- **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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