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Correlation of COD and BOD of Damodar River Water Samples Before and After Meeting of Mining Effluents Around Khas Karnpura Coalfields, Jharkhand

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Abstract - The COD and BOD are important parameter for indication of pollution. The correlation of BOD and COD of Damodar River water has been assessed seasonally in the year 2014 before and after meeting of mining effluents from station (1 to 6). The variable α and β shows 5.20 and 0.012 before meeting of mining effluents and 0.28 and 0.068 after meeting of mining effluents respectively. It has been observed significant correlation between BOD and COD.

A straight line equation between BOD and COD are observed for Damodar River water before and after meeting mining effluents.

BOD = α+β (COD)

It has been found that BOD is function of COD.
Keywords - Stations (BOD), (COD), Mining effluents, Correlation

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INTRODUCTION

Coal is a Prime source of energy playing important part in the industrial growth of India. Khas Karnpura coal field comes under Central coal field limited situated in the Jharkhand state under Hazaribagh District, a subsidiary of coal India limited. This is most intensively exploited coal field and produces the bulk amount of coal in India. Mining causes impacts on river water due to discharging of mining effluents.

The Mine effluents possess various kinds of pollutants eg. (Nitrate, suspended solid, heavy metals etc.). Mine waste water of Urimari, Sayal D block, Khas Karmpura area and Bhurkunda area of South Karnpura of Central coal field limited a subsidiary of coal India limited located in the Hazaribagh district of Jharkhand being discharged into River Damodar and its tributary Nalkari River main drainage of study area. Which ultimately causing gigantic problem. The River running through area becomes a sewer. The effluents can vary in concentration of contaminant upon location and hydro geological nature of Mine. (Esener AA. Roels JA. Kossen,1981).

The quality of Mining effluents and their nature are dependent upon conditions of Mining and geological status (yonger et al, 2002).

The effluents and their concentration of pollutants differ from mine to mine. Some Mine water has small extent of pollutants which is similar to level of drinking water standard. (Kannan C. Raja Shekhran, 1991).

According to report of (Khan et al 2005), Mine water may contain pollutants of harmful substances heavy metals, organic and microbes.

The Mining effluents when discharged into river water enhances the suspended solid, contaminates the river water by mixing of microbes, heavy meals, coal sludge, residues of oils and petroleum and other pollutants (Metcalf, Eddy 2003).

Damodar river water in Karnpura coalfield area receives Mining effluents form collieries, thermal power station and sewages of residential colony, along with its tributary Nalkari river which off loads its pollutant into Damodr River. The fulfillment of need of fresh water for its population in India is a great problem. River water meets this requirement. Studies indicates that only 4% of worlds fresh water is found in India and its feeds 16% of world population (Singh et al 2003).

The study of correlation of BOD and COD of Damodr River around Khas Karnpura coalfield as

not been done till date. However impact of coal mining effluents on the quality of river water has been reported for Jhariya coalfields (Younger et al 2002).

EXPERIMENTAL

The Khas Karnpura coalfields is subsidiary unit of central coalfields limited situated in Jharkhand state.

River Damodar and its tributaries Nalkari are the main drainage of study area.

Analysis of water quality of these River have been done with a view to access the impact of all kind of industrial activity in this area.

For study 6 sampling stations have been selected these station are

1. Station number 1
Damodar River upstream point here Ashwa village.

2. Station number 2

Damodar River Downstream point (sample of this point is an indicator of impact of Effluents of Urimari, Sayal D and Khas Karnpura collieries).

3. Station number 3

Confluence of Damodar and Nalkari River.

4. Station number 4

Damodar River of stream ie (500m before meeting its tributaries Benjari near Ramgarh.

5. Station number 5

Damodar River downstream (500m after meeting the tributary Banjari near Ramgarh.

6. Station number 6

Downstream of Nalkari (before meeting Damodar River). This tributary of Damodar carries Effluents of Patratu thermal power station and Saunda projects.

Data in the above area summarized in table.

Table 1: Before meeting of Effluents (Seasonal variation)

Stations	BOD in PPM	COD in PPM
Summer		
S1	8	20
S2	4	51
S6	13	792
Monsoon		
S1	3.1	17
S2	6	65
S6	11.9	219
Winter		
S1	3	12
S2	5.1	45
S6	11.2	318

Table 2: After Meeting of Effluents (2014)

Stations	BOD	COD
Summer		
S3	12	178
S4	7.3	127
S5	7	113
Monsoon		
S3	8	100
S4	7	78
S5	6.8	71
Winter		
S3	7	85
S4	6.8	95
S5	4	85

The parameter BOD and COD of different samples collected from stations (1 to 6) were assessed by using standard methods (Trivedy RK Goel PK.1984). Standard deviation, standard error, 95% confidence limit and correlation have been calculated by the data collected.

