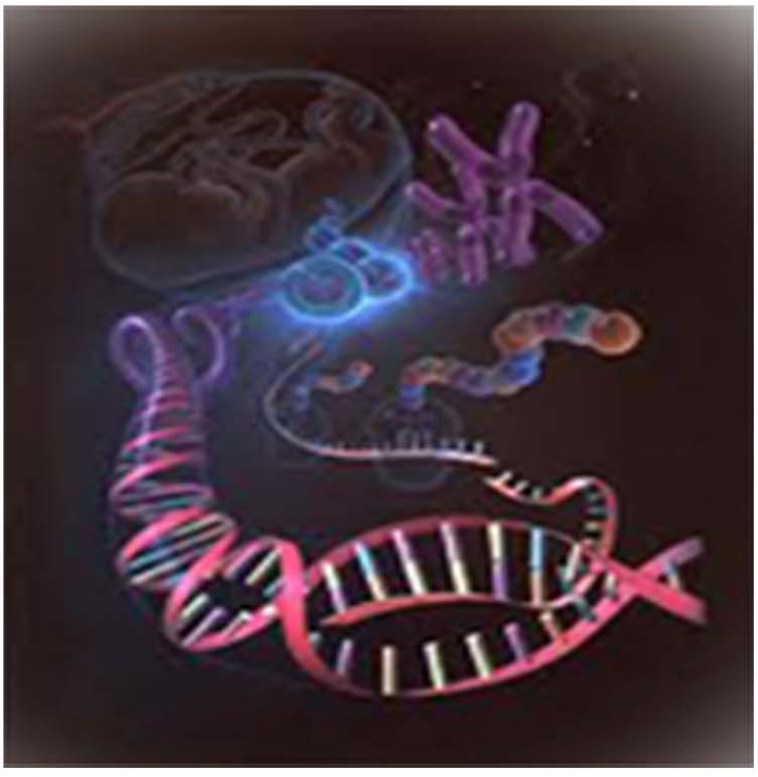
IJLBPR

ISSN 2250 - 3137
Vo1. 2, No. 1, January 2013

# International Journal of

## Life Sciences Biotechnology and Pharma Research



International Journal of Life Sciences Biotechnology and Pharma Research
Hyderabad, INDIA

www.ijlbpr.com

Email : editorijlbpr@gmail.com or editor@ijlbpr.com

International Journal of Life Sciences Biotechnology and Pharma Research

*ISSN 2250-3137 www.ijlbpr.com*
*Vol. 2, No. 1, January 2013*


*Research Paper*

# WASTEWATER MANAGEMENT - CONTEMPORARY POSITION AND STRATEGIES FOR THE EXPECTATIONS

**A Babu[1], I Joseph A Jerald[1], Sathish Kumar S[2*] and Saravanan P[3]**

**Corresponding Author: **Sathish Kumar S,** ✉ svsathishkumar105@yahoo.com*

Wastewater management is a part of community water management which comprises of the sum of all targeted environmental protection measures. In India, the need for proper drainage and disposal of waste water seems to have been felt long before, even in ancient times. In this paper an attempt has been made to evaluate the efficiency of the Sewage Treatment Plant in Panjapur, wastewater characterization, its operational problems and strategies for utilizing the treated wastewater for growing greens, vegetables and for aquaculture. The roles of stakeholders, the partnership building methods among various authorities, and public have been emphasized.

***Keywords:*** Environmental degradation, water pollution, waste water treatment and fish culture

## INTRODUCTION

Water is an important element for all living organisms. Water is so essential that without water human cannot survive. Most of the reactions which occur in the living cells and the non-living environment involve the medium of water. Man uses water for various purposes; it includes drinking, cooking, bathing, washing, heating, air-conditioning, industrial processing, power generation and other recreational purposes (Nanda Kumar, 1998).

Once the water is used, it becomes a waste because of the various impurities mixed with the water, which changes the quality of water (Metcalf and Eddy, 2000). The characteristics of wastewater that result due to the presence of the impurities are listed in Figure 1.

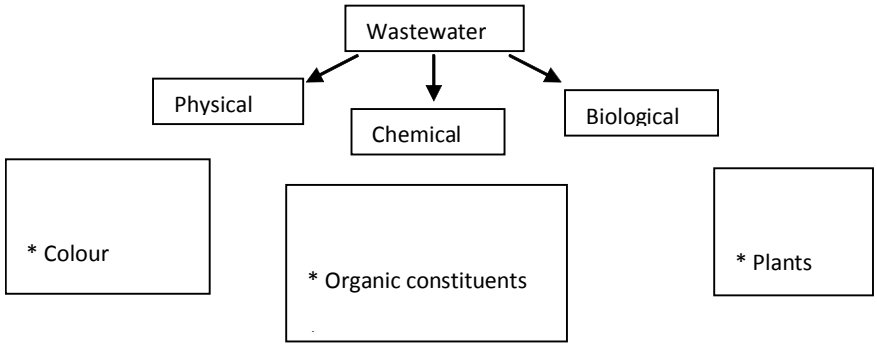
The untreated wastewater, if allowed to accumulate, leads to the production of large qualities of malodorous gases, and also causes diseases through the pathogenic microorganisms. It can stimulate the growth of aquatic plants and also contains toxic compounds. For these reasons, the immediate and nuisance-free removal of wastewater from its sources of generation, followed by treatment and disposal

[1] PG and Research Department of Zoology, Jamal Mohamed College (Autonomous), Tiruchirappalli.

[2] Department of Botany, St. Joseph's College (Autonomous), Tiruchirappalli - 2.

[3] Department of Biotechnology, St. Joseph's College (Autonomous), Tiruchirappalli - 2.

**Figure 1: Characteristics of Waste Water**



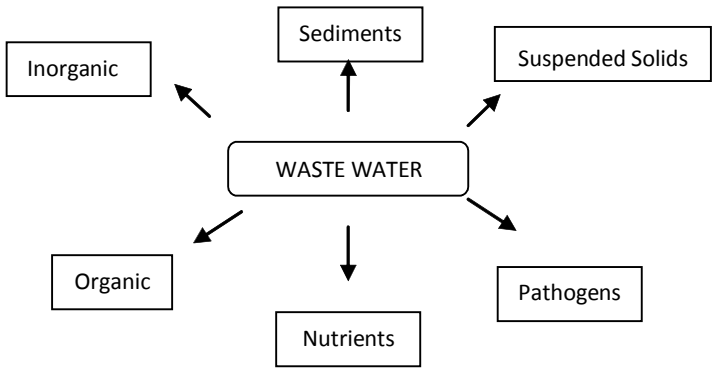

is not desirable but also necessary. The contaminants present in wastewater have been listed in Figure 2.

For the treatment to be effective wastewater must be managed efficiently. Waste water management is a part of community water management, which comprises the sum of all targeted environmental protection measures to supply communities, trade and industry with satisfactory drinking or industrial water as well as the disposal of domestic, commercial and industrial waste water from these areas.

At present all the developed countries have well developed and efficient treatment facilities comprising primary, secondary and advanced treatments. But they are yet to chalk out a reasonable programme for the treatment of wastewater. In India, the need for proper drainage and disposal of sewage seems to have been felt long before that is even in ancient times. In the 18$^{th}$ century the renaissance began and attention began to be paid to sanitary engineering.

The authorities have realized the importance of sanitation and many of the larger cities are therefore now provided with modern methods of sewage treatment. Laws have been passed regarding treatment and disposal of sewage. The Water (prevention and control of pollution) Amendment Act, 1988, stresses the conditions.

**Figure 2: Important Contaminants in Wastewater**



The establishment of wastewater management scheme of small community is highly essential, since wastewater discharges finally disrupts the serenity of the fragile ecosystem. The domestic wastewater has its own effects on human health as well as on the well being of other organisms. Therefore it is essential to study the characteristics of the sewage and propose a suitable sewage treatment plant for small community. Thus wastewater analysis and their treatment have become increasingly important and were worked out by many authors.

The detailed study on the improvement of the quality of the sewage shows that under controlled conditions, almost complete removal of nitrogen and phosphorous from the effluent of the secondary sewage treatment plan can de attained (Vincent M Wutt, 1983). A rapid method which is very effective for the enumeration of E-Coli in sewage and other polluted waters has been suggested (Thomas Koshy and Ganapathy, 1964). The wastewaters of most of the towns in UP, contains nutrients that can support the rich growth of algae (Singh *et al*., 1967). Treating domestic sewage on the principle of anaerobic activated sludge process reduces 83% of COD (Subba Rao *et al*., 1971).

The literature review pertaining to the application of wastewater treatment technologies are available. Strategies for wastewater management have not been proposed so far in a comprehensive manner. Hence, the present work has been undertaken to prepare an appropriate wastewater management strategy.

## OBJECTIVES

- To review the status of wastewater quantity, quality, Collection, transport network, treatment, disposal, recycling and reuse.
- To determine the level of awareness among people on the Drainage Schemes, network connections etc.
- To identify the existing problems in quantitative manner.
- To propose, alternative collection network, strategies for increasing sewer connections, optimal routing etc.

## MATERIALS AND METHODS

1) **Data Collection:** Data was collected from field observations, interviews and questionnaire surveys.
2) **Field observation:** The field observation covered the pumping collection and disposal practice and the potential problems posed by the disposal. Observation were also covered the behaviour and attitudes of the workers in pumping stations.
3) **Interview:** The authorities of corporation and the TWAD board were interviewed on the drainage schemes, their implementations, maintenance and problems faced.
4) **Questionnaire Survey:** It was conducted to judge the awareness level among the public about the drainage schemes, networking connections etc.

## RESULTS AND DISCUSSION

The present study reveals that there are only 3 lagoons occupying 55.83 acres, which is found to be inadequate to handle the current sewage discharge. From the collection point of view, the sewerage system consists of 22000 house connections and pumping main of 3-4 inches and 1100 mm diameter. The total length of pumping

main is 160 km. With reference to population only 45% of houses have been assessed to be suitable to obtain sewer connections. Thus, collection system requires immediate expansion so as to serve a population of 8.25 lakhs.The study also shows that 32 areas in Tiruchirapalli are omitted in the existing sewerage network and an additional length of 90 km of pumping main should be provided.

Wastewater generated from municipalities and communities are ultimately discharged to receiving water bodies or to the land. If the untreated wastewater is allowed to accumulate, the decomposition of the organic materials it contains can lead to the production of large quantities of malodorous gases. In addition, it contains pathogenic or disease causing microorganisms that dwell in human intestinal tract or that may be present in certain industrial waste. Wastewater also contains nutrients, which can stimulate plant growth of aquatic plants, and it may contain toxic compounds (Metcalf and Eddy, 2000). This calls for an immediate and nuisance-free removal of wastewater from its sources of generation, followed by treatment and disposal. The ultimate goal of Wastewater management is the protection of the environment in a manner commensurate with public health, economic, social, and political concerns (Metcalf and Eddy, 2000).

The municipal wastewater disposal comprises the following disposal stages:

1. Wastewater collection
2. Wastewater removal
3. Wastewater treatment
4. Wastewater discharge

The disposal stages mentioned may refer both to sewage and rainwater. The percolating water should also be taken into consideration, which includes ground water that penetrates sewers through leaks or drainage water, which results from ground water lowering and is removed via the drainage network.

In the individual disposal stages the following wastewater processes take place:

### Wastewater Collection:

Collection of wastewater is best achieved by a full sewerage (carriage system/transportation system (Duncan Mara, 1978). Collection of wastewater at source using connections, down and soil pipes as well as by wastewater collection pits, cesspits, latrines etc. (GFMECD, 1995).

## WASTE WATER MANAGEMENT

### Sewerage System in Tiruchirapalli City

The sewerage system in Tiruchirapalli is an underground drainage and sewerage system designed to serve a population of 3.40 lakhs at an intermediate stage (1981) and 4.25 lakhs at ultimate stage (1996).

### Quantity of Sewage

The discharge of sewage is expressed in liters per capita per day (LPCD). It depends on the following four factors:

1. Population
2. Type of area served
3. Rate of water supply
4. Ground water infiltration (Duggal, xxxx)

The year wise particulars of population and total output of sewage was given in Table 1. It shows that there is a fluctuation in the sewage output and population with a marginal increase during the period 1990 – 2000. This may be attributed to

class of consumers having higher economic status, better standard of living etc. Thus the number of inhabitants plays an important role in the generation of sewage, its quantity, quality and the facilities for collection, transport, treatment and disposal (Duncan Mara, 1978).

## Wastewater Removal

The use of conventional gravity flow sewers for the removal and transport of waste water from residences and commercial establishment has, and continues to be, the accepted norm for sewerage practice in most of the places. In Trichy many area the use of gravity flows sewers may not be economically feasible for reasons of topography, high ground water, structurally unstable soils, and rocky conditions. To overcome these difficulties a small-diameter variable-slopes have been developed as alternatives. But as before stated, this type has not covered many parts of city.

## Wastewater Treatment

Wastewater collected from municipalities and communities must ultimately be returned to receiving waters or to the land. The complex question of which contaminant in wastewater must be removed to project the environment and to what extent-must be answered specifically for each case. The answer to this question requires analysis of local conditions and needs, together with the application of scientific knowledge, engineering judgement based on past experienced and consideration of control and state government requirements and regulations.

## Current Status

Methods of treatment in which application of physical forces predominates are known as unit operations, treatment in which the removal of contaminants is brought about by chemical or biological reactions are known as unit processes. Currently the unit operations and processes are grouped together to provide what is known as primary, secondary and advanced (or tertiary) treatment. In primary treatment, physical operations such as screening and sedimentation are used to remove the floating and settleable solids found in wastewater. In secondary treatment, biological and chemical processes were used to remove most of the organic matter. In advanced treatment, additional combination of unit operations and processes are used to remove other constituents, such as nitrogen and phosphorous, that are not reduced significantly by secondary treatment. Land treatment processes, now more commonly termed “natural systems”, combine physical, chemical and biological treatment mechanisms and produced water with quality better than or similar to that from advanced wastewater treatment.

## Sewage Treatment Plant (STP)

Sewage treatment plant is located in Panchapur, which is 12 kms from Trichy city. It is located at an elevation of 76 mtrs. Panchapur is the lowest part of Trichy having a drop of 5mtr from Kambarasampettai water works. Padugai settlement and part of Koraiyar bound Panchapur on the east of McAdam’s chemicals and part of Koraiyar on the north. Kuttimalai quarries and Saranathan college of Engineering on the West. Melapanchapur and Kelapanchapur village on the south. The siting of STP is in accordance with the design criteria (Metcalf and Eddy, 2000). The total area of STP is 574 acres, the treatment units include screening, grit removal, intermediate aeration pond and stabilization pond. Currently, the treatment units are constructed in 90 acres area.

| Table 1: Population and Total Sewage Output | | |
|---|---|---|
| Year | Population (in lakhs) for Which drainage service available | Sewage ($m^3$) |
| 1981 | 3.40 | 39,100 |
| 1996 | 4.25 | 48,900 |
| 1997 | 4.90 | 56,350 |
| 2000 | 5.40 | 62,100 |

| Table 2: Present and Future Population Projection | | | | |
|---|---|---|---|---|
| S. No. | Method | Year | | |
| | | 2000 | 2010 | 2020 |
| 1. | Arithmetical method | 733696 | 875151 | 976607 |
| 2. | Geometrical method | 805384 | 936257 | 1152356 |
| 3. | Incremental increase method | 792319 | 925381 | 1072759 |

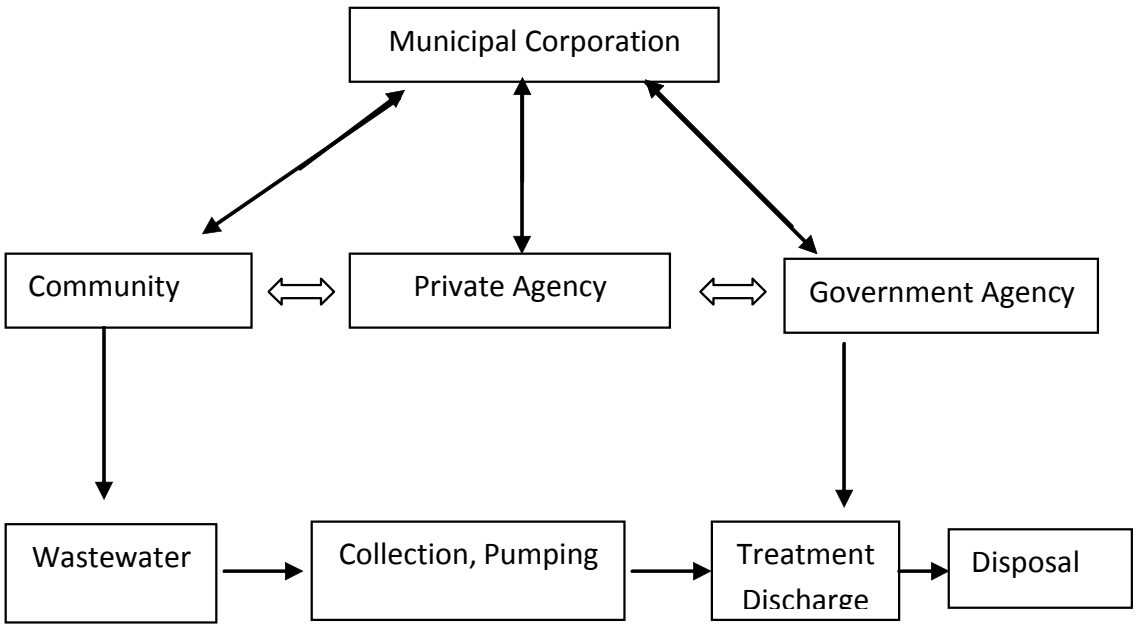
## Waste Water Discharge

Waste water discharge is the return of treated wastewater to natural water cycle. The most common means of treated wastewater disposal is by discharge and dilution into pond, streams, rivers, lakes, etc. For many years, the discharge was accomplished by an open pipe or canal. Mixing was accomplished variably depending up on the natural characteristics of the receiving water.

An important aspect of wastewater discharge is the assimilative capacity of the receiving water, often representing the organic matter that could be discharged without excessively taxing the dissolved oxygen resources. The wastewater after treatment was supposed to be reused for agriculture (growing fruit bearing trees, fodder crops, fuel wood) and aquaculture if found feasible (TWAD, 1998).

The field observations shows that, the treated sewage from the lagoon flows through a narrow canal and reaches the Koraiyar river after traveling a distance of 900mtrs at a flow rate of 0.07$m^3$/sec. The point of sewage outfall is covered by Typha angustata, a common reed. Before mixing with the receiving body the treated wastewater is accumulated in a milli watershed between lagoons and the Koraiyar causing a public nuisance. Hence, discharge of treated wastewater into the Koraiyar River should be stopped and it should be reused for agriculture. The evaluation of existing wastewater management practices are done by identifying the broader groups, [viz the generators or the communities, agencies responsible for collection and pumping, treatment and discharge and the overall administrative body], their specific role in wastewater management, work, duties accomplished so as to meet goals and objectives of wastewater management. Evaluation of wastewater management in Trichy city was shown in Figure 3.

**Figure 3: Waste Water Management**




## Problems

The existing wastewater management was evaluated and the following problems were identified.

1. Lack of awareness among the public on the existing facility and procedures for obtaining sewer connections.
2. The duties of the private agency were not clearly specified leading to poor collection and transport.
3. As a result of which the sewage received at the treatment plant contain bulk quantities of floating materials and coarse solids. This creates a problem of clogging during transport, an increase in pollution load on the treatment units there by decreasing the efficiency of aerobic pond and facultative stabilization pond.
4. The reasons for the above problems were found to be lack of administrative coordination among private agency, TWAD, and community.
5. It was also found that these agencies blame one another while failing in their duties.
6. The efficiency of the STP, Panchapur is very poor, only 40% BOD removal is obtained. This is mainly due to quality of the influent, silting of the lagoons, development of anaerobic conditions, lead to the reduction in the efficiency of the plant. The problem could be very well handled by making the agencies realize their responsibilities and try to build partnerships with the public.
7. Poor land use practices and discharge of sewage on to the river system has resulted in public demonstration and appeal calling for appropriate land use and potential reuse of wastewater for agriculture and pisciculture.
8. Reuse of wastewater for agriculture was not

a successful one due to quality of treated wastewater, selection of crop and poor land use pattern.

## RECOMMENDATIONS

- A decentralized local sewerage system (individual sewerage system at each source with wastewater collection pits, cesspits or small sewage works, latrines, etc).
- Safe collection and removal of sewage and rainwater in order to protect against disease.
- Maintenance or improvement of the quality of surface water and groundwater.
- Construction of permanently watertight sewers and repair of leaking sewers, pressure pipes and drains.
- Optimization of drainage works.
- Appropriate and adequate dimensioning of sewers and storage chambers to cope with peak flows (avoidance of flooding of properties, roads and land).
- Suitable routing of sewers and arrangement of outfalls (in combined systems).
- Flow control installations.
- Use of materials, which fully meet the technical and hygiene standards.
- Reuse of wastewater for agriculture and aquaculture i.e., Pisciculture.

## CONCLUSION

Thus the ultimate goal of Wastewater management is the protection of the environment in a manner commensurate with public health, economic, social, and political concerns. For effective management of wastewater, cooperation between various agencies is necessary. This requires people's control over source and a partnership without conflict and knowledge among the stake holder's which will be helpful in reducing the load by saving water and there by minimizing the level of waste water generation.

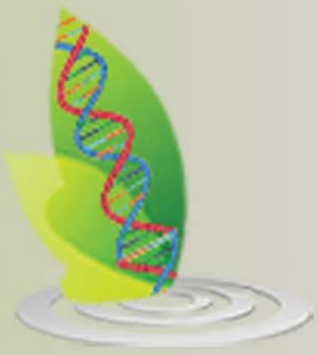
## REFERENCES

1. Duggal K N (1975), Elements of Public Health Engineering, S.Chand & Co.
2. Duncan Mara (1978), *Sewage treatment in Hot Climates*, A Willey, Inter science Publication.
3. GFMECD (1995), *German Federal Ministry for Economic Cooperation & Development, Environmental Handbook – Documentation on Monitoring & Evaluating*. Removal Impacts – Introduction, Cross section Planning Infrastructure, Vol. I.
4. Metcalf and Eddy (2000), *Waste Water Treatment, Disposal and Reuse*, Tata Mc. Graw Hill.
5. Nanda Kumar (1998), "Wastewater Treatment by using Wnd mil Savonious", Rotor M.Sc., Dissertation submitted to Bharathidasan University, Tiruchirappalli.
6. Singh V P, Saxena P N, Tewar A, Lonsane B K, Khan M A and Miss. Arora (1967), "Algal Flora of Sewage of up in Relation to Physico Chemical Variables", *Indian Journal of Environmental Health,* Vol. II.
7. Subba Rao B S V., Ramade and Punjari M V (1971), "Anaerobic Activated Sludge Process", *Ind. J. Environmental Health*., Vol. 12, No. 2, pp. 12-16.

8. Thomas Koshy and Ganapathy (1964), "A Rapid Method of Renumeration of *E.Coli* type I, In the Sewage of Polluted Waters", *Indian Journal of Environmental Health*, Vol. VI.

9. TWAD, Tiruchirappalli Water Works and Drainage, 1998.

10. Vincent M Wutt (1983), "Improvement of Domestic Sewage Effluents", *Indian Journal of Environmental Health,*. Vol. 5.



International Journal of Life Sciences Biotechnology and Pharma Research
Hyderabad, INDIA. Ph: +91-09441351700, 09059645577
E-mail: editorijlbpr@gmail.com or editor@ijlbpr.com
Website: www.ijlbpr.com