0.284	0.064	0.059	0.182	0.121	0.117	0.641	0.034
Phenol	0.004	0.009	0.012	0.013	0.010	0.012	0.128	0.124

* All parameters in mg/L except Conductivity (µS/cm), Turbidity (NTU) and P^H
MS_1– Birgahani (River Water), MG_1– Birgahani (Borewell Water), MS_2– Deoraha(River Water), MG_2–Deoraha(Borewell Water), MS_3– Pithampur (River Water), MG_3– Pithampur(Borewell Water), MS_4– Garapali (River Water) MS_4– Garapali (Borewell Water).

- **EC**: In the present study, EC was measured from 852 µScm^{-1} to 1258 µScm^{-1}. The min. EC was found in ground water source MG_3, Nov'12 while the high concentration was detected at the surface water source MS_2, Feb'13 which is indicated, that the surface water sources are contaminated with inorganic chemicals comes from paper mills effluents.
- **Turbidity:** Turbidity is caused due to the presence of suspended matter, clay silt, particles, plankton and other microscopic organism [16]. In study period the ranging values were obtained in wide ranges 3 NTU in MG_4, Nov'12 to 94 NTU in MS_2, Jan'13. The min. value was quite close to the permissible limit, while the higher value was many folds higher than the permissible limit.

Table 2: Statistical Parameter of water Quality

Parameters	*N*	*MEAN*	*S.D*	*S.E*	*%CV*	*MIN*	*MAX*	*RANGE*	*Indian Drinking water Std. IS 10500: 2012*	*WHO Rec.2011*
Temperature	8	25.076	0.072	8.857	0.288	24.960	25.183	24.96 -25.183	***	27-28
PH	8	7.385	0.207	2.643	2.799	7.082	7.713	7.081 -7.713	6.5-8.5	6.5-8.5
Conductivity	8	1092.042	49.474	410.299	4.530	1010	1160.5	1010 -1160.5	***	1000
Turbidity	8	26.833	25.867	6.423	96.4	6.167	83.167	6.166 -83.166	5-8 NTU	5 NTU
TS	8	557.729	161.307	183.376	28.922	418.833	895.5	418.833 -895.5	520-2050	***
TDS	8	404	153.750	111.723	38.057	248.5	716.667	248.5 -716.666	500-2000	1000
TSS	8	154.146	39.632	71.653	25.711	114.833	202.667	114.833 -202.666	20-50	***
Alkalinity	8	457.375	179.105	185.203	39.159	124.833	667.5	124.833-667.5	300-600	***
T. Hardness	8	340.042	19.904	132.465	5.853	312.833	374.667	312.833 -374.666	300-600	500
Chloride	8	270.296	180.746	52.622	66.870	73.575	594.292	73.575 -594.291	200-1000	200-1000
Fluoride	8	0.936	0.091	0.319	9.713	0.812	1.072	0.811 -1.071	1-1.2	1.5
Sulphate	8	307.458	78.211	137.355	25.438	219.5	439.167	219.5 -439.166	200-400	250
D.O	8	5.299	0.835	2.075	15.766	4.317	6.715	4.316 -6.715	5	***
BOD	8	4.366	0.455	1.305	10.426	3.652	4.805	3.651 -4.805	5	***
COD	8	88.438	24.023	43.546	27.164	50.667	123.167	50.666 -123.166	10	***
Nitrate	8	33.788	8.699	11.867	25.745	24.333	45.865	24.333 -45.865	45	50
Phosphate	8	0.145	0.039	0.056	27.075	0.117	0.235	0.116 -0.235	0.1	***
Sodium	8	372.875	110.799	95.931	29.715	257.5	550.333	257.5 -550.333	***	200
Potassium	8	8.167	1.723	2.828	21.096	6.333	10.5	6.333 -10.5	***	***
Calcium	8	107.552	7.965	40.303	7.406	95.745	120.885	95.745 -120.885	75-200	200
Magnesium	8	17.391	5.557	8.098	31.957	10.910	25.852	10.91 -25.851	<30	***
Iron	8	0.281	0.107	0.090	38.018	0.145	0.442	0.145 -0.442	0.1-1.0	0.3
Copper	8	0.019	0.002	0.007	7.796	0.017	0.022	0.017 -0.021	0.05	2
Zinc	8	0.132	0.068	0.027	51.655	0.075	0.259	0.075 -0.259	5	3
Manganese	8	0.188	0.200	0.100	106.396	0.034	0.641	0.033 -0.640	0.1	0.5
Phenol	8	0.039	0.054	0.001	137.496	0.004	0.128	0.003 -0.128	0.001	***

