EXPERIMENTAL ANALYSIS OF INDUSTRIAL WASTE WATER QUALITY AND TREATMENT FOR THE PURPOSE OF IRRIGATION

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***Abstract*: The aim of our project is to treat the waste water from an industry such as food and sugar industry and reuse the water for agriculture as drip irrigation followed for future agricultural purpose, at the same time water can be treated in physical, chemical, biological treatment methods. Here we use chemical and natural treatment method using waste water. Normal water are used for agriculture but mainly here we use waste water effluent are treated and used as drip irrigation system. It gives more yields for agriculture.**

***Keywords*: Waste water effluent, Water treatment by natural and chemical method, Water quality analysis, Drip irrigation.**

1. INTRODUCTION

Spent or used water with dissolved or suspended solids, discharged from homes, commercial establishments, farms, and industries. Industrial wastewater treatment describes the processes used for treating wastewater that is produced by industries as an undesirable by-product. After treatment, the treated industrial wastewater (or effluent) may be reused or released to a sanitary sewer or to a surface water in the environment. It is treated by chemical and natural method.

Principles of water treatment

- To treat the waste water from sugar & food industry.
- To remove toxicants and pathogen bacteria.
- To Analyze and monitor the water quality.
- To form drip irrigation for agriculture after treating waste water.

2. LITERATURE REVIEW

Gomez et al. (2006) studied the phenol removal in a laboratory scale fluidized bed reactor by immobilized derivatives of soybean peroxide. The effect of different variables on the process is also studied and a model is setup based on the experimental results that shows the behaviour of system in both steady and transient state. He consider the fluidized bed reactor as the plug flow reactor in series with an ideal mixer and obeys a kinetic law based on the observed external mass transfer resistances in order to work out the process rate.

Sokol & korpal et al. (2006) investigated in the inverse fluidized bed bio film reactor (IFBBR) in which polypropylene particles of density 910 kg/m3 were fluidized by an upward co-current flow of gas and liquid. Measurements of chemical oxygen demand (COD) versus residence time t are performed for various ratios of settled bed volume to bioreactor volume (Vb/VR) and air velocities u to determine the optimal operating parameters for a reactor, that is, the values of (Vb/VR), u and t for which the largest reduction in COD occurred. The biomass loading in a reactor depended on the ratio (Vb/VR) and an air velocity u.

Sowmeyan & Swaminathan et al. (2007) worked to evaluate the feasibility of an inverse fluidized bed reactor for the anaerobic digestion of distillery effluent, with a carrier material that allows low energy requirements for fluidization, providing also a good surface for biomass attachment and development. Inverse fluidization particles having specific gravity less than one are carried out in the reactor.

Yurii A.Klyachko was former head of the faculty of analytical chemistry in the All-Russia research and development institute of a food-processing industry.His interest was in scientific researches and development in the field of analysis of a structure both properties of different chemical agents and articles.

In(1972), the AWWA Disposal of Water Treatment Plant Waste Committee published an updated report (AWWA, 1972). It dealt with processing and re-processing in sludge production, i.e., selection and modification of treatment processes, reclamation of lime and alum, recovery of filter backwash water, processing of wastes to recover useful by-products, processing of wastes for disposal, ultimate disposal, and future research.

Nöie et. al., (1992) The primary treatment involves separation of the suspended matter through physical methods such as sedimentation. The secondary treatment uses techniques such as aeration and chemical methods to oxidize the organic matter present in the wastewater. The effluent coming out of the secondary stage carries large amounts of inorganic nitrogen and phosphorus as well as some heavy metals which are ultimately discharged to large water bodies .

Nöie et al. (1992) When the effluent from secondary treatment is discharged directly to the water bodies, it increases the level of nutrients present in water to very high levels as compared to their natural state. It has been shown that effluents from urban, agricultural or industrial sourceshave a total nitrogen concentration up to three orders of magnitude higher than natural levels.

McGriff and McKinney, (1972) The same holds true for total phosphorus. This increased level of nutrients give rise to high growth of phyto-planktons and algae in the water bodies, which is also referred to as eutrophication. US National Academy of Sciences (1969) defined eutrophication as, "..... eutrophication refers to natural or artificial addition of nutrients to bodies of water and to the effects of the added nutrients. When the effects are undesirable, eutrophication may be considered a form of pollution........". The problem with eutrophication lies in the imbalance it creates in the marine and freshwater ecosystems. This imbalance starts with the increased growth of certain species like phyto-planktons and algae in the ecosystem. Ultimate decomposition of algae results in additional oxygen demand, which is stressful for other fauna and flora living in these ecosystems.