The data has been summarized in different tables I and II contains BOD and COD before meeting and after Meeting effluents (2014)

Table 3: Contains Statistical parameter data for water sample before meeting and after meeting of mining effluents.

Parameters	n	Minium	Maximum	Average	Standard Deviation	Standard error	95% Confidence limit
(X) COD pre	9	12	792	171	255.65	85.21	12.5
(Y) BOD pre	9	3	13	7.25	4.45	1.48	4.5
(X) COD Pre	9	71	178	103.55	114.66	34.51	89.37
(Y) BOD Pre	9	4	12	7.32	10.7	2.44	2.89

Table 4: Represents Correlation coefficient (r) and value of α and β

Parameters	r	α	β
COD-BOD (before meeting of effluents)	0.69	5.20	0.012
COD-BOD (after meeting of effluents)	0.97	0.28	0.068

The correlation coefficient (r) has positive value (r = 0.97) after meeting the Mining effluents and 0.69 before meeting Mining effluents in River water samples. The value of α = 5.20 and β = 0.012 has been observed before meeting Mining effluents similarly the value of α and β are 0.28 and 0.068 after meeting of Mining effluents in Damodar River water samples.

It appears form the above finding that increase the value of X (COD), Y (BOD) also increases correspondingly. All the variables X, Y, r SD, SE, 95% CL was calculated by the following formula.

$$\sum \beta xy = \sum xy - \frac{\sum x \sum y}{n}$$

$$\sum x^2 = \sum y^2 - \frac{(\sum x)^2}{n}$$

$$\beta yx = \frac{\sum xy}{\sum x^2} \qquad \boxed{\beta = \frac{\sum xy}{\sum x^2}}$$

$$\propto = \bar{y} - \beta\bar{x}$$

$$\bar{y} = \frac{\sum y}{n} \qquad \bar{x} = \frac{\sum x}{n}$$

$$\sum y^2 = \sum y^2 - \frac{(\sum y)^2}{n} \qquad S.E = \frac{Sx}{\sqrt{n}}$$

$$\beta xy = \frac{\sum xy}{\sum y^2} \qquad S.D(Sx) = \sqrt{\frac{\sum x^2}{n-1}}$$

$$\text{Correlation (r)} = \sqrt{\beta yx . \beta xy}$$

Regression equation

$$y = \alpha + \beta x$$

$y = BOD$ β = Slope of the line

$x = COD$ $C L = \bar{x} \pm t * SE$ (t = 1.86)

For 95% CL

All observation shows a straight line equation with COD and BOD Damodar River water sample before and after meeting of Mining effluents during 2014 in summer, monsoon and winter season.

RESULT AND ITS IMPLICATION

The influence of Mining effluents on water quality of Damodar River before meeting and after meeting as recorded in table II to IV COD and BOD before meeting (12 to 792 mg/liter) and (3 to 13 mg/liter) respectively.

COD and BOD after meeting of Mining effluents were (71 to 178 mg/liter) and (4 to 12 mg/liteer) respectively.

The value of SD, SE and 95% of CL for COD and BOD before and after meeting Mining effluents were, 171, 255.65, 85.21, 12.5 and 7.25 4.445, 1.48, 4.5 mg/liter respectively as observed in table III.

The value of 95% CL indicates that there is a correlation between COD and BOD.

By calculating the COD the BOD can by predicted ie BOD depends upon COD. (Russell DL, 2006).

The parameters COD and BOD also depend on the sample stations and their concentration (Srivastava Vs, 1999).

The BOD indicates concentration of organic pollutants oxidized by micro organisms but COD

estimates all types of impurities organic and inorganic pollutants.

The parameter BOD and COD and their relations shows Biodegradability index (BI), (Turak UG, Fsar HA, 2004).

CONCLUSION

The above finding indicates that value of BOD before meeting of Mining effluents is always lower than that of COD before meeting of Mining effluents.

COD has value (12 to 712) BOD has value (3 to 13). This clearly indicated that there is a greater amount of oxidisable organic matter in the sample.

The higher the organic matter the lower will be dissolved oxygen (DO) that will be a problem or unsafe for aquatic animals.

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