- **TDS:** The Total dissolved solids in water are represented by the weight of residue left when a water sample has been evaporated up to dryness. TDS values varied from 215 mgL^{-1} at sampling spot MS_4, Oct'12 to 750 mgL^{-1} at sampling spot MS_2, Nov'12. These ranges values are under acceptable ranges 500 mgL^{-1} to 1500 mgL^{-1}. The high value was reported at the sampling point MS_2 indicating more intrusion of paper mills effluents [17].
- **Total hardness:** The hardness of water related to the amount of Ca^{2+} and Mg^{2+} in the water. The chief sources of these ions are rocks, soils, domestic sewage and industrial effluents. In investigation period, the total hardness was noted in very narrow ranges 180 to 564 mgL^{-1}. The min. value was note down as the site no MG_3, Nov'12, while the high conc. was seen at the water sample collected from MG_1, Nov'12 which is close to discharging point of paper mills effluent.
- **Total alkalinity:** Alkalinity is the quantitative capacity of an aq. media to react with hydrogen ion [18]. The desirable value is 200 mgL^{-1} and max. tolerable value 600 mgL^{-1}. The analytical results spread from 112 mgL^{-1} to 674 mgL^{-1}. The min. one was observed at the site No. MS_4, Nov'12 and high one was observed at the site No MG_2 (Jan'13), which is close to the discharging point of paper mill effluent.
- **Chloride:** Chloride is one common constituents of all natural water, higher concentrations of chloride impart a salty taste to water making at unacceptable for public consumption. As per standards the desirable limit of chloride for drinking water is 250 mgL^{-1} and the permissible limit in the absence of alternate source is 1000 mgL^{-1} [13, 14]. In study field the ranges values were noted down between 67 mgL^{-1} (MS_4, Oct'12) to 618 mgL^{-1}(MS_2, Feb'13). The higher value is crossed the desirable unit.
- **Fluoride:** Fluoride is an active element, which unit concentration is mandatory for bone metabolic activity while high concentration causing of different type of fluorosis . The acceptable range for drinking water is 1 mgL^{-1} to 1.5 mgL^{-1}. In our monitoring period the recorded concentration of fluoride ion was varied from 0.8 mgL^{-1}(MS_2 , Nov'12) to 1.12 mgL^{-1} (MS_4 , Feb'13), which are under acceptable ranges.
- **Sulphate:** Presence of sulphate has less effect as the taste of water compared to the presence of chloride ion. The high concentration of sulphate may induce diarrhoea and intestinal disorder. The desirable limit of sulphate in drinking water prescribed by BIS [13]; 200-400 mgL^{-1}. In our observation period the ranges value for sulphate was 190 mgL^{-1}(MS_4, Nov'12) to 456 mgL^{-1} (MS_2, Feb'13), which is slightly above the upper limit.
- **Nitrate:** The upper nitrate concentration for potable water is 50 mgL^{-1} as per WHO (2011) recommendation [14]. The high concentration of nitrate is toxic and causing of blue babies disease in infants. The observation value was found as ranges 22.8 mgL^{-1} (MS_1, Jan'13) to 46.51 mgL^{-1} (MS_2, Nov'12), which is under permissible level. These concentrations are not harmful for aquatic biota as well as human being.
- **Phosphate:** It is essential element for growth, propagation and activity of plant, animals even aquatic species and microbes. The analytical results were formulates as ranging from 0.1 mgL^{-1} (MS_3, MS_4, Nov'12) to 0.26 mgL^{-1} (MS_2, Jan'13), which is slightly above the upper limit of prescribed value as per BIS [13].

