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Primary Article

Asssesment of Industrial Wastewater Quality and Management

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ABSTRACT

Wastewater is being considered a highly valued water source for irrigation. In this paper, an attempt is made to assess the quality of effluent from Oil & Cattle feed industry in MIDC Nanded region had been analyzed during the study period of year 2011 to 2012. This region located on the bank of river Godavari. In this investigation the collected samples were tested for following parameters such as alkalinity, chloride, hardness, total dissolved solids, total suspended solid, pH, electrical conductivity, sulphate, sodium, potassium, biochemical oxygen demand and carbon dioxide had been analyzed of the effluent collected from the oil industry of Nanded region. It is necessary to analyze and treat the industrial wastewater because it may deteriorate the groundwater and soil. Also it causes surface water pollution due to its discharge. Except oil & grease all the parameters included in this study were found to be within the permicble or prescribed discharge limits for industries.

Keywords:
Industrial wastewater, Water Quality, Manangement, Assesment, Nanded.

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Introduction

Populations and incomes are rising and countries are industrializing. This progress creates a demand for water in urban areas of developing countries which will increase significantly in the coming decades. The majority of environmental goods and services are provided by lakes/ rivers, wetlands and marine waters (Costanza et al. 1997). Increased population, urbanization, improved living conditions and economic development have driven the generation of increased volumes of wastewater by the domestic, industrial and commercial sectors (Asano et al., 2007; Lazarova and Bahri, 2005).

According to the United Nations World Water Development Report, industry accounts for 22% of all global water withdrawals. This varies from 59% in highincome countries, to 8% in low-income countries. This is not as much as is used by agriculture, which accounts for about 50% of freshwater use. (Brenda and Lee 2009) In India, only 24 % of wastewater generated by households and industry is treated before its use in agriculture or disposal to rivers (Minhas and Samra, 2003). A large number of wastewater treatment plants dealing with the other one-third are not properly operated and maintained. The reality is that as much as two-thirds of the wastewater generated in the world receives no treatment at all. For example, less than 10% of the existing wastewater treatment plants in Mexico are estimated to be operating satisfactorily (Mario and Boland, 1999). Poverty, lack of access to alternative water sources and poor water quality in and around cities with inadequate sanitation infrastructure are contributing factors to the productive use of wastewater by poor urban communities for agriculture in and around cities in less developed countries. A non-exhaustive rapid survey of data available in literature (Van der Hoek, 2003) indicates that wastewater use in urban agriculture is a widespread practice in both developed and developing countries.

High levels of nitrogen in wastewater may result in nitrate pollution of groundwater sources used for drinking, which could lead to adverse health effects. Accumulation of heavy metals in soils and its uptake by plants is another risk associated with wastewater irrigation (Khouri et al.,1994). The most common diseases associated with wastewater and excreta are the diarrheic ones. Examples include several kinds of helminthiases that are caused by intestinal infestation of parasitic worms. Helminthiases are common where poverty and poor sanitary conditions prevail; under these conditions they can affect up to 90% of the population (Bratton and Nesse, 1993). Wastes, discarded and unwanted materials, result inevitably from human activities, whether domestic or industrial. If wastes are allowed to accumulate on the ground, or if dumped indiscriminately into rivers and other bodies of water, unacceptable environmental problems would result (Eckenfelder, 2000). Major problems are due to wastewater containing heavy metals, toxic chemicals, chloride, lime with high dissolved and suspended salts and other pollutants (Uberai, 2003).

In developing countries like China, Mexico, Peru, Egypt, Lebanon, Morocco, India and Vietnam, wastewater has been used as a source of crop nutrients over many decades (AATSE, 2004; Jiménez and Asano, 2008). Therefore, agricultural use of untreated wastewater has been associated with land application and crop production for centuries (Keraita et al., 2008). Based on information from the countries providing data on irrigated areas, it is estimated that more than 4–6 million hectares (ha) are irrigated with wastewater or polluted water (Jiménez and Asano, 2008; Keraita et al., 2008, UNHSP, 2008). A separate estimate indicates 20 million ha globally, an area that is nearly equivalent to 7% of the total irrigated land in the world (WHO,2006). In a new review integrating data from Jiménez and Asano (2008) and the UNHSP (2008), 46 countries report the use of polluted water for irrigation purposes. In a cost–benefit analysis of greywater reuse systems constructed in residential schools in India, the internal and external benefits far outweighed the costs (Godfrey et al., 2009). Wastewater generates additional benefits including greater income from cultivation and marketing of high-value crops such as vegetables, which create year round employment opportunities (Buechler, 2005; IWMI, 2003; 2004; Keraita et al., 2008; Lazarova and Bahri, 2005). Therefore, agricultural use of untreated wastewater has been associated with land application and crop production for centuries (Keraita et al., 2008). Israel is one of the leading countries in wastewater usage as it expects that 70 % of its agricultural water demand in 2040 will be met by treated wastewater (Haruvy 1997). Across major cities in West Africa, between 50 and 90 % of vegetables consumed by urban dwellers are produced within or close to the city (Drechsel et al., 2006) where much of the water used for irrigation is polluted. In Pakistan, about 26% of national vegetable production is irrigated with wastewater (Ensink et al., 2004).

The objective of the present work is to analysis and discuss the suitability of indusrial waste water for agricultural irrigation.

Study Area

The Nanded is located between 18°.15' and 19°.55' North latitude and 77°.7' to 78°.15' east longitudes. The district has a geographical area of 10528 Sq. Km. Nanded is one of the fastest growing city of Marathwada region of Maharashtra.

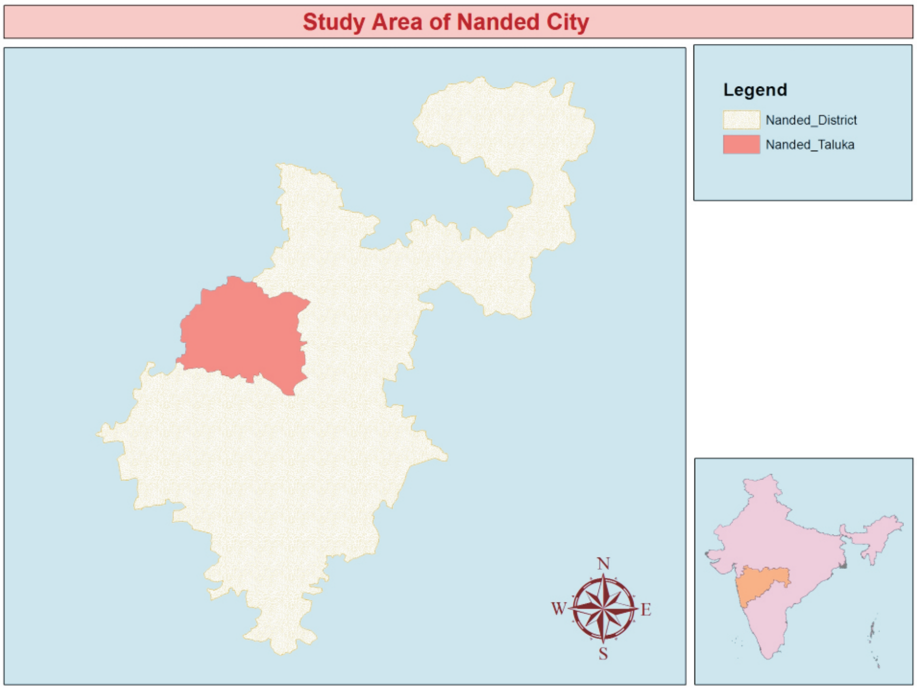

Figure:1.1 Showing study areas map of Nanded Taluka

Material And Methods

Site And Field Selection: Two sites and three fields were selected to monitor irrigation and nutrient applications and heavy metal build up. The main wastewater had received over a period of thirty years, from the Cattle feed industries which located in MIDC (Maharashta & Industrial Developement Corporation) of CIDCO New Nanded.

Sampling Methods: For the present investigation the effluent samples were collected from local cattle feed industries, situated in MIDC of Nanded. The physical and chemical parameters were analyzed as per Standard Methods for the Examination of Water and Waste Water, 17th edition, APHA (1989). Sampling was done three times in the year at morning in 2011-12. The pH, temperature, DO, and TDS were determined on the spot rest of the parameters were analyzed in the laboratory by standard methods.

Results And Discussion

In this study water samples ware analyzed from industrial wastewater. The number of physical parameters like total solids, total dissolved solids, Electrical conductivity, Colour were measured. The chemical paramaters estimated like pH, carban dioxide, total hardness, phenolphthalein alkalinity, total alkalinity, salinity, total acidity, oil & grease. Also some ionic parameters like chloride, phosphate, sulphate, calcium, magnesium, sodium, potassium, floride, iron, chromium and manganese were determined. Biological properties like standard plate count and most propable number were performed. The colour is usually the first contaminant to be recognized in wastewaters that affects the aesthetics, water transparency and gas solubility of water bodies (Yuxing and Jian 1999). All effluent samples were blackish in colour. The pH of waste water varies from 6.9 to 8.7 and temperature 200C to 30 0C. The total dissolved solid is in the range of 784 to 1730. Since the water contains dissolved and suspended constituents in varying proportions.

In the present study the data revealed that there were considerable variations in the quality with respect to their physicochemical characteristics. The average value of various waste water quality parameters had been mentioned in Table 1 and represented in graphs. This paper has describes the strong links between wastewater use and management.

Management of Wastewater

By using this wastewater poor farmares can make irragation in their respectve lands. This management approach is applied to our study area in Nanded city. Since wastewater which is coming from oil & cattle feed industry which is used in surounding agiculture area near vasarni. Similar results were found for wastwater irrigation in many countries like Nepal, Cambodia, India, Pakistan and Vietnam etc. In Quetta, Pakistan, farmers paid 2.5 times more for wastewater than for freshwater (Ensink et al., 2004).

Wastwater irrigation practices has also famous in India to, in which good example is Hyderabad. Farmers in Hyderabad alternate the use of groundwater with wastewater depending on the stage of plant growth. This was found to increase yields and decrease pest attacks on crops and infections among farm workers. Farmers were also found to be shifting to more wastewater-tolerant crops, gradually replacing paddy rice with fodder crops that are more tolerant to high salinity levels induced by the wastewater and still have a high market value rather than other crops.

The most important benefit to farmers in this semi-arid region is the reliable supply of wastewater, which allows them to grow high-value vegetable crops or agriculture. The wastewater supply runs continuously throughout the year and farmers not only have their own turns in using it, but can also exchange turns with each other to make water availability more responsive to crop water requirements. However, at the tail end of irrigation systems or throughout in the dry season, wastewater may be the only water flowing in the canals in areas such as Haroonabad in Pakistan and Hyderabad in India (Ensink et al., 2004; Ensink, 2006).

Health-Risk Measures Used By Farmers

In general, farmers experiment on their own, responding to perceived production risks like pest attacks, water scarcity or reduced fertile land and labour availability (Mutsaers et al., 1997). Among the perceived drivers for change, health risks are not prominent which is not surprising given the low health-risk awareness. However, low water quality can be a concern to farmers, even if its health affecting components are not perceived. It is therefore important to encourage farmers to look for solutions on their own, and several indigenous solutions actually reduce health risks even if it is inadvertent (IWMI, 2008). One of the negative environmental impacts associated with wastewater use is groundwater contamination through high concentrations of nitrates, salts and micro-organisms (Mara 1977; USEPA 1992). The reported skin problems included itching and blistering on the hands and feet problems were reported by rice farmers along the Musi River in Hyderabad, India and urban vegetable farmers using wastewater in Ghana (Buechler et al., 2002; Obuobie et al., 2006). Studies in Nepal, Cambodia, India, Pakistan and Vietnam have strongly associated skin diseases to contact with untreated wastewater (Keraita et al., 2008b).

Wastewater induced salinity may reduce crop productivity due to general growth suppression, at pre-early seedling stage, due to nutritional imbalance and growth suppression due to toxic ions (Kijne et al. 1998). Where exotic vegetables are produced for the market, farmers generally do not consume them and may not be aware of possible health implications from own experience (Drechsel et al., 2006). Thus, in many cases, farmers have been found to be developing strategies and innovations to adapt to deteriorating water quality in order to maintain or increase yields and reduce other negative trade-offs including health problems of particular interest are those innovations which aim at reducing inputs, such as labour while also reducing health risks, like furrow irrigation compared to overhead irrigation with watering cans. There is a variety of management options for small holder farmers in developing countries to address the challenges and risks of exposure to heavy metals or excessive salts and nutrients through irrigation water.

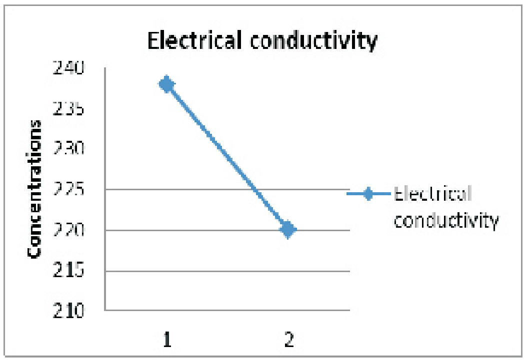

Fig.2: Observed Electrical conductivity.

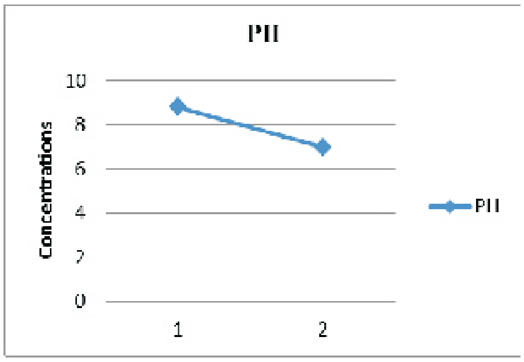

Fig.3: Observed pH of Water samples.

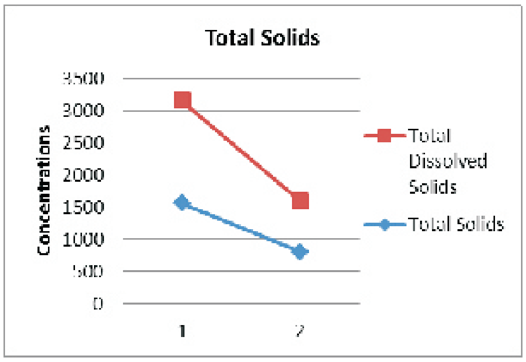

Fig.4: Observed Total solids of samples.

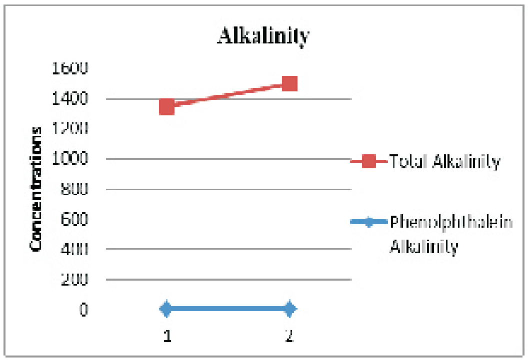

Fig.5: Variations in Alkalinity content.

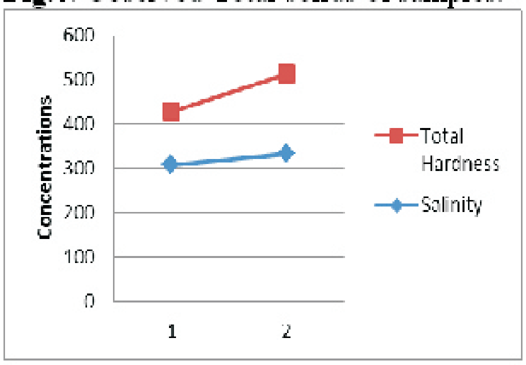

Fig.6: Observed Total Hardness & Salinity.

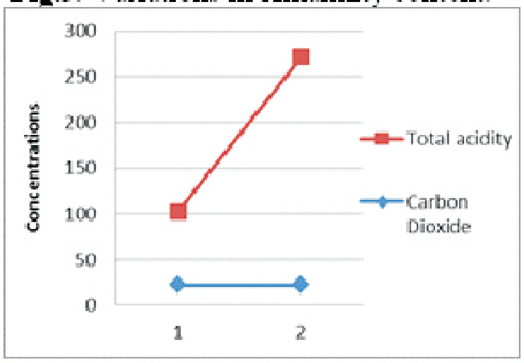

Fig.7: Conc of CO_2 & Total acidity.

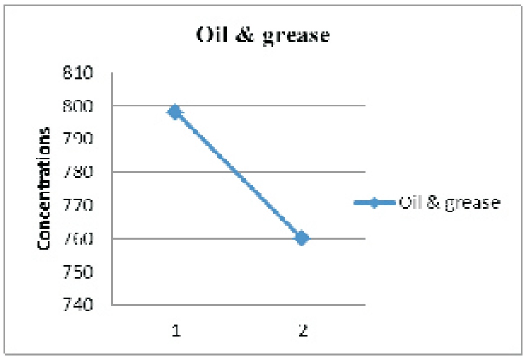

Fig.8: Cons of Oil & grease in sample.

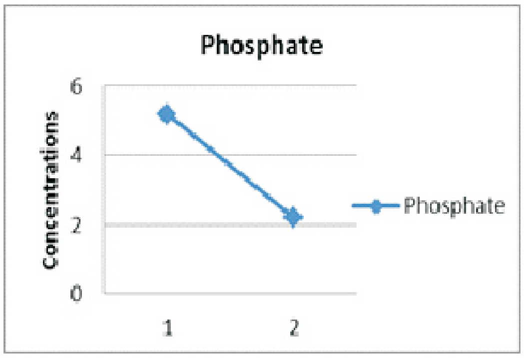

Fig.9: Variations in phosphate content.

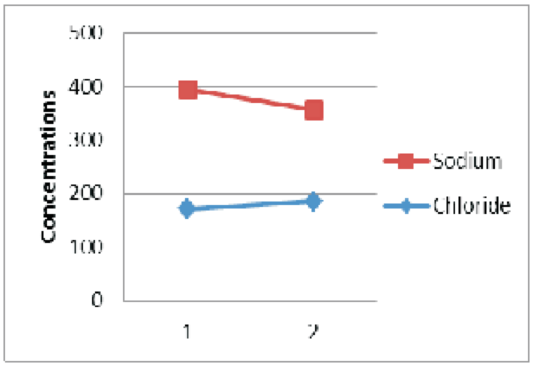

Fig.10: Cons of Sodium & chloride.

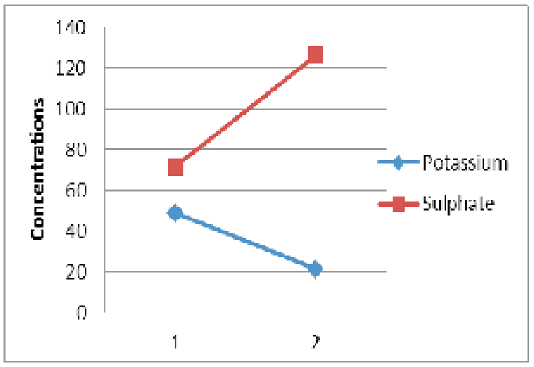

Fig.11: Observed Potassium & Sulphate.

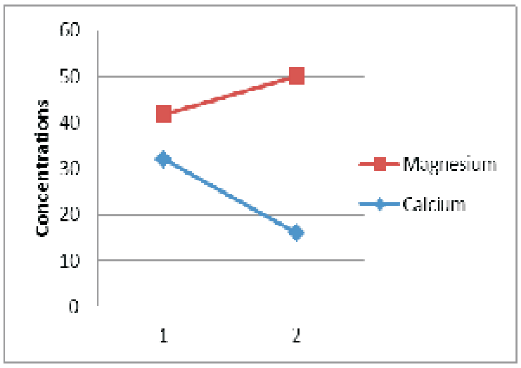

Fig.12: Cons of Calcium & Magnesium.

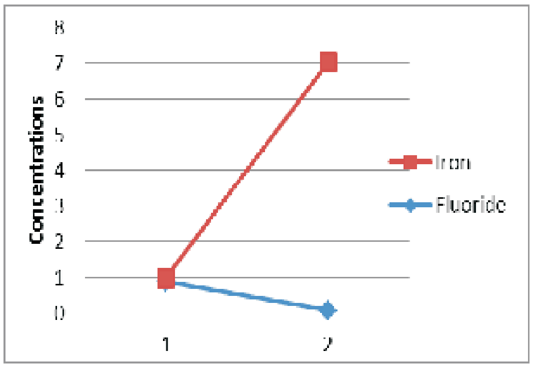

Fig.13: Observed Iron & Fluoride.

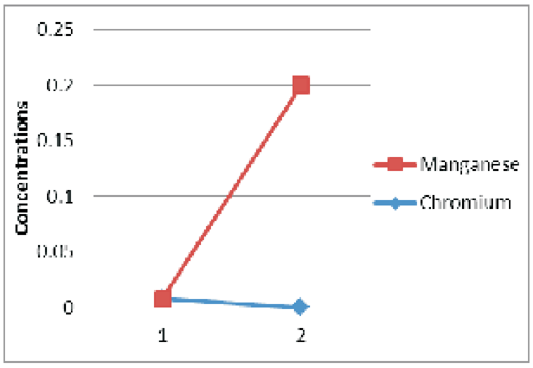

Fig.14: Cons of Manganese & Chromium.

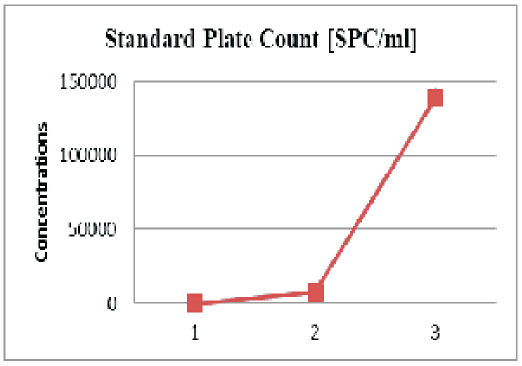

Fig.15: Observed SPC in water samples.

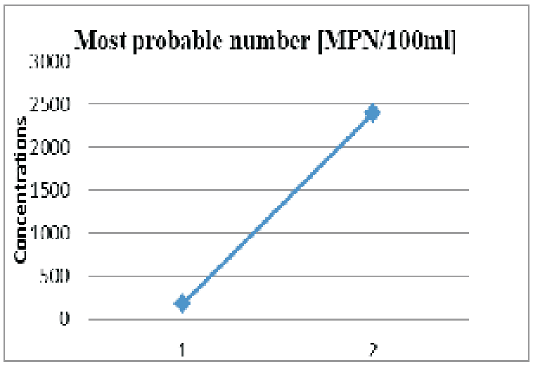

Fig.16: Observed MPN in water samples.

Table 1: Physico-chemical parameters of industrial water samples

Sr.No.	Water Parameters	Premansoon	Mansoon	Postmonsoon	Mean±SD
	Physical parameters				
1.	Total Solids	1560	808	1230	1199.3±376.9
2.	TDS	1590	784	1730	1368± 510.5
3.	EC [uS/cm]	238	220	208	222±15.0
4.	Colour	Blackish	Blackish	Blackish	Blackish
5.	Temperature	23 °C	20°C	30°C	24.3 ±5.1
	Chemical parameters				
6.	P^H	8.79	6.99	8.10	7.96±0.9
7.	Carbon Dioxide	22	22	18	20.6±2.3
8.	Total Hardness	120	180	200	166.6±41.63
9.	Phenolphthalein Alkalinity	BDL	BDL	BDL	BDL
10.	Total Alkalinity	1350	1500	1430	1426.6±75.0
11.	Salinity	307.6	333.2	310.1	316.9±14.1
12.	Total acidity	80	250	300	210 ±115.3
13.	Oil & grease	798	760	810	789.3± 26.1
	Ionic parameters				
14.	Chloride	170.4	184.6	210	188.3 ±20.06
15.	Phosphate	5.2	2.19	4.62	4.0±1.59
16.	Sulphate	71.4	126.3	80	92.56 ±29.52
17.	Calcium	32.06	16.03	40.23	29.44± 12.3
18.	Magnesium	9.74	34.11	35.12	26.32 ±14.37
19.	Sodium	223.9	172.1	225.1	207.0±30.2
20.	Potassium	48.7	21.2	35.1	35 ±13.75
21.	Fluoride	0.89	0.085	0.29	0.42±0.41
22.	Iron	0.086	6.95	7.01	4.682 ±3.98
23.	Chromium	0.008	BDL	BDL	0.002±0.0046
24.	Manganese	BDL	0.2	BDL	0.06±0.11
	Biological parameters				
25.	Standard plate count	7637.5 SPC/ml	138872 SPC/ml	101872 SPC/ml	82793.8 ± 67665.4
26.	Most probable number	186MPN/100 ml	2400MPN/100ml	460MPN/100 ml	1015.3 ±1206.9

Except Electrical conductivity, pH, colour, SPC and MPN all the parameters are expressed as mg/Lit.
Limits for industrial effluent discharged into inland surface waters.

Conclusions

Farmers in India and many other countries consider wastewater a valuable resource because of its high productivity and profitability. The reality is that farmers will take health risks and will use wastewater when there is an opportunity for direct economic benefits. In cities like Nanded where water is scarce, poor farmers use untreated wastewater. And as industrial pollution is limited, there is scope for improvement in the use of water and nutrients to further optimize the economic benefits of wastewater use. Wastewater farmers have an abundance of water and nutrients and therefore, apply them in excessive amounts. At the same time adequate measures should be put in place to control variuos infections in populations exposed to wastewater. While treatment of wastewater before use would reduce health risks. The communities of wastewater farmers in small towns. Using untreated urban wastewater is undesirable and even unacceptable to many, but it is a reality for many poor farmers who are unlikely to benefit from wastewater treatment facilities any time soon. This study suggests that it is possible to further increase benefits of urban wastewater. Such things requires a new look at wastewater irrigation practices and entails the need to devise realistic methods for maximizing benefits and reducing risks under the prevailing social and economic conditions.

On the basis of above discussion it is concluded that the effluent discharged from oil and cattle feed industry except oil and grease all values prescribed by the Standards of Environmental Protection Act and Ministry of Environment Forest, New Delhi. Therefore, it should take little attention towards here before to disposal in the environment. In order to find common ground and to use knowledge to change perceptions and behaviour, farmers and scientists need to work together. Without its proper management, wastewater use poses serious health and environmental risks.

Recommendations For Implementation

Recommended practices might have to undergo adjustments to keep efforts low and outputs high. These may not necessarily be the most effective measures in reducing health risks but are probably more sustainable. Policies and decisions on wastewater use in agriculture should generally be motivated locally, as the socioeconomic, health and environmental conditions which vary across countries will dictate how far common recommendations are applicable. The following general recommendations are nevertheless made to guide decisions, based on the findings of this study.

1.Prevent pollution rather than treating symptoms of pollution.
2.Use the precautionary principle.
3.Pertaining to Regulation, Risk Reduction and Safe Use of Wastewater
4.Cleaner Production: This principle used by industry
5.Apply the polluter-pays-principle.
6.Apply realistic standards and regulations.
7.Balance economic and regulatory instruments.
8.Apply water pollution control at the lowest appropriate level.
9.Establish mechanisms for cross-sectoral integration.
10.Give open access to information on water pollution.
11.Promote international co-operation on water pollution control.
12.Crop Selection: Some crops are more prone to contamination from pathogens than others.

Further studies are required to address other smallholder irrigation systems and crops to develop new measures.

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