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Physico-Chemical Parameters of Municipal Sewage Water of Various Municipalities in Kadapa District, Andhra Pradesh

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ABSTRACT

"Municipal solid waste" is a term commonly used to describe the waste generated within a municipality. One of the significant contributors to municipal waste is sewage water, which originates from various sources such as domestic, industrial, and rainfall. The presence of sewage water can have adverse effects on the environment, impacting water quality, soil health, and air quality. In a recent study, we collected sewage water samples from three municipalities located in the Kadapa district. These samples were then analyzed to assess various physico-chemical parameters of the sewage water. Parameters examined included color, turbidity, pH levels, electrical conductivity, total dissolved solids (TDS), total alkalinity, hardness, and the presence of specific chemical and toxic substances such as calcium (Ca), magnesium (Mg), chlorine (Cl), fluorine (F), nitrate (NO3), and sulfate (SO4). The results of our analysis revealed that, across all the water samples tested, the total alkalinity values exceeded the permissible limits set for such parameters. However, the values for the remaining parameters fell within acceptable limits. When comparing the sewage water quality among the three municipalities under study, it was observed that Yerraguntla municipality had higher physico-chemical parameter values in its sewage water compared to Proddatur and Kadapa.

Keywords: Municipal waste, sewage water, Kadapa district, Physico-chemical parameters.

INTRODUCTION

With the global urban population on the rise, urban areas are witnessing a surge in the consumption of goods and services. This increase in population, coupled with rising living standards and rapid technological advancements, has led to a substantial growth in the quantity and diversity of solid waste generated. Municipal solid waste originates from a wide range of sources including private households, hotels, offices, stores, educational institutions, industries, construction sites, commercial establishments, and other institutions. Traditionally, the disposal of municipal solid waste has been carried out through methods that are relatively simple, convenient, cost-effective, and technologically less advanced. This typically involves the use of dumps, junkyards, sewage canals, and designated disposal areas. However, due to the continuous expansion of urban populations and economic activities, solid waste management has become a pressing issue for nearly all municipalities. The improper handling of municipal solid waste has significant repercussions on the environment, leading to pollution of water, soil, and air. One of the primary contributors to municipal waste is sewage. Sewage, in particular, is a major source of pollution. It encompasses various types of wastewater, with domestic wastewater being the predominant component. Sewage water contains a multitude of chemical and toxic substances, making it a significant environmental concern. Sewage typically consists of:

a) Domestic wastewater, originating from sources such as bathrooms, toilets, kitchens, and more.
b) Industrial wastewater, which may be either untreated or treated, and is discharged into the sewerage system. Sometimes, it contains harmful chemicals.
c) Rainwater and urban runoff, which can also contribute to sewage composition.

The flow rate and composition of sewage can vary significantly from one location to another, influenced by factors like economic conditions, societal behavior, the presence and nature of industries in the area, climate conditions, water consumption patterns, and the type of sewerage system in place. The primary pollutants found in sewage include suspended solids, soluble organic compounds, and potentially harmful microorganisms, including fecal pathogens. However, sewage is not limited to human waste and water; it also contains an array of chemicals such as heavy metals, trace elements, detergents, solvents, pesticides, and even unconventional substances like pharmaceuticals, antibiotics, and hormones. Additionally, urban runoff can introduce potentially toxic compounds like oil from vehicles and

pesticides into the sewage system, which may eventually find their way into water bodies, further emphasizing the need for proper sewage management.

CLASSIFICATION OF SEWAGE

Domestic or Sanitary Sewage:
Domestic sewage refers to the liquid waste generated from everyday activities in residential, commercial, or institutional buildings. It includes wastewater from toilets, bathrooms, kitchen sinks, wash basins, and the like. This type of sewage tends to have a strong and unpleasant odor due to the presence of human waste.

Industrial Sewage or Wastewater:
Industrial sewage comprises liquid waste produced during industrial processes in various sectors such as dyeing, papermaking, brewing, and others. The quality of industrial sewage varies widely depending on the specific industry and the chemicals used in their production processes. At times, industrial sewage can be highly noxious and may require extensive treatment before it can be safely discharged into public sewer systems.

Storm Sewage:
Storm sewage refers to water runoff that results from rainfall, snowmelt, or snowfall and is discharged from surfaces like roads, roofs, and pavements. This type of sewage is primarily a result of natural precipitation events

MATERIALS AND METHODS

Study Area:
This study was conducted in the Kadapa district of Andhra Pradesh, India. We collected sewage water samples from three municipalities within the Kadapa district i.e., from Proddatur, Yerraguntla, and Kadapa. **(Fig-2).**

Samples collected:
The sewage water samples has been collected in bottles from various places of these 3 municipalities, taken to the laboratory and water quality analysis were performed according to the standard methods (APHA, 1995).

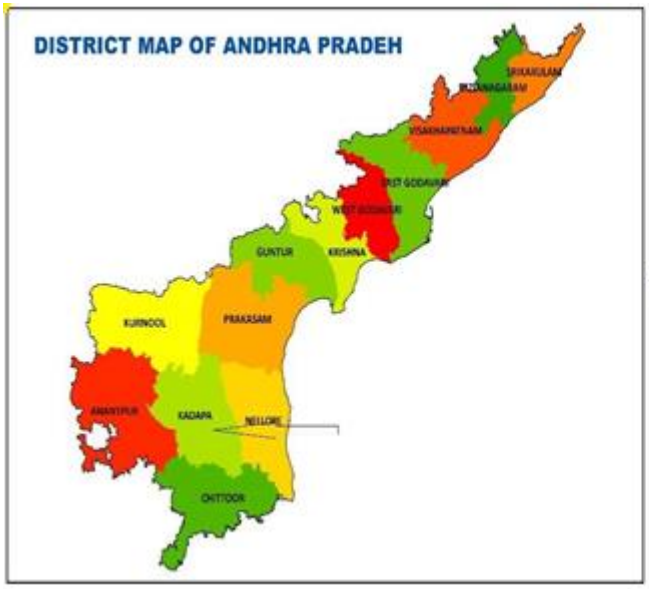


Fig-1

Fig-2

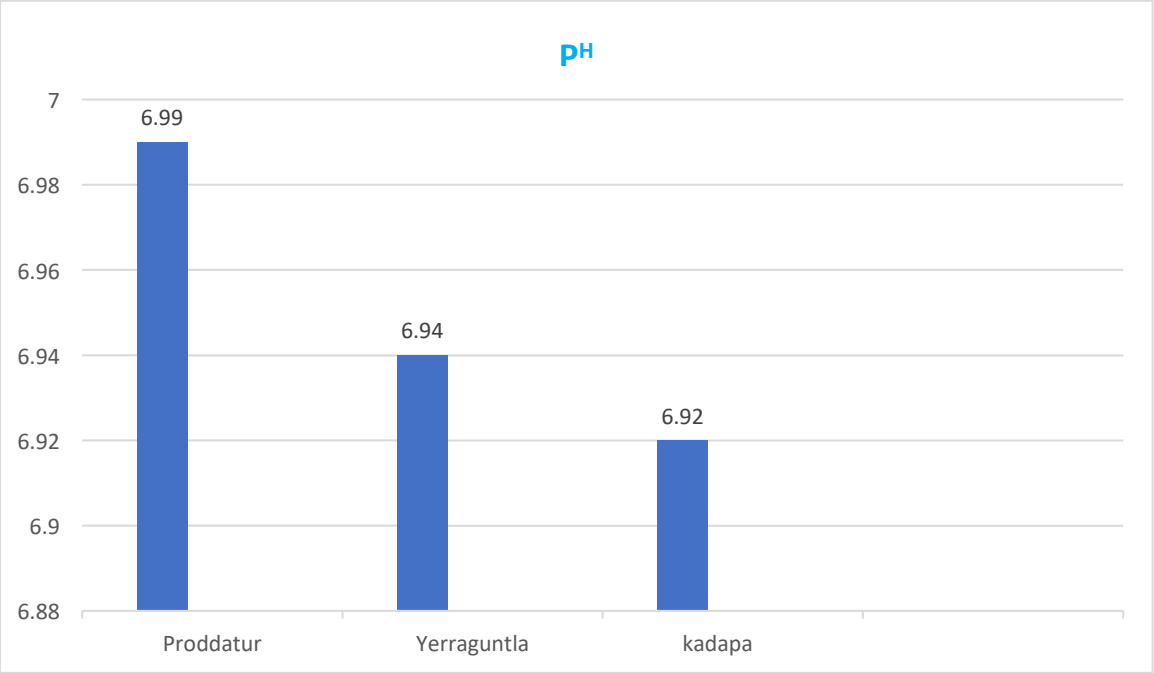
S.No	Parameters	Methods Followed
1.	Colour	Visual Method
2.	Turbidity	NTU Method
3.	pH	Instrument Method
4.	Electrical Conductivity	Instrument Method

5.	**TDS**	**Instrument Method**
6.	**Total Alkalinity**	**Titrimetric Method**
7.	**Total Hardness**	**Titrimetric Method**
8.	**Cacium mg/l**	**Titrimetric Method**
9.	**Magnesium mg/l**	**Titrimetric Method**
10.	**Chloride mg/l**	**Titrimetric Method**
11	**Flouride mg/l**	**Ion selective Method**
12	**Nitrate**	**Instrument Method-Spectrophometric**
13.	**Sulphate**	**Instrument Method- Spectrophometric**

RESULT:

Standard methods were used for the analysis of physico-chemical water quality parameters.

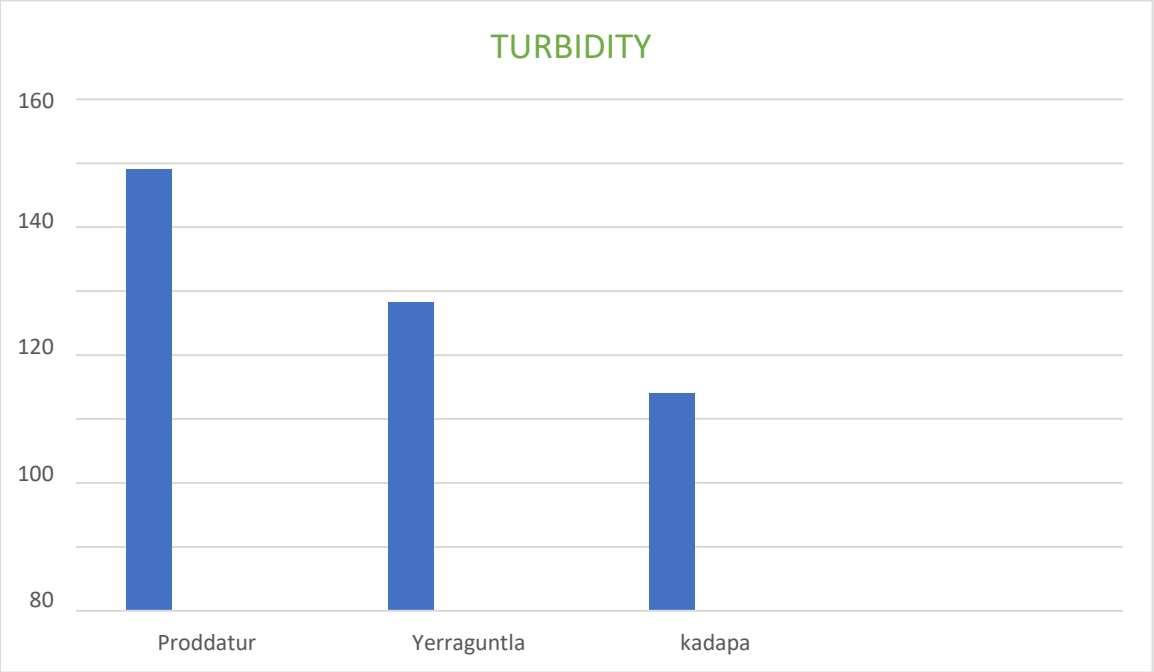
P^H: Proper chemical treatment of water, including disinfection, requires control of pH. The pH values obtained are within the WHO standards of 6.5to 8.5. pH has no direct adverse effect on health [Haile Reda A., 2016].The P^H values obtained are within the limited range 6.92-6.99.In this three municipalities Proddatur sewage water has high P^H values when compared to Yerraguntla and Kadapa sewage water.



Turbidity:

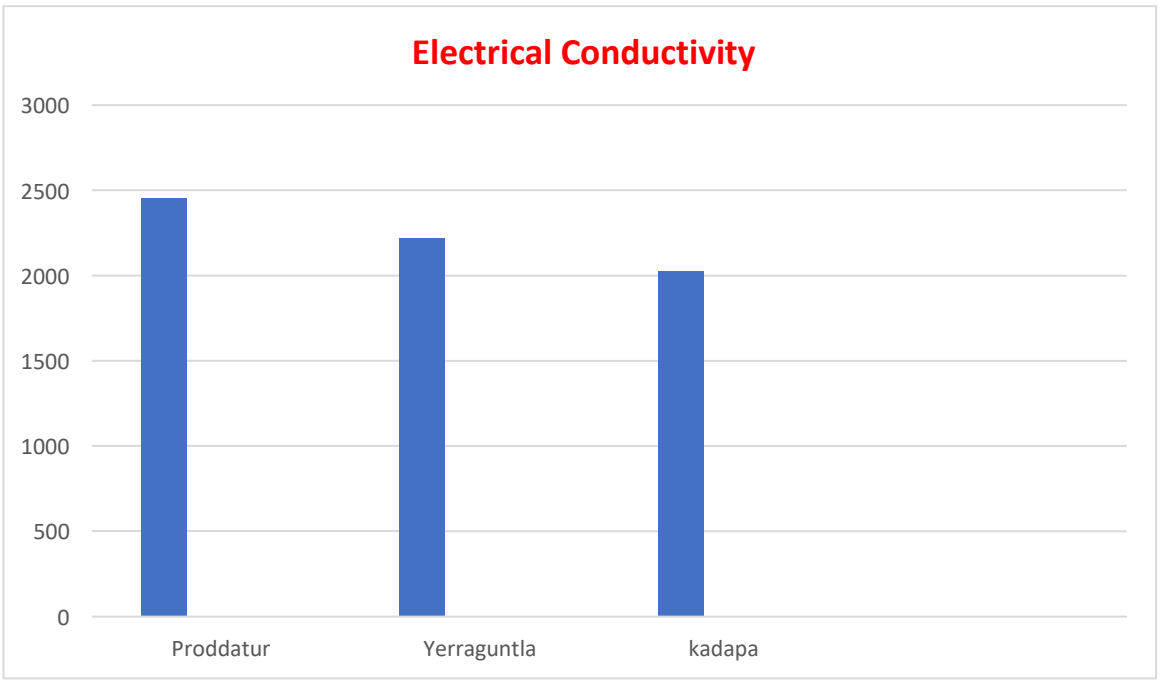
Turbidity values are very high for three of these municipalities sewage water. Even they are very high than the permissible limits. The turbidity value for Yerraguntla municipality sewage water is 138.1,and it is very high when compared to other two municipalities sewage water.

Proddatur municipality sewage water turbidity value is 96.4 and when compared to both of these municipalities the turbidity values of Kadapa sewage water is low i.e., 68.2.



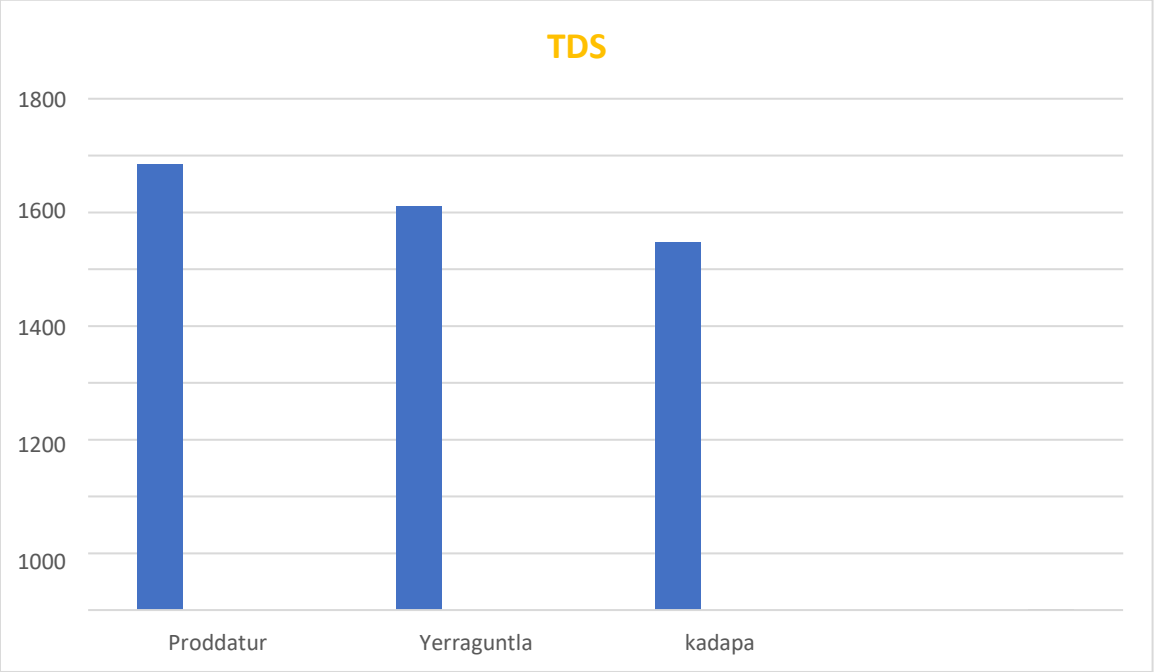
Electrical Conductivity:

The Permissible limits for Electrical Conductivity of water is 2500.Here for this three municipalities of sewage water the electrical conductivity value is within the permissible range. Electrical conductivity value for Proddatur municipality sewage water is 2455 and 2223 is EC value of Yerraguntla sewage water when compared to both municipalities Kadapa ECvalue is 2024.



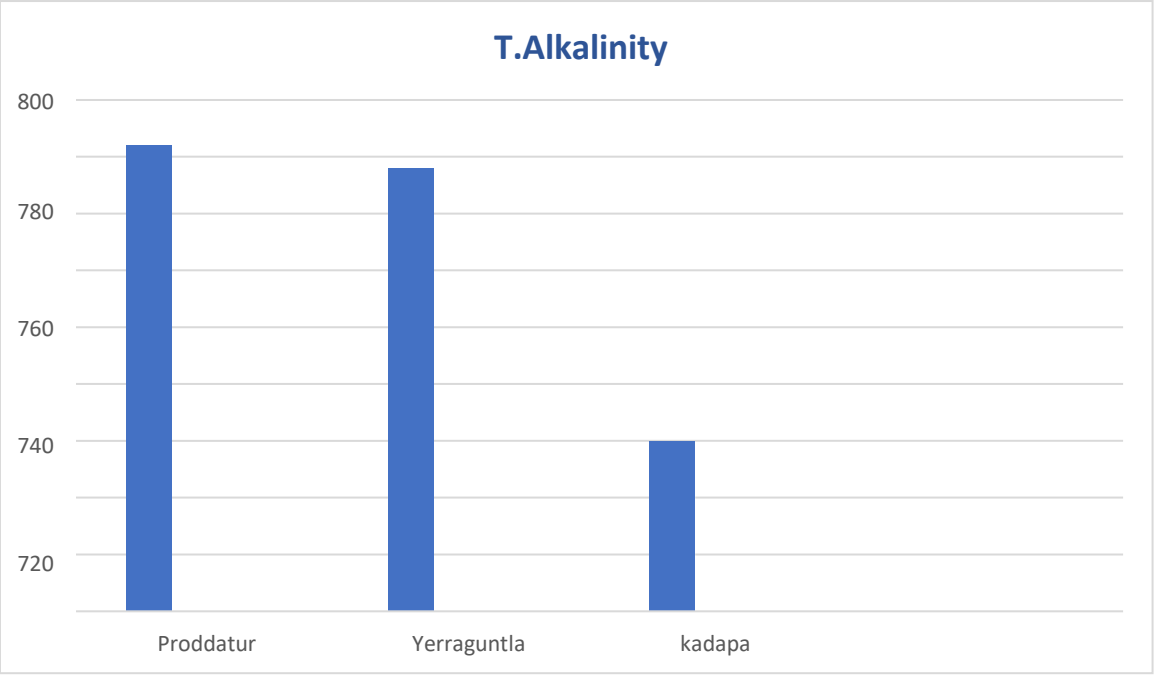
TDS:

The TDS value for Proddatur municipality sewage water is 1571 and for yerrraguntla is 1423.When compared to both Kadapa is low i.e., 1295. Although the three municipalities sewage water TDS value is within the permissible range.



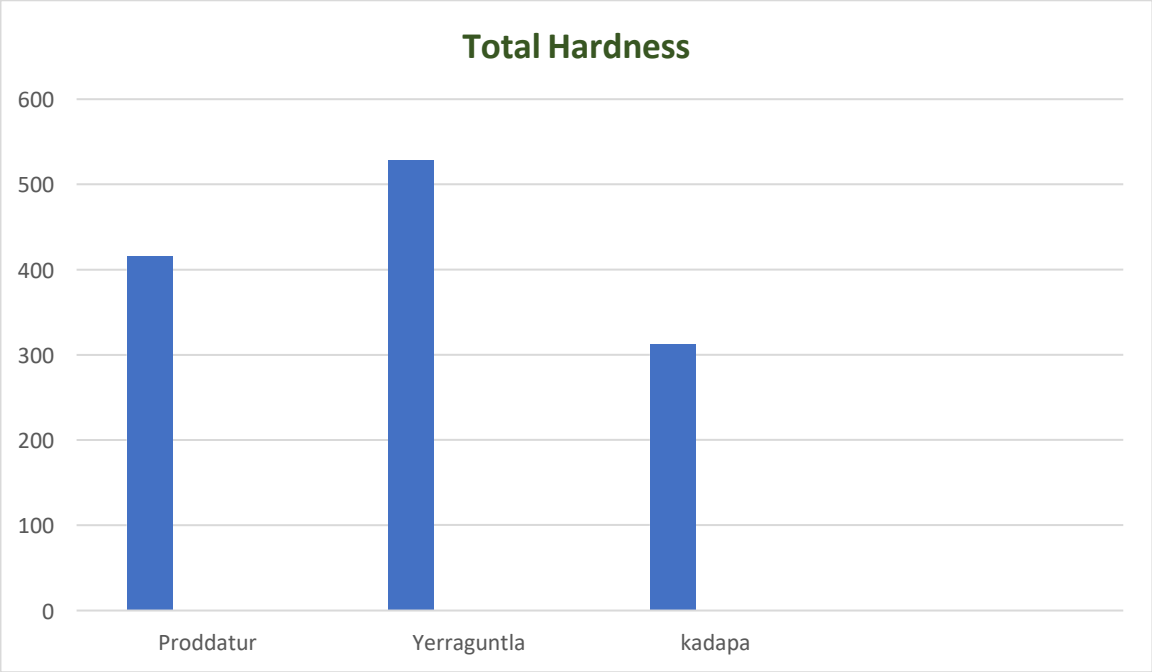
T. Alkalinity:

T. Alkalinity is very high for the three municipalities sewage water, it is above the permissible limits. For Proddatur municipalality sewage water the T. Alkalinity value is 784, 776 is the T.Alkalinity for Yerraguntla sewage water. Finally the T. Alkalinity of Kadapa municipality sewage water is 680 it is very low when compared other two municipalities.



Total Hardness:

Total Hardness is within the limit for these three municipalities. The total hardness value for the Proddatur municipal sewage water is 416 and for Yerraguntla is 528 it is very high than two other municipalities and finally Kadapa is 312 it is very low when compared to other two municipalities.



Chemical & Toxic Substances:

Calcium:
The calcium values for these three municipal sewage water is within the permissible range. For Proddatur municipal sewage water it is 83, 109 is the Yerraguntla municipality sewage water value and finally Kadapa has less value than other two municipalities i.e., 64. In thisthree municipal sewage water Yerraguntla sewage water has high calcium values.

Magnesium:
Magnesium values are also within the permissible range for this municipal sewage water. The magnesium range for Proddatur municipal sewage water is 49, and 62 for yerraguntla municipal and magnesium levels of Kadapa municipal sewage water is 37. For this three yerraguntla municipal sewage water has high magnesium levels.

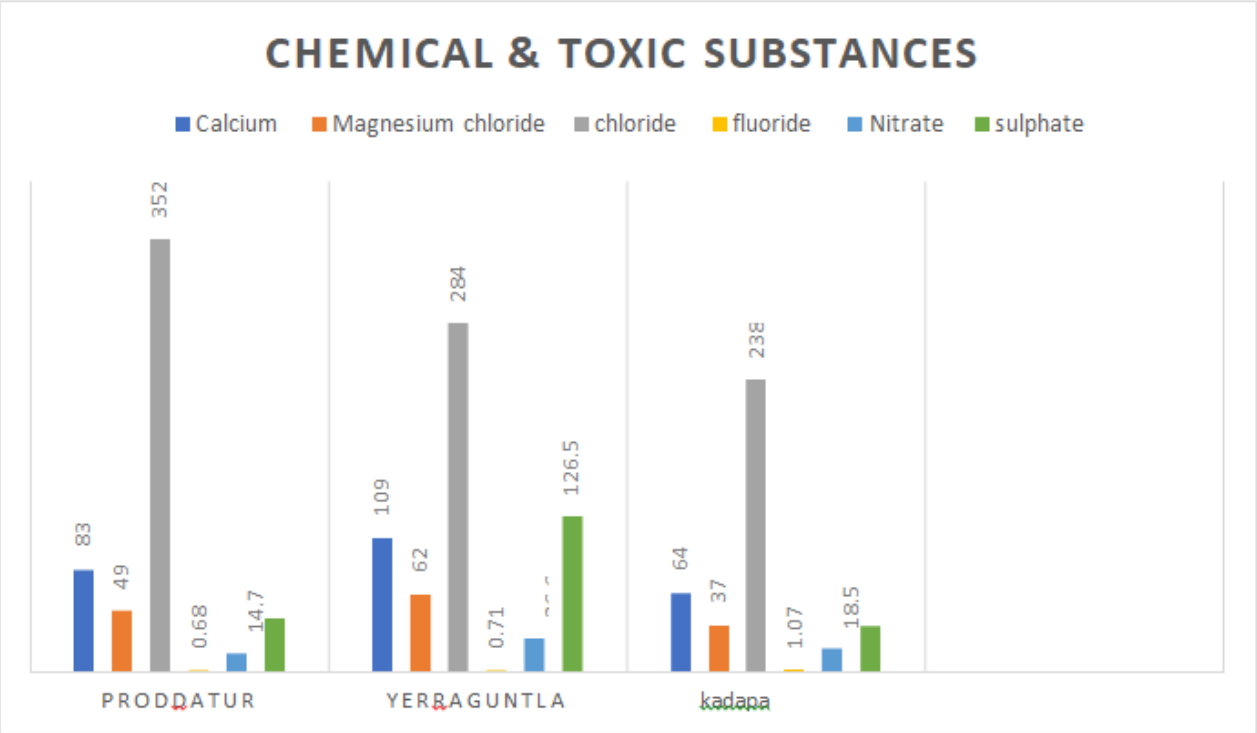
Chloride:
Chloride values for Proddatur municipal sewage water is 352, and Yerraguntla has 284 and last Kadapa has 238.Of this three Proddatur municipal sewage water has high chloride values.

Fluoride:
Here in this three municipal sewage the fluoride values for Proddatur and Yerraguntla is belowthe acceptable range i.e., Proddatur has 0.68 and for yerraguntla it is 0.71.In Kadapa the fluoride levels of municipal sewage water is 1.07 it is in permissible range.

Nitrate:
For nitrate the acceptable value is 45.0, there is no permissible range. For these three municipalities the nitrate values are within the acceptable range. The nitrate levels for Proddatur municipal sewage water is 14.7 Yerraguntla it is 26.6 and for Kadapa it is 18.5.

Sulphate:

For sulphate the acceptable value is 200, there is no permissible range. For these three municipalities the sulphate values are within the acceptable range. The sulphate levels for Proddatur municipal sewage water is 43.5, Yerraguntla it is 126.5 and for Kadapa it is 36.7.



BIS:10500-2012 Permissible Limits	colour	Turbidity	PH	Electrical conductivity	Total dissolved solids	T. Alkalinity	Total Hardness	calcium	Magnesium	Chloride	fluoride	Nitrate	Sulphate	Phosphate
BIS:10500-2012 Permissible Limits														
Requirement (Acceptable limit)		1.0	6.5		500	200	200	75	30	200	1.0	45.0	200	0.1
Permissible limits in the absence of alternate source		5.0	8.5		2000	600	600	200	100	1000	1.5	100	400	1.0
Location														

Yerraguntla		**138.1**	**6.94**	**2223**	**1423**	**776**	**528**	**109**	**62**	**284**	**0.71**	**26.6**	**126.5**	**0.51**
Proddatur		**96.4**	**6.99**	**2455**	**1571**	**784**	**416**	**83**	**49**	**352**	**0.68**	**14.7**	**43.5**	**0.62**
kadapa		**68.2**	**6.92**	**2024**	**1295**	**680**	**312**	**64**	**37**	**238**	**1.07**	**18.5**	**36.7**	**0.59**

CONCLUSION

The Present study shows the detailed Physico-Chemical Parameters of sewage water in 3 municipalities of Kadapa district i.e., Proddatur, Yerraguntla and Kadapa. The current investigation indicates that all the parameters are within the permissible range except (Total alkalinity) as per the standards proposed by WHO(1993) and BIS(2012).In this study the sample is the sewage water and all the parameters are within the permissible range it indicates that there is no effect on environment .

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