- **DO:** Dissolved oxygen is one of the important parameter that play a vital role in the rate of chemical reaction and the nature of various biological activities [19]. In study time, the ranges values were covered from 3.38 mgL^{-1} in MG_4, Feb'13 to 7.73 mgL^{-1} which is beyond the min. concentration of DO, 5 mgL^{-1} as per WHO [14]. These ranges values indicated the water sources are not loading of high amount of organic material.
- **BOD:** BOD is defined as the amount of oxygen required by the bacteria while stabilizing decomposable organic matter under aerobic conditions [20]. In the analysis period, the ranges values covered from 3.41 mgL^{-1} in MS_1, Jan'13 to 5.16 in MG_3, Mar'13 mgL^{-1}, which is under the permissible level as indicating the water sources did not receive any organic contaminates.
- **COD:** Chemical oxygen demanding is extremely useful in finding out the pollution strength of industrial effluents [21]. In the present study, ranges values were far away from permissible limit; 10 mgL^{-1} as per BIS [13]. The reported experimental observations were 43 mgL^{-1}(MG_4, Nov'12) to 140 mgL^{-1} (MS_1, Dec'12) as minimum and maximum respectively. This high concentrations indicating releasing large amount of oxygen demanding chemicals.
- **Mg:** Mg is one of the essential alkaline earth metals for various metabolic functions in the living body. Low magnesium causes more Ca to flow into the vascular muscle cells, which contracts them leading to tighter vessels and higher blood pressure. In study period the ranges were covered from 10.5 mgL^{-1} (MG_2, Dec'12) to 26.23 mgL^{-1} (MG_3, Dec'12), which is below the reference value; 30 mgL^{-1} [13].
- **Ca:** The balance amount of Ca is useful for human body, the deficiency of Ca less than 75 mgL^{-1} cause deformation rickets, softening of bones and reduced bone density. In observed analytical results, the ranges values covered from 80 mgL^{-1} (MG_1, Oct'12) to 131.81 mgL^{-1} (MG_1, Dec'12) which is agree with the desirable ranges; 75-200 mgL^{-1} [13].
- **Na:** Sodium is an essential micronutrient. Its high concentration in diet and water causing of hypertension, circulatory or cardiovascular ailments. In study period the obtained results were ranging as min. 200 mgL^{-1} to max. 612 mgL^{-1} which is above the excessive permissible level, as per WHO; 200 mgL^{-1}[14]. The high amount was found at the sampling site MG_2 in Jan'13 owing to high degree influx of paper mills effluents.
- **K:** Potassium also contributes towards the hardness of water. When K level above 100 mgL^{-1} may have a laxative effect and level above 300 mgL^{-1} will impart a bitter taste in water [22]. In investigation period the minimum concentration was found 4 mgL^{-1}(MG_2, Nov'12) while maximum concentration was seen 12 mgL^{-1} (MS_4, Feb'13; Mar'13) as these statistical values are in the permissible level.
- **Iron:** In our study 0.018 mg/L (MG_4, Feb-2013) to 0. 865 mg/L (MS_1, Feb-2013) were reported. The amount of iron is high which is above the permissible limit as per drinking water standard, BIS; 1.00 mg/L [13].
- **Copper:** In our study period minimum amount was detected as 0.002 mg/L on the sampling spot MG_4 in the month of Feb-2013 while 0.03 mg/L was reported in the month of Oct-2012 on the sampling location MG_1, MS_1, MG_4 & MS_4 respectively.
- **Zinc:** In our study, minimum amount was detected as 0.001 mg/L on the sampling spot MS_2 in the month of Feb-2013 while. 0.36 mg/L was reported on MS_2, May-2013 sampling location respectively. Both values are under acceptable ranges 5 mg/L to 15 mg/L.
- **Manganese:** In the study field minimum concentration was detected as 0.0031 mg/L on the sampling spot MG_4 in the month of Feb-2013 while 3.63 mg/L was reported on MS_4, Mar-2013 sampling location respectively

Table 3: Correlation Matrix of water Quality

	Temp.	PH	Cond.	Turb.	TS	TDS	TSS	Alk.	T.H	Cl–	F–	SO42-	D.O	BOD	COD	NO3–	PO43–	Na	K	Ca	Mg	Fe	Cu	Zn	Mn	Ph
Temp.																										
PH	-0.369																									
Cond.	-0.468	0.651									Significant at 5% level, r > 0.649															
Turb.	-0.253	0.790	0.457																							
TS	-0.165	0.849	0.339	0.814																						
TDS	-0.144	0.728	0.200	0.705	0.970																					
TSS	-0.100	0.620	0.604	0.577	0.297	0.056																				
Alk.	0.341	-0.332	0.230	-0.011	-0.234	-0.231	-0.038																			
T.H	-0.048	0.030	0.581	-0.284	-0.325	-0.451	0.434	0.165																		
Cl–	0.277	0.178	0.176	0.565	0.485	0.486	0.102	0.541	-0.145																	
F–	-0.540	0.073	-0.112	-0.262	-0.182	-0.146	-0.192	-0.747	-0.078	-0.809																
SO42-	-0.088	0.851	0.689	0.793	0.711	0.535	0.818	0.067	0.160	0.356	-0.354															
D.O	-0.680	0.768	0.801	0.746	0.656	0.554	0.515	-0.019	0.162	0.354	-0.093	0.692														
BOD	0.344	-0.468	-0.559	-0.161	0.040	0.246	-0.789	0.306	-0.563	0.491	-0.356	-0.493	-0.321													
COD	-0.566	0.228	0.766	0.150	-0.032	-0.101	0.251	0.430	0.361	-0.082	-0.019	0.337	0.561	-0.383												
NO3–	-0.607	0.787	0.502	0.825	0.660	0.531	0.620	-0.389	-0.036	0.234	0.119	0.628	0.835	-0.420	0.151											
PO43–	-0.056	0.583	0.545	0.833	0.696	0.610	0.469	0.453	-0.128	0.745	-0.659	0.797	0.695	0.031	0.380	0.500										
Na	0.835	-0.715	-0.613	-0.348	-0.430	-0.354	-0.360	0.540	-0.192	0.357	-0.549	-0.424	-0.719	0.598	-0.480	-0.671	-0.119									
K	-0.488	0.412	-0.039	0.573	0.420	0.351	0.337	-0.445	-0.503	-0.105	0.212	0.349	0.413	-0.246	0.041	0.659	0.298	-0.456								
Ca	0.149	-0.384	0.115	-0.139	-0.621	-0.762	0.451	0.460	0.476	-0.012	-0.297	0.000	-0.133	-0.383	0.225	-0.101	-0.020	0.332	-0.089							
Mg	-0.082	-0.376	-0.101	-0.372	-0.326	-0.261	-0.329	0.345	-0.149	-0.343	-0.035	-0.191	-0.195	0.121	0.500	-0.502	-0.028	0.047	0.088	0.060						
Fe	0.632	-0.714	-0.440	-0.561	-0.709	-0.663	-0.304	0.498	-0.046	-0.192	-0.147	-0.446	-0.807	0.187	-0.085	-0.828	-0.347	0.744	-0.459	0.440	0.408					
Cu	0.125	-0.041	-0.541	-0.329	-0.128	-0.105	-0.121	-0.832	-0.157	-0.640	0.683	-0.328	-0.504	-0.199	-0.661	-0.078	-0.726	-0.084	0.113	-0.273	-0.289	0.033				
Zn	0.357	-0.362	0.045	-0.148	-0.400	-0.364	-0.203	0.663	0.069	0.250	-0.208	-0.233	-0.310	0.224	0.139	-0.433	-0.004	0.544	-0.626	0.330	-0.042	0.664	-0.319			
Mn	-0.290	0.361	0.133	0.208	-0.018	-0.195	0.681	-0.617	0.226	-0.479	0.480	0.286	0.151	-0.828	-0.083	0.537	-0.202	-0.459	0.500	0.319	-0.366	-0.254	0.526	-0.383		
Ph	0.273	0.284	-0.386	0.004	0.269	0.261	0.075	-0.781	-0.208	-0.321	0.423	0.037	-0.307	-0.169	-0.722	0.102	-0.371	-0.098	0.141	-0.433	-0.474	-0.137	0.888	-0.363	0.464	1

- **Phenol:** In our study, minimum amount was detected as 0.006 mg/L on the sampling spot MS_1 (Mar-2013) and MS_4 (Feb-2013) of while 0.29 mg/L was reported on MS_4 in the month of Oct'2012 as max. value, crossed the high limit as per BIS:0.001 mgL^{-1} [13].
- **Correlation Matrix:** 325 correlation coefficient 'r' among various water quality parameters were observed for

SW for GW, in which 156 positive (+) while 169 negative (–) correlation. Higher positive correlation was found between TDS and TS (r = 0.970) while higher negative correlation was seen between $F^-$and Cl^- (r = –0.809). Minimum positive r value was detected between Phenol and Turbidity (r = + 0.004) while minimum negative correlation was occurred between Zn and PO_4^{3-} (r = – 0.004). Near about 33 correlations were found above the significant at 5% level (r >0.649).

- **Water Quality Index:** Water quality index was calculated for different sampling locations, on the basis of selected parameters, the results were found in the ranges of 99.840 at the sampling point MS_3 to 100.733 at the MG_4 which is beyond the standard ranges. The high value of this statistical parameter indicated high intrusion of various kinds of pollutant. All the sampling point showed very high values of WQI (>100); Table 4, indicate the discharging of pollutants through leaching or percolation of surface water via paper mill industrial effluent.

Table 4: Water Quality Index

Sampling Spot	$\sum QiWi$	$\sum Wi$	$WQI = \sum QiWi / \sum Wi$
MS1	19.639	0.196	100.2
MG1	19.665	0.196	100.333
MS2	19.639	0.196	100.2
MG2	19.731	0.196	100.667
MS3	19.569	0.196	99.84
MG3	19.665	0.196	100.333
MS4	19.626	0.196	100.133
MG4	19.744	0.196	100.733

4. Conclusion

We have taken minor, but deeply month wise monitoring of Surface and Ground water in the eight sampling spots MS_1 to MS_4 and MG_1 to MG_4 in and around the Madhyabharat Paper Mill industry (C.G.) India. From the results of experiment, it may be concluded that the Ground and Surface water is polluted in references of EC (1258 µS/cm), turbidity (94 NTU), TSS (245 mg/L), DO (3.38mg/L), COD (140 mg/L), Phosphate (0.26 mg/L), Sodium (612 mg/L), Potassium (12 mg/L), Iron (0.865 mg/L), Cu (0.03 mg/L), Manganese (3.63 mg/L) and Phenol (0.29 mg/L). These qualities were marginally higher than the standard values of drinking water. Higher Positive correlation of significant was calculated out between TDS vs TS (r = + 0.960) indication of both parameters are significantly correlated and follow similar kind of pattern together (increasing or decreasing). WQI reported >100 almost all the sampling point showing more loading of pollutant in that water sources and the Ground water sources, basically bore well water are not suitable for drinking. Industrial effluents need a continuous monitoring and proper management before their discharge. We have suggested to peoples by accompanying prior treatment of water sources is necessary before human consumption for especially potable and agricultural purpose.

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