Camargo and Alonso, (2006) In freshwater ecosystems nitrogen pollution has been shown to cause the acidification of water bodies and development of primary products which ultimately cause eutrophication and toxic conditions which impair the ability of aquatic animals to survive, grow and reproduce. Drinking of such polluted water has been linked to many health problems in humans.

Paerl and Piehler, (2008) Nitrogen pollution in marine ecosystems has been shown to cause increase in plant production, discoloration, algae blooms and ecosystem-scale oxygen depletion, which can cause the loss of habitats.

3. SOURCES OF WATER SAMPLE

3.1SUGAR INDSTRTY

It is Modified Atmosphere Packaging (MAP), cooling, chilling or freezing applications include bakery goods, fruit and vegetables, poultry, meats, ready meals or anything in-between, Air Products' Freshlines solutions offer you high-purity gases and equipment, international supply capability, and - most importantly - unmatched industry experience and technical support to help you succeed, just about anywhere in the world. Ask Air Products…and expect more. We can help you freeze, chill and crust freeze your bakery products continuously or in batches, and control the temperature of your flour at various parts of the process flow for quality and consistency. The treatment of waste water is an increasingly important issue for food producers. Our offerings include oxygen and other industrial gases provided by a variety of production and supply modes. We also provide a comprehensive suite of innovative, value-added technology solutions to improve the quality of your wastewater stream for discharge or reuse, to increase your treatment capacity, and to reduce the cost and environmental footprint of your treatment process. Ask our experts to introduce you to our complete portfolio of Halia wastewater offerings.

Two forms of solid wastes are normally generated in the manufacture of cane Sugar viz., Bagasse and Press mud. Every 1,000 tons of processed Sugarcane generates about 270 tons of Bagasse. The Sugar industry is faced with the problem of proper and economical disposal of large quantities of Bagasse and Pressmud.

3.2 FOOD INDUSTRY

Wastewater generated from agricultural and food operations has distinctive characteristics that set it apart from common municipal wastewater managed by public or private sewage treatment plants throughout the world: it is biodegradable and non-toxic, but has high concentrations of BOD and suspended solids (SS). The constituents of food and agriculture wastewater are often complex to predict, due to the differences in BOD and pH in effluents from vegetable, fruit, and meat products and due to the seasonal nature of food processing and post-harvesting.Processing of food from raw materials requires large volumes of high grade water. Vegetable washing generates waters with high loads of particulate matter and some dissolved organic matter. It may also contain surfactants.

4. CHARACTERISTICS OF WASTE WATER

WASTE WATER

- PHYSICAL
  - Total solids
  - PH value
  - Colour
  - Temperature
  - Turbidity
  - Odour
- CHEMICAL
  - Inorganic
  - Organic
  - Biochemically Oxygen demand
  - Chemically Oxygen demand
  - Sulphates
  - Chlorides
  - Alkalinity
  - Nitrogen
  - Phosphorus
- BIOLOGICAL
  - Bacteria
  - Protozoa
  - Virus

4.1. TEST ON WASTEWATER EFFLUENTS

4.1.1 PHOSPATE

Phospate content present in sugarcane industry waste water are **3402 ppm** same in food industry contains **2721 ppm**.

4.1.2 NITRATE

Nitrate content in present sugarcane industry waste water are **310 ppm** and in food industry contains **308ppm.**

4.1.3 BOD (BIOCHEMICAL OXYGEN DEMAND)

BOD content present in sugarcane industry waste water are **16000 ppm** and in food industry contains **14000 ppm.**

4.1.4 COD (CHEMICAL OXYGEN DEMAND)

COD content present in sugar industry wastewater are **400 ppm** and in food industry contains **1358 ppm.**

4.1.5 AMMONIA NITROGEN

Ammonia nitrogen content present in sugar industry wastewater are **284 ppm** and in food industry contain **417 ppm.**

4.1.6 SUSPENDED SOLIDS

Suspended solids content present in sugar industry waste water are 6.85 ppm and in food industry contains 1.16 ppm.

4.1.7 CALCIUM

Calcium content present in sugar industry waste water are **105.7 ppm** and in food industry contains **336 ppm.**

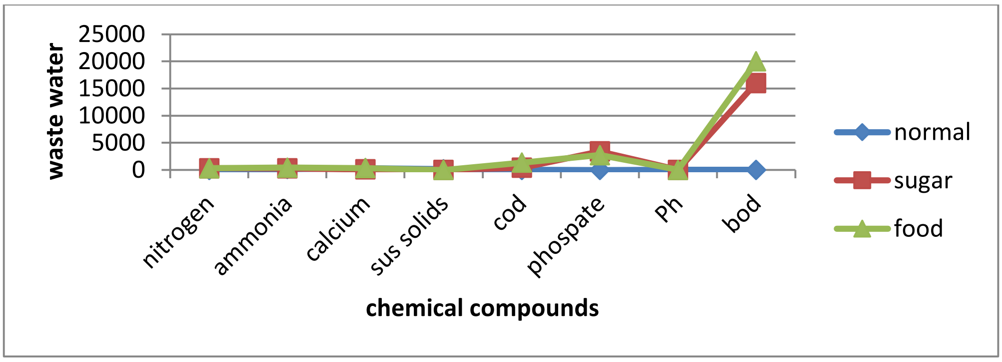
Figure 2-Digital spectrometer

5. WATER QUALITY ANALYSIS

Table 1 WATER QUALITY PARAMETER

CHEMICAL COMPOUNDS	NORMAL WATER (ppm)	WASTE WATER (ppm)	
		SUGAR INDUSTY(ppm)	FOOD INDUSTRY(ppm)
Nitrate	10	310	308
Ammonia	160	284	417
Calcium	135	105	336
Suspended solids	Less than 3	6.85	1.16
COD	5	400	1358
Phosphate	0.005 to 0.05	3402	2721
pH	6 to 8.5	4.23	7.27
BOD	6 to 9	16000	20000

GRAPH 1: COMPARISON CHART OF NORAMAL WATER AND SUGAR AND FOOD INDUSTRY WASTE WATER

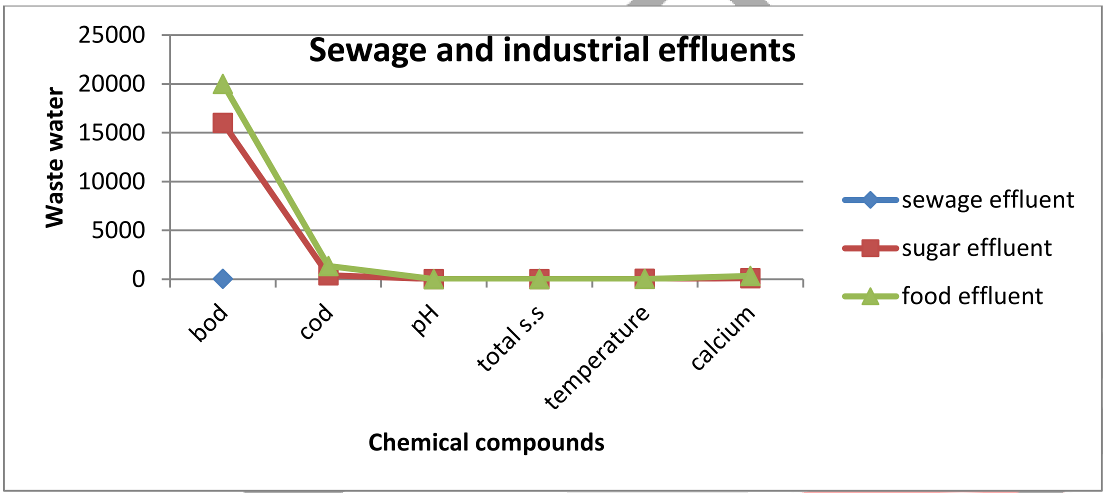


The values in phosphate and bod varies all other values are in similar range.

Table 2-STANDARDS FOR DISCHARGE OF SEWAGE AND INDUSTRIAL EFFLUENTS IN SURFACE

Characteristics of an effluent (ppm)	Limit value of sewage Effluent discharged into ground(ppm)	Sugar Industry effluent (ppm)	Food industry effluent (ppm)
BOD	20	16000	20000
COD		400	1358
pH		8.5	7.27
Total suspended solids	30	6.85	1.16
Temperature		30	28
Calcium		105	336
Ammonia		284	417
Nitrate		310	308
Phospate		3402	2721

GRAPH:2 COMPARISON CHART FOR SEWAGE AND INDUSTRIAL EFFLUENTS

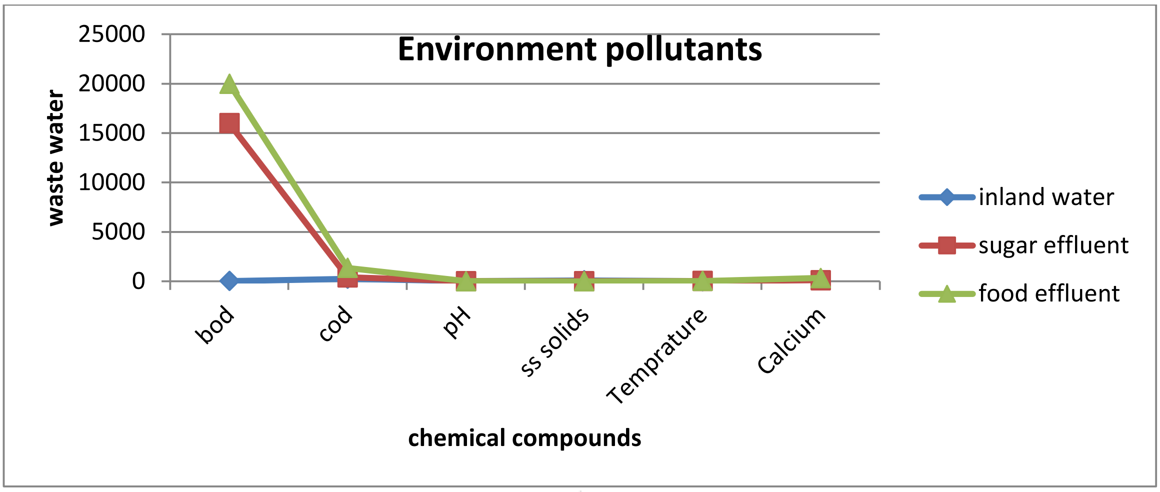


Here the bod values in food and sugar effluent increases comparing to all other values which are harmful.

Table:3 GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENT POLLUTANTS

Characteristics of an effluent (ppm)	Inland surface water (ppm)	Sugar industry effluent (ppm)	Food industry effluent (ppm)
BOD	30	16000	20000
COD	250	400	1358
pH	9	8.5	7.27
Total suspended solids	100	6.85	1.16
Temperature	5	30	28
Calcium		105	336
Ammonia	5	284	417
Nitrate	10	310	308
Phospate	5	3402	2721

GRAPH:3 CHART ON WASTE WATER EFFLUENTS TO LAND IRRIGATION

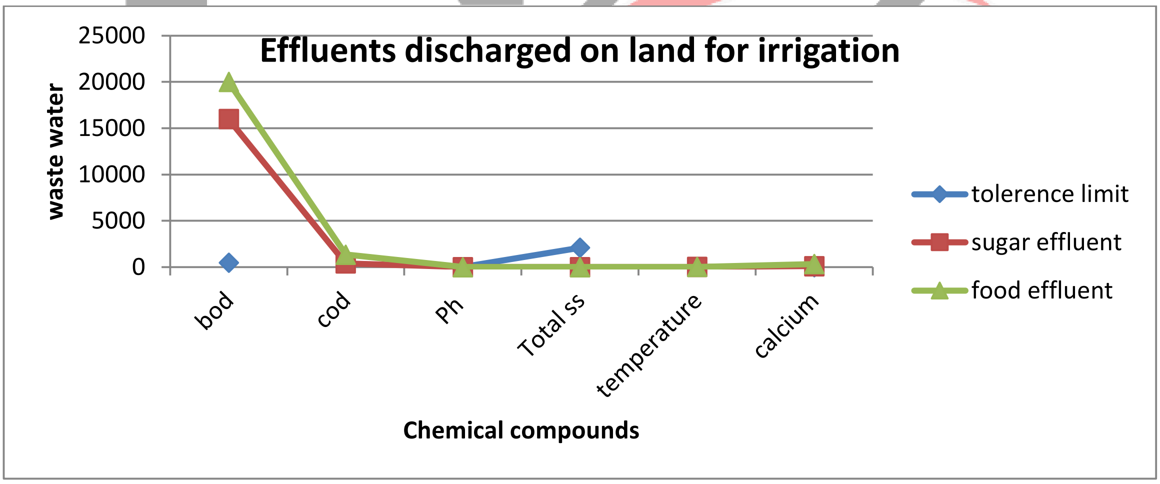


Here the values of bod in sugar and food effluents increases and remaining values ranges same.

TABLE:4 STANDARDS OF WASTE WATER EFFLUENTS TO BE DISCHARGED ON LAND FOR IRRIGATION

Characteristics of an effluent (ppm)	Tolerence limit (ppm)	Sugar industry effluent (ppm)	Food industry effluent (ppm)
BOD	500	16000	20000
COD		400	1358
Ph	9	8.5	7.27
Total suspended solids	2100	6.85	1.16
Temperature		30	30
Calcium	0.06	105	336
Ammonia	0.06	284	417
Nitrate		310	308
Phospate		3402	2721

GRAPH:4 CHART OF MARINE COASTS

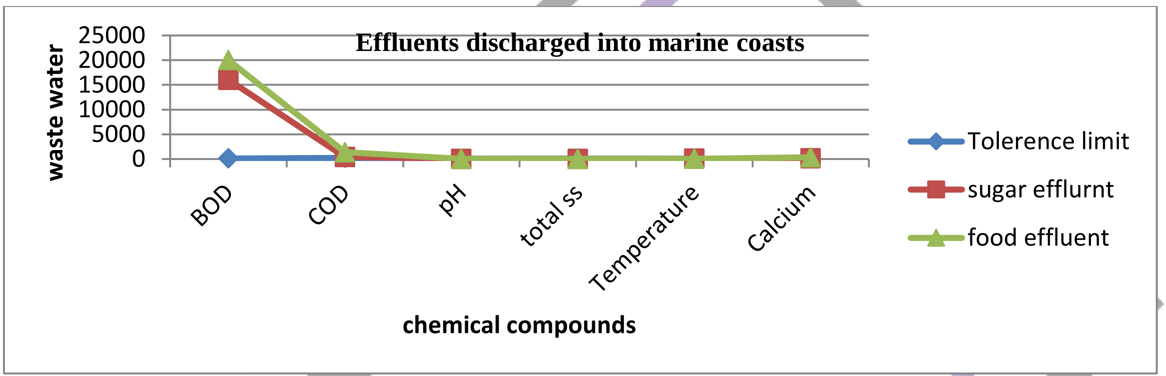


Here the range of effluents exists more when comparing to Tolerence limit.

TABLE 5-STANDARDS FOR WASTE WATER EFFLUENTS TO BE DISCHARGED INTO MARINE COASTS

CHARACTERISTICS	TOLERENCE LIMIT (ppm)	Sugar effluent (ppm)	Food effluent (ppm)
BOD	100	16000	20000
COD	250	400	1358
pH	9	8.5	7.27
Total ss	100	6.85	1.16
Temparature	30	30	28
Calcium		105	336
Ammonia	50	283	417
Nitrate		310	308
Phosphate		3402	2721

Graph-5 Effluents discharged into marine coasts



6. EFFECTS CAUSED IN PLANTS BY INSECTS IN SOIL

Ants are the predator and prey since they eat the eggs of many insects and serves as a food and other beneficial. Their tunnels aerate the soil and allow water and nutrients to flow directly to the plant roots. They also distribute seeds by storing them in their tunnels. Chemicals depends on the type of crops and type of soil which intake for its growth. And more fertilizers are used.

6.1. NATURALLY PURIFICATION OF WASTE WATER

- Sand
- Chlorine
- Coconut fibre
- Peebles
- Carbon filteration
- Charcoal
- Gravel

Figure 2 –Natural purification system

6.2. CHEMICAL METHOS INVOLED ON PURIFICATION OF WASTE WATER

- Primary treatment
- Secondary Treatment
- Tertiary treatment
- Sedimentation
- Coagulation
- Filteration

7. IRRIGATION:

Irrigation refers to the process of supply of waste water through artificial means such as pipes, ditches, sprinklers, etc. The irrigation system helps the farmers to have less dependency on rain-water for the purpose of agriculture.

7.1. DRIP IRRIGATION:

It involves the use of small diameter poly tubing with emitters and is used to apply water to a small area directly to the root zone of a crop. The emitters can be installed into the tubing by hand to water a specific tree or plant. Also used is emitter tubing which has drip emitters installed at the factory on a specific spacing to reduce installation costs. Drip systems can be installed above ground or can be buried to reduce damage to the tubing. Drip tape is a type of drip irrigation which has drip emitters installed in a very thin tube which is shipped flat in coils or rolls. The emitters are spