Research Paper

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Waste Water Treatment Techniques With Special Reference to Kota City

Engineering

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Dr. K. M. Sharma	HOD Chemistry, Career Point University, KOTA
Ms. Pooja Nama	HOD Civil, Career Point University, KOTA
Mridul Jain	B.Tech Civil III year, Career Point University, KOTA
Rajat Srivastava	B.Tech Civil III year, Career Point University, KOTA

ABSTRACT

Currently, In India the scenario of sewage water generation is more than 38,254 (approx) million litres per day. It is estimated that less than 30% of waste water is recollected which is then undergo through the treatment before disposed into freshwater bodies or the sea so we need to develop sewage treatment plants with low power consumption and extra effective techniques to handle complex wastes. The subject wastewater treatment is broad as well as laid focus upon the possibilities of using sludge or wastewater as a fertilizer or in irrigation process. Our water resources are degraded by the sewage discharged from cities and towns and it cause water pollution. Most of the river basins and ground water beds in India and elsewhere are come to extinct and experiencing severe water shortages. Current and future demand for fresh water could be met by enhancing water use efficiently and properly managed its demand. In this paper, we discuss about waste water treatment techniques and new technological changes by taking Kota as a model.

INTRODUCTION

Kota is an important industrial hub of Rajasthan located on the banks of Chambal River. Major part of the city is located on right bank consisting of the old city area and the Railway station. The area of the left bank has developed around the development of the various industries in the 50s and 60s when factories like Sri Ram fertilisers, J. K. Synthetics came up. The last two decades have seen a phenomenal development of education coaching centres for various engineering, medical entrance examination.

The location of the city on the banks of the River Chambal with the barrage constructed on it within the city area makes access to reliable and easy availability of water. This has given it the distinction of being one of the very few cities in India having 24 hour water supply on taps. This in turn creates a good quality of sewage which finds its way to River Chambal.

This problem has been attracting attention due to the unhygienic conditions it creates in the city and also the pollution it creates in the river. Earlier in the 80s an effort was made to prevent pollution of the river by constructing sewage through 1000 mm diameter outfall sewer leading to the proposed site of the sewage treatment plant at Kanswa nalah. Few sewers were also laid in a small segment of the city near the station area. In the years 2003-04 STP finalised at the Dhakar Kheri for the city on the right bank. 20 MLD Sewage Treatment Plant constructed with 5 pumping stations. This benefited only 8.34 % of the total population of year 2001.

The city has 60 ward and a population of 10, 01,365 as per the 2011 census out which 32 (30 on right bank and 2 on left bank) wards covering a population of 2, 31,270 (2, 02,650 on right bank and 28,620 on left bank) i.e. 32.89% of population drains directly towards the River. This includes both the banks of River. These areas have been proposed to be covered under the NRCP Project.

Some researchers already worked on related topics of sewage treatment such as Turbidity and chlorine demand reduction using locally available physical water clarification mechanisms before household chlorination in developing countries done by [Nadine Kotlarz et Al. 2009]. Appropriate wastewater treatment systems for developing countries: criteria and indictor assessment in Thailand done by [W. Singhirunnusorn and M. K. Stenstrom 2009]. A new paradigm for low-cost urban water supplies and sanitation in developing countries by [Duncan Mara and Graham Alabaster 2008]. Use of modelling for optimization and upgrade of a tropical wastewater treatment plant in a developing country by [D. Brdjanovic et Al. 2007]. Ceramic membranes for direct river water treatment applying coagulation and microfiltration by [A. Loi-Brügger et Al. 2006]. [Wisaam S. Al-Rekabi et Al 2007] gave various methods of improvement in waste water treatment techniques. [Prashant A. Kadu, el Al 2013] had given Treatment of Municipal Wastewater by using Rotating Biological Contractors (RBC).

SEWAGE TREATMENT PLANT

Basically, there are three stages of waste water treatment:

PARAMETERS ADOPTED FOR DESIGN

a) Sewage treatment
b) Sludge Manure
c) Bio-gas

Generally, sampling of nalah water exhibits lower values since the sewage flow in open drain settles down organic matter which constitute to BOD flow in open drain settles down organic matter which constitute to BOD/COD/SS. Further the sample collected from the bottom of nalah would exhibit higher values.

TREATMENT CONSIDERATION

If we construct a sewage treatment plant, the following alternatives for waste water treatment have been considered for evaluation:-

1. Waste stabilisation pond
2. Aerated lagoon with maturing pond
3. Activated sludge process
4. Extended aeration
5. High rate trickling filters
6. Sewage for agro forestry
7. USAB up flow anaerobic sludge blanket followed by aerated lagoon
8. SBR (Sequential batch reactor)

In evaluation of different treatment process the main factors to be considered as:-

a) Overall costs both capital as well as recurring expenses.

b) Capability of the plant to give desired performance.
c) Requirement of energy.
d) Availability of land for construction.
e) Ease of operation.
f) Man power requirement, skilled & unskilled.
g) Bearing on local conditions such as climate, final mode of disposal.

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LOCATION OF STP

The sewage treatment plants in Kota city are proposed to be constructed under Chambal action plan are:-

a) Sewage treatment plant on the right bank of river Chambal near Dusshera ground.
b) Sewage treatment plant near Balitha.

GENERAL TOPOGRAPHY

The area proposed to be covered is which flows directly into the River Chambal both upstream of barrage and downstream of the barrage.

PROJECT NEED

There are 26 drains that drain directly into the city. They carry the sewage and the rain water also when it rains, into the river. It is important to provide sewerage system to the entire catchment of these drains so as to prevent entry of the sewage into the river. An analysis is given for a sample collected in May 2014 upstream end of the city near Tilam Sangh before the city pollution enters and at the two places inside city. The quality deteriorates after passing through the city. As per the data collected recently at two point one up stream of bridge varies as below:

Parameter	Upstream of city	Akelgarh	Railway Bridge
pH	8.6	7.8-8.4	7.6-8.6
Turbidity	Nil	1 NTU	15 NTU
DO	6.2	5.9-8.0	6.5
BOD	Nil	2.5-2.6	3.8-5.4
COD	5.5	11.5-40	12.29-16

Table 1: classification of parameters at different drains

*NTU – Nephelometric Turbidity Unit

*DO – Dissolved Oxygen

*BOD – Biological Oxygen Demand

*COD – Chemical Oxygen Demand

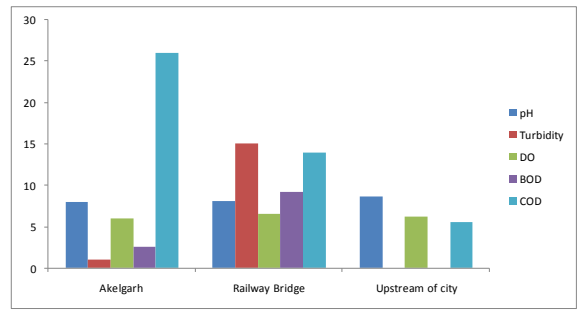

Figure- 1: Graph showing the quality deterioration after passing through the city

It is therefore an immediately necessity to provide sewerage in this catchment to prevent pollution of the river and also to improve environment in general for the city.

POPULATION PROJECTIONS

According to census 2001, the population was 6, 94,316 and in 2011 the population was 10, 01365 while it is expected in 2021 it should be approximate to 14,00,000.

COVERAGE IN DIFFERENT PROJECTS

The areas covered in different projects undertaken for providing sewerage Kota City is as below:

Project	Wards covered	Population 2001	Population 2041 (Expected)	%age Population
Already covered area and under commissioning	15,19,20,21, 22,23,24,25&26	58,683	1,01,378	8.34%
Proposed in NRCP	Left Bank 2,27 Right bank3,4,26(part),28,29,30, 31,32,33(part),34,35, 36,37,39,40	2,31,270	5,12,108	32.89%
Remaining core area of city to be covered on priority	12,11,33(part),44, 45,47,48,49(part),55(part), 60(part)4,5,6,7(part),37, 38,39.40(part),41,42, 46(part),59(part),	2,59,504	7,31,042	36.91

Table 3: Areas covered under different projects

*NRCP-National River Conservation Plan (India)

The areas where the work has been completed covers 8.34%of population as per the 2001 census, the NRCP project proposed will cover 32.89% of population and the remaining core area to be covered has 36.91% of population bringing the total coverage to about 78.14% population and the balance 21.86% which is still scattered will have to be covered in the other programme from time to time.

EXISTING SEWERAGE:

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A sewerage scheme has been first constructed and commissioned in the year 1982 covering part of area of the city on the right bank on downstream of barrage. It covers civil lines, Kherli and Nayapura area drawing away from the barrage. The outfall diameter ranged between 1000-1400 mm. The STP site is about 5 km from outskirts of the town STP of 20 MLD capacity has been commissioned.

RESULT & DISCUSION:
There are different processes for sewage treatment we use generally, such as:

1. Pre-treatment: It removes the large solids that are carried in with the wastewater. The screen removes large floating objects. Screens are generally placed in a chamber or channel and inclined towards the flow of the wastewater. The inclined screen allows debris to be caught on the upstream surface of the screen, and allows access for manual or mechanical cleaning.

2. Primary Treatment: It involves basic processes to remove suspended solid waste and reduce its biochemical oxygen demand (BOD). It removes organic and inorganic solids by the physical processes of sedimentation and flotation.

3. Secondary Treatment: It uses biological processes to catch the dissolved organic matter missed in primary treatment. The sludge is further treated in sludge digesters.

4. Tertiary Treatment: It is used for disinfection to reduce pathogens, which are micro-organisms which can pose a risk to human health. For disinfection, mainly chlorine is used. It can remove more than 99 percent of all the impurities from sewage, producing an effluent of almost drinking water quality.

Common water treatment techniques are-
a) Ultra filtration
b)Microfiltration
c)Chemical/Biological
d) Membrane / Biological / Membrane
e) Membrane / Membrane (UF/RO or UF/NF)

The problem in these common water treatment techniques are:

In Chemical treatment:
a) Inflexible on various wastes
b) requires skilled Operator
c) Creates salts within the process
In Membrane filtration technique:
a) Membrane sensitive to fouling.
b) Salts and metals pass through membrane.
In biological treatment:
a) Not every chemical is readily biodegradable.
b) Industry is moving toward bio-stable chemistries.

RECENTLY USING METHODS:
1) **Advance photo oxidation process (APOP):** APOP is a new concept for advanced photo oxidation process at waste water treatment plants by using the APOP concept a non hazardous effluent from waste water treatment plants can be achieved. The principle in the system is that light from ultraviolet lamps is able to destroy mechanism inside bacteria and remove chemical substances from waste water with use of chloride dioxide.

2) **Mechanical Vapour recompres**

sion: In this process there are total four steps: a)Distillation b) Mechanical compression of the Distillate c) Recovery of the Heat into the Boiling Zone d) Condensing of the Vapour

3) **Rotating Biological Contractor (RBC):** This is a mechanical secondary treatment system which is capable of removing organic load. In this method rotating disk develop growth and micro-organism present in the sewage which breakdown organic pollutants but for this oxygen and food is necessary for their growth. The design of RBC is such that a parallel, deformed disc mounted perpendicularly on a shaft that is slowly rotated in a tank through which the waste water is passed. Oxygen get from the atmosphere as the disc rotates. As the micro-organic grow they form a media until they are removed due to shear forces provided by the rotating disc. Effluent from RBC is then passed through final clarifier where micro-organism settle down as sludge which is removed time to time. The whole process is depends upon oxygen mass transfer rate and temperature. However, the speed of the disc is also important.

NEW TECHNOLOGIES:
1) **Membrane Filtration:** Micro and ultra filtration membranes provide best pre-treatment to remove variety of contaminates. After treatment with membrane bioreactor high quality effluent is obtained which can be treated by RO and UV and we got non-potable water which is useful for industrial purpose.

2) **Automatic Variable Filtration (AVF) Technology:** In AVF technology upward flow of influent is cleaned by downward flow of filter media during the treatment process filter media is cleaned by the filtered influent so no requirement for additional filter media for cleaning of water. This method is best for refining secondary waste water for reuse. AVF technology comprises sensors, pre programmable logic controllers for automatic operation. The key factor for this method is easy operation and maintenance and low power consumption.

3) **New urban sanitation Technology:** In urban sanitation technology, our main aim is treatment of waste water by reusing energy and minerals by the combination of two process electro flocculation and anaerobic digestion. In electro flocculation, we separate organic pollutant from waste water with electro coagulation (ECF rector). Organic sludge of the ECF rector is sediment in a circular sedimentation vessel, sludge (organic compound) which then fed to anaerobic reactor gets converted biogas which can be converted into energy for captive utilization.

CONCLUSION:
In developing countries like India, due to lack of treatment of waste water the problem arises. Water pollution issues dominate public concerns about national water quality and maintaining healthy ecosystems. Our main challenge is to find low-cost newer technology, user friendly methods, which can avoid threatening and protect degradation of our valuable natural resources. Past approaches for water pollution control must be modified. Because of available water resources continuously getting deteriorated amendments must be done by using new developing techniques of waste water treatments. In this paper, we tried to explain the techniques for waste water treatment we are using now and which can be added with these techniques.

FUTURE SCOPE:
Pollution of water and their reutilization is a big issue as the demand of water is increasing day by day so this is a good topic for research in present study we recommend various water treatment techniques using worldwide for waste water in our next step we are planning a small project for sewage treatment and after this we recommend techniques which will suite for small and medium town cities on basis of various factors.

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REFERENCE

[1] A. Loi-Brugger, S. Panglisch, P. Buchta, K. Hattori, H. Yonekawa, Y. Tomita and R. Gimbel (2006) Water Science & Technology: Water Supply, 6(4), 89–98. | [2] D. Brdjanovic, M. Mithaiwala, M.S. Moussa, G. Amy and M.C.M. van Loosdrecht (2007) Water Science & Technology, 56(7), 21–31. | [3] Duncan Mara and Graham Alabaster (2008) Water Policy, 10(2), 119–129. | [4] Nadine Kotlarz, Daniele Lantagne, Kelsey Preston and Kristen Jellison (2009) Journal of Water and Health, 7(3), 497–506. | [5] Prashant A.Kadu1, Amruta A. Badge, Dr.Y. R. M. Rao (2013) American Journal of | Engineering Research, 2(4), 127-132. | [6] Wisaam S. Al-Rekabi1, He Qiang and Wei Wu Qiang (2007) Pakistan Journal of Nutrition, 6 (2), 104-110. | [7] W. Singhirunnusorn and M. K. Stenstrom (2009) Water Science & Technology, 59(9), 1873–1884.