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Appraisal of biological oxygen demand and chemical oxygen demand of ground water in the command area of Ksk Sahakari Sakhar Karkhana Ltd., Kopargaon, dist. Ahmednagar

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Abstract
The area of Karmaveer Shankarrao Kale Sahakari Sakhar Karkhana Ltd., Kopargaon, Dist. Ahmednagar was surveyed for assessment ground water quality. The GPS base water samples were collected in the in the jurisdiction of Karmaveer Shankarrao Kale Sahakari Sakhar Karkhana Ltd., Kopargaon. In the vicinity of sugar factory the post biomethanated spentwash was applied on soil as liquid manure. So to study the impact of post biomethanated spentwash on ground water source the study was undertaken to assess the quality of ground water and its suitability for irrigation and to study the extent of causing accumulation of heavy metals in ground water. Fifty five ground water samples were collected from the open well /bore well from jurisdiction of sugar factory. While selecting the wells, precautions were taken to see the wells were affected and not affected by industrial effluent and used for irrigation purpose for long time. Impacts of post biomethanated spentwash on BOD and COD of ground water are documented in this manuscript. The BOD ranged from 4 to 16 mgL^{-1}, with an average 10.21 mgL^{-1}. The COD ranged from 32 to 57 mgL^{-1}, with average value 43.89 mgL^{-1}.

Keywords: BOD, COD, ground water, sugar factory, spentwash

1. Introduction
India is a major producer of sugar in the world and India rank second after Brazil in the world. Sugar industry offers an employment and significantly contributes sustainable socio-economic development. There are 285 distilleries in India, producing 2.7 billion liters of alcohol and generating 40 billion of waste water. The proportion of waste water generally known as spent wash, is nearly the15 times of total alcohol production. This massive quantity of approximately 40 billion waste spentwash is disposed untreated, causing considerable stress on water bodies and leads widespread damage to aquatic life. The pollution in the vicinity of distilleries is one of the most crucial environmental issue. Maharashtra is one of the most industrialized state in India. Many industries are situated all over the state. The industries play an important role for the development of Indian economy and employment generation. However, the industrial development sometime creates adverse effect on the human population, water, air, soil and environment. The chemical analysis for the ground water and tube wells near industrial area has become prominent issue of every city in Maharashtra and India. The physical examination attributes the color clarity on and test have became of greater importance in classifying the portable quality of water. This ground water was first used for domestic as well as agricultural purpose since past 5-6 years as the industrial area has developed nearby this wells, due to percolation seepage of the industrial effluents the total nearby ground water is polluted to such an extent that it is unsuitable for domestic purpose.
The present study aims to evaluate the water quality parameters (BOD and COD) of ground water around sugar factory and compare them to standard permissible limit prescribed by the Board of Indian Standards (BIS). The study identifies the ground water quality has been considerably affected due to the spentwash from the sugar industry. Efforts should be taken so that the water quality can be restored and its further deterioration can be prevented by suggesting the appropriate remedial measures as per ground water quality

2. Material and method

In the vicinity of sugar factory the post biomethanated spentwash was applied on soil as liquid manure. So to study the impact of post biomethanated spentwash on ground water source the study was undertaken to assess the quality of ground water and its suitability for irrigation and to study the extent of causing accumulation of heavy metals in ground water. Fifty five ground water samples were collected from the open well /bore well from jurisdiction of sugar factory.

2.1 Location

The Karmaveer Shankarrao Kale Sahakari Sakhar Karkhana Ltd., located at, Kopargaon, district Ahmednagar, Maharashtra. It is located at $19^0 52'$ N latitude and $74^0 20'$ E longitude. Six villages were selected in 5 km jurisdiction of sugar factory area.

2.2 Climate

The area of Karmaveer Shankarrao Kale Sahakari Sakhar Karkhana Ltd., Kopargaon Dist. Ahmednagar comes under semi-arid tropics with an annual rainfall 450-750 mm. The mean annual maximum and minimum temperatures ranged from 27.7 ^{0}C to 43.5 ^{0}C and 15.00 ^{0}C to 24 ^{0}C, respectively.

2.3 Cropping pattern

The major crops grown in Karmaveer Shankarrao Kale Sahakari Sakhar Karkhana Ltd., Kopargaon, Dist. Ahmednagar are cereals and pulses with assured irrigation facilities from wells.

