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Effect of Coal Mining on the Surface Water Quality in Northern Coalfield Singrauli, India

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ABSTRACT

The present study aimed at determining the effect of surface water quality due to coal mining near the northern coalfield Singrauli, Madhya Pradesh, India. The experiment was adopted for surface water parameter pH, EC, TDS, Alkalinity, Fe. All the parameters of surface water exceeding the normal range compared with Central Pollution Control Board (CPCB). Direct consumption of surface water may cause the serious health problem among the local people and animals at all the coal mining sites of Singrauli district.

1. Introduction

Coal is the basic source of energy in our country and the coal resource is found in the crust of earth. To get this resource the upper layer of the crust is removed and the mining process takes out this resource from the crust. Coal is first and processed mining before it is burned to generate power. This process generated spillover affected especially in areas with large reserves where mining is active **(Bian and Inyang, 2010).** Beside the coal mining process also pollutes the environment. The effects of coal mining depend on whether the mine is active or abandoned, the coal mining methods used in addition to the sites' geological conditions **(Bell and Bullock, 2001).** Coal mining is a water intensive process, which leads to reduced ground water levels in some areas. The relation between coal mining and water use varies with activity and location. Coal mining affects the water by causing a drop in the ground water table. Mining activities pollute the water in addition to altering the direction of watercourses. Mining impact on water and environment. In underground mining, waste materials are piled at the surface creating runoff that both pollutes and alters the flow of local streams. As rain drain through these piles, soluble components are dissolved in the runoff and cause the elevation of total dissolved solids (TDS) in water bodies. Coal mining activities cause emissions of oxides of nitrogen, methane, and sulfur dioxide that are major contributors of global warming **(Bian and Inyang, 2010).** Thus the present study was planned-

To determining the effect of surface water quality due to coal mining near the northern coalfield Singrauli, Madhya Pradesh, India.

2. Material and Methods

The samples was randomly collected from the different projects of the Singrauli Coalfields, Northern Coalfields Limited, Singrauli district, Madhya Pradesh, India in different season (summer, monsoon and winter). Research area was focused on 5 residential area of the Singrauli i.e. Amlori (24°7'3" N 82°38'56"Eº), Nigahi (24°6'56" N 82°39'23"Eº), Jayant (24°7'16" N 82°40'54"Eº), Dudhichua (24°7'1" N 82°41'53"Eº) and Khadia (24°7'7" N 82°342'8"Eº).

For Surface Water Sample

S.No.	Parameters	Methods
1.	pH	pH Meter **(APHA, 2005)**
2.	Electrical conductivity (µS cm^{-1})	EC Meter **(Wilcox 1950)**
3.	Total dissolved solids (mg/l)	TDS meter **(APHA, 2005)**
4.	Alkalinity (mg/l)	Tritrimetric method **(APHA, 2005)**
5.	Iron (mg/l)	Atomic Absorber Spectrophotometer **Black (1965)** and **Lindsay and Norwell (1978)**

3. Result and Discussion

Table 1: Effect of coal mining on pH of Surface water at different sites of Singrauli District in different seasons during 2016-17 and 2017-18

SITES	2016-17				2017-18			
	Summer	Manson	Winter	Mean	Summer	Manson	Winter	Mean
1	7.68	8.63	8.55	8.28	8.53	8.60	8.55	8.56
2	8.03	8.19	8.05	8.09	8.23	8.21	8.14	8.19

3	8.22	8.30	8.29	8.27	8.26	8.38	8.36	8.33
4	8.41	8.55	8.36	8.44	8.47	8.56	8.38	8.47
5	8.18	8.29	8.17	8.21	8.19	8.31	8.19	8.23
SD	0.28	0.19	0.19	0.22	0.15	0.71	0.16	0.34

SD= Standard Deviation

Table 1 showed the mean value of the pH showed that site 4 was found maximum pH 8.44 and the minimum pH 8.09 at site 2 in all the different seasons through out the year. The maximum value during the summer season was found at site 4 i.e. pH 8.41, in monsoon and winter season site 1 showed the maximum value of pH 8.63 and 8.55. The minimum value of pH in summer season was found at site 1 i.e. pH 7.68, in monsoon and winter season site 2 showed the minimum values of pH 8.19 and 8.05 in the year 2016-17. The mean value of the pH showed that site 1 was found maximum pH 8.56 and the minimum pH 8.19 at site 2 in all the different seasons throughout the year. The maximum value during the summer, monsoon and winter season was found at site 1 i.e. pH 8.53, 8.60 and 8.55. The minimum value of pH in summer season was found at site 1 i.e. 8.19, in monsoon and winter season site 2 showed the minimum values of pH 8.21 and 8.41 in the year 2017-18. It was shown in the table that pH value is high as compare to normal range that is harmful for the health of human as well as animals and also for environment. The same results was also observed by **Panda *et al.,* (2016)** that the lower pH in the summer season may be attributed to low flow of water and decomposition of organic materials at high temperature that liberates acids. The higher pH in rainy season can be due to photosynthesis by autotrophs as myxophyceae bloom was observed in the riverbed, high flow of water that dilutes the pollutants.

Table 2: Effect of coal mining on EC (µS cm^{-1}) of Surface water at different sites of Singrauli District in different seasons during 2016-17 and 2017-18

SITES	2016-17				2017-18			
	Summer	Manson	Winter	Mean	Summer	Manson	Winter	Mean
1	0.75	0.82	0.79	0.78	0.95	0.83	0.82	0.86
2	0.64	0.73	0.68	0.68	0.66	0.75	0.71	0.70
3	0.55	0.58	0.57	0.56	0.58	0.62	0.61	0.60
4	0.30	0.34	0.28	0.30	0.32	0.36	0.31	0.33
5	0.48	0.53	0.51	0.50	0.49	0.56	0.53	0.52
SD	0.17	0.18	0.19	0.18	0.23	0.18	0.20	0.20

SD= Standard Deviation

Table 2 showed the mean value of the EC (µS cm^{-1}) showed that site 1 was found maximum EC 0.78 µS cm^{-1} and the minimum EC 0.30 µS cm^{-1} at site 4 in all the different seasons through out the year. The maximum value during the summer, monsoon and winter season was found at site 1 i.e. EC 0.75 µS cm^{-1}, 0.82 µS cm^{-1} and 0.79 µS cm^{-1}. The minimum value of EC in summer, monsoon and winter season was found at site 4 i.e. EC 0.30 µS cm^{-1}, 0.34 µS cm^{-1} and 0.28 µS cm^{-1} in the year 2016-17. The mean value of the EC showed that site 1 was found maximum EC 0.86 µS cm^{-1} and the minimum EC 0.33 µS cm^{-1} at site 4 in all the different seasons through out the year. The maximum value during the summer, monsoon and winter season was found at site 1 i.e. EC 0.95 µS cm^{-1}, 0.83 µS cm^{-1} and 0.72 µS cm^{-1}. The minimum value of EC in summer, monsoon and winter season was found at site 4 i.e. EC 0.32 µS cm^{-1}, 0.36 and 0.31 µS cm^{-1} in the year 2017-18. The table indicated that the EC was high in surface water in mining area, which affect on the people's health as well as local environment. Same as **Prakash and Somashekar (2006)** explained in their study that surface water tends to have high EC due to the presence of high amount of dissolved salts.

Table 3: Effect of coal mining on TDS (mg/l) of Surface water at different sites of Singrauli District in different seasons during 2016-17 and 2017-18

SITES	2016-17				2017-18			
	Summer	Manson	Winter	Mean	Summer	Manson	Winter	Mean
1	2047.25	2042.25	2043.00	2044.16	2089.75	2048.00	2044.50	2060.75
2	1838.00	1883.50	1860.50	1860.66	1841.25	1885.50	1862.25	1863.00
3	2005.00	2022.00	1997.25	2008.08	1674.00	2026.75	1999.50	1900.08
4	2028.25	1813.50	2018.00	1953.25	2030.25	1815.75	2021.00	1955.66
5	2117.25	2174.75	2145.00	2145.66	2128.50	2177.25	2148.50	2151.41
SD	103.43	141.72	102.29	115.81	190.92	142.35	102.84	145.37

SD= Standard Deviation

Table 3 showed the mean value of the TDS (mg/l) showed that site 5 was found maximum TDS 2145.66 mg/l and the minimum TDS 1860.66 mg/l at site 2 in all the different seasons through out the year. The maximum value during the summer, monsoon and winter season was found at site 5 i.e. TDS 2117.25 mg/l, 2174.75 mg/l and 2145.00 mg/l. The minimum value of TDS in summer and monsoon season was found at site 2 i.e. TDS 1838.00 mg/l and 1883.50 mg/l, in winter season site also 2 showed the minimum values of i.e. TDS 1860.50 mg/l in the year 2016-17. The mean value of the TDS showed that site 5 was found maximum TDS 2151.41 mg/l and the minimum TDS 1863.00 mg/l at site 2 in all the different seasons through out the year. The maximum value during the summer season was found at site 5 i.e. TDS 2128.50 mg/l, monsoon and winter season was found at also site 5 i.e. TDS 2177.25 mg/l and 2148.50 mg/l. The minimum value of TDS in summer season was found at site 3 i.e. 1674.00 mg/l, in monsoon season site 4 showed the minimum values of i.e. TDS 1815.75 mg/l and 1862.25 mg/l minimum values in winter season in the year 2017-18. It is showed that TDS is high in surface water sample that causes many diseases. Similarly **Mor *et al.,* (2006)** also explained in his study that the high value of TDS might be due to the various pollutants into groundwater. The high concentration of TDS decreases the palatability and may cause gastro-intestinal irritation in human.

Table 4: Effect of coal mining on ALKALINITY (mg/l) of Surface water at different sites of Singrauli District in different seasons during 2016-17 and 2017-18

SITES	2016-17				2017-18			
	Summer	Manson	Winter	Mean	Summer	Manson	Winter	Mean
1	94.75	100.00	96.50	97.08	106.75	101.50	98.50	102.25
2	101.00	112.50	106.50	106.66	104.25	114.25	108.25	108.91
3	103.25	107.25	98.50	103.00	106.25	110.00	102.50	106.25
4	99.50	104.50	98.00	100.66	106.75	106.50	99.75	104.33
5	106.00	112.50	109.00	109.16	113.50	113.75	111.25	112.83
SD	4.22	5.37	5.81	5.13	3.51	5.33	5.50	4.78

Table 4 showed the mean value of the ALKALINITY (mg/l) showed that site 5 was found maximum 109.16 mg/l and the minimum 97.08 mg/l at site 1 in all the different seasons through out the year. The maximum value during the summer, monsoon and winter season was found at site 5 i.e. 106.00 mg/l, 112.50 mg/l and 109.00 mg/l. The minimum value of ALKALINITY in summer season was found at site 1 i.e. 94.75 mg/l, in monsoon and winter season site also 4 showed the minimum values of i.e. TSS 100.00 mg/l and 96.50 mg/l in the year 2016-17. The mean value of the ALKALINITY showed that site 5 was found maximum 112.83 mg/l and the minimum 102.25 mg/l at site 1 in all the different seasons through out the year. The maximum value during the summer, winter season was found at site 5 i.e. 113.50 mg/l, 111.25 mg/l and during monsoon season was found at site 2 i.e. 114.25 mg/l. The minimum value of ALKALINITY in summer season was found at site 2 i.e. 104.25 mg/l, in monsoon season site 1 showed the minimum values of i.e. 101.50 mg/l and 98.50 mg/l minimum values in winter season in the year 2017-18. Result showed that the high value of ALKALINITY which reduced the drinking water quality of the local area. Its regular consumption may cause many health related diseases. Therefore **Mishra *et al.,* (2009)** also concluded that the alkalinity is mostly due to the presence of bicarbonate. Alkalinity (150 mg/L) found conductive to productivity of water bodies.

Table 5: Effect of coal mining on IRON (mg/l) of Surface water at different sites of Singrauli District in different seasons during 2016-17 and 2017-18

SITES	2016-17				2017-18			
	Summer	Manson	Winter	Mean	Summer	Manson	Winter	Mean
1	1.39	1.51	1.46	1.45	1.86	1.51	1.46	1.61
2	1.19	1.41	1.27	1.29	1.19	1.41	1.27	1.29
3	1.14	1.27	0.92	1.11	1.34	1.43	1.44	1.40
4	1.45	1.54	1.28	1.42	1.47	1.54	1.28	1.43
5	1.50	1.50	1.42	1.47	1.59	1.50	1.42	1.50
SD	0.16	0.11	0.21	0.16	0.25	0.06	0.09	0.13

Table 5 showed the mean value of the IRON (mg/l) showed that site 5 was found maximum IRON 1.47 mg/l and the minimum IRON 1.11 mg/l at site 3 in all the different seasons through out the year. The maximum value during the summer season was found at site 5 i.e. IRON 1.50 mg/l, the monsoon season was found at site 4 i.e. iron 1.54 mg/l and 1.46 mg/l found at site 1 in winter season. The minimum value of iron in summer, monsoon and winter season was found at site 3 i.e. iron 1.14 mg/l, 1.27 mg/l and 0.92 mg/l in the year 2016-17. The mean value of the iron showed that site 1 was found maximum IRON 1.61 mg/l and the minimum iron 1.29 mg/l at site 2 in all the different seasons through out the year. The maximum value during the summer, winter season was found at site 1 i.e. IRON 1.86 mg/l, 1.46 mg/l and monsoon

season was found at site 4 i.e. iron 1.54 mg/l. The minimum value of IRON in summer, monsoon and winter season was found at site 2 i.e. 1.91 mg/l, 1.41 mg/l and 1.27 mg/l in the year 2017-18. It is reported from that study that iron value was slightly high in surface water. **Singh (2016)** also explained in his study that the iron formed during the acid- generating reactions further reacts with the available pyrite to form additional acidity, ferrous and sulphate ions. These reactions indicated that sulphate is in part stoichiometrically related to acidity.

4. Conclusion

All the parameters of surface water were exceeding the normal range compared with Central Pollution Control Board (CPCB) and BIS (Bureau of Indian Standard). Direct consumption of surface water may cause the serious health problem among the local people and animals at all the coal mining sites of Singrauli district. It is suggested that local people should consume treated water (purified water) and also should plantation. It may reduce the surface water pollution and it also provides good health.

References

1. APHA (2005). Standard Methods for the Examination of Water and Wastewater. 21st Edition, American Public Health Association, Washington DC.
2. Bell, F. G. and Bullock, S. E. T. (2001). Environmental Impacts Associated with an Abandoned Mine in the Witbank Coalfield, South Africa. *International Journal of Coal Geology.* Volume 45, Issue 2-3, pg. 95-216.
3. Bian, Z. and Inyang, H. I. (2010). Environmental Issues from Coal Mining and their Solutions. *Mining Science and Technology (China).* Volume 20, Issue 2, pg. 215-223.
4. Black, C. A. (1965). Method of Soil Analysis, Chemical and Microbiological Properties, *American society of Agronomy.* Volume 2, pg. 861-864.
5. Singh, .G (2016). Mine Water Quality Deterioration due to Acid Mine Drainage. *Mine Water and the Environment.* Volume 6, Issue 1, pg. 49-61.
6. Lindsay, W. L. and Norwell, W. A. (1978). Development of Dtpa Soil Test for Zinc, Iron, Manganese and Copper. *Journal of American society of soil science*. Volume 42, pg. 421-428.
7. Mishra, D., Mudgal, M., Akramkhan, M. and Chakradhar, B. (2009). Assessment of Ground Water Quality of Bhavnagar Region Gujarat. *Journal of scientific and Industrial Research.* Volume 68, pg. 964-966.
8. Mor, S., Ravindra, K., Dahiya, R. P. and Chandra, A. (2006). Leachate Characterization and Assessment of Groundwater Pollution near Municipal Solid Waste Landfill Site. *Environmental Monitoring and Assessment*. Volume 118, pg. 435-456.
9. Panda, P. K., Panda, R. B. and Dash, P. K. (2016). Seasonal Variation of Physico-Chemical Parameters of River Salandi from Hadagada Dam to Akhandalmani, Bhadrak, Odisha, India. *Journal of Environmental Science, Toxicology and Food Technology.* Volume 10, Issue 11, pg. 15-28.
10. Prakash, K. L. and Somashekar, R. K. (2006). Groundwater Quality-Assessment on Anekal Taluk, Bangalore Urban district, India. *Journal of Environmental Biology.* Volume 27, Issue 4, pg. 633-637.
11. Wilcox, L. V. (1950). Electical Conductivity, Amer. *Water Works Association Journal*. Volume 42, pg. 775-776.s