2.4 Experimental Details

2.4.1 Collection of water samples

The GPS based irrigation water samples were collected from irrigation source i.e. open/ bore wells of 5 km jurisdiction of sugar factory in the month of April 2017. The ground water samples were collected in clean plastic can of one litre capacity, tightly stoppered and brought to the laboratory for analysis.

2.5 Methods

The methods followed for determination of BOD and COD of water are described below.

2.5.1 Water analysis

After water sample received in laboratory, BOD and COD of water were estimated immediately.

Table 1: Standard method used for irrigation water analysis

Sr. No.	Parameter	Method	References
1	BOD	Wrinkler Titration	Franson (1985) [6]
2	COD	Reflux	Franson (1985) [6]

2.6 Statistical Analysis

Simple correlation analysis was carried out among water quality parameters as per procedure outlined by Panse and Sukhatme (1995) [13].

3. Result and discussion

Biological oxygen demand (BOD)

The water samples were collected from the different villages in the jurisdiction of Karmaveer Shankarrao Kale Sahakari Sakhar Karkhana Ltd., Kopargaon. In Kolpewadi the BOD of ground water samples ranged from 4 to16 with an average value 11.28. In Kolagonthadi the BOD of ground water samples were ranged from 6 to15 with an average value 9.7. In Shahajapur the BOD of ground water samples were ranged from 9 to11 with average value 10.11. In Kolgaonmal BOD of ground water samples ranged from 9 to 15 with average value 11.8. In Laxmanpur BOD of ground water samples range between 11 to12 with an average value 11.25. In Suregaon BOD of ground water samples ranged from 4 to 8 with an average value 5.8, presented in table 2. The BOD of total collected ground water samples ranged from 4 tov16 with average value 10.21, presented in table 3. BOD in water which is due to industrial effluent might have contributed some organic pollutants sometime percolate through the sub soil and reaches the ground water table forming contaminated pool, which is potential threat of water contamination. Nirgude *et al.* (2014) [12] found similar type of results in ground water samples from Vapi town, Gujrat.

Table 2: Pollution parameter and derived parameter of ground water samples from different villages in the jurisdiction of sugar factory

Particular	COD (mgL^{-1})	BOD (mgL^{-1})
Kolpewadi		
Min.	32	4
Max.	57	16
Average	42.5	11.28
Kolgaonthadi		
Min.	33	6
Max.	56	15
Average	45.4	9.7
Shahajapur		
Min.	44	9
Max.	48	11
Average	46	10.11
Kolgaon Mal		
Min.	44	9
Max.	56	15
Average	50.4	11.8
Laxmanpur		
Min.	48	11
Max.	51	12
Average	49	11.25
Suregaon		
Min.	32	4
Max.	37	8
Average	35.1	5.8

Table 3: Average of pollution parameter and derived parameter of ground water samples from different villages in the jurisdiction of sugar factory

Particular	COD	BOD
	(mgL^{-1})	
Range	32-57	4-16
Mean	43.89	10.21
SD	7.2	3.36

Chemical oxygen demand (COD)

In Kolpewadi the COD of ground water samples ranged from 32 to 57 with an average value 42.5. In Kolagonthadi the COD of ground water samples were ranged from 33 to56 with an average value 45.4. In Shahajapur the COD of ground water samples were ranged from 44 to 48 with average value 46. In Kolgaonmal COD of ground water samples ranged from 44 to 56 with average value 50.4. In Laxmanpur COD of ground water samples range between 48 to 51 with an average value 49. In Suregaon COD of ground water samples ranged from 32 to 37 with an average value 35.1, presented in table 2. The COD of total collected ground water samples ranged from 32 to 57 with average value 43.89, presented in table 3.

The COD is used to measure pollution load in terms of quantity of oxygen required for oxidation of organic matter to produce carbon dioxide and water. Water with high COD indicates that there is presence of organic waste and oxygen is required for the oxidation of these wastes so all oxygen is used for the oxidation of organic waste and that is why there is inadequate oxygen available in water sample. Presence of low oxygen in the water reduced the ability to sustain aquatic life (Yadav *et al.*, 2014) [20].

4. Conclusion

All the water samples were analysed for BOD and COD. The results clearly Indicates the need for management of current source of irrigation water or to utilize alternate source of good water for irrigation. The BOD ranged from 4 to 16 mgL^{-1}, with an average 10.21 mgL^{-1}. The COD ranged from 32 to 57 mgL^{-1}, with average value 43.89 mgL^{-1}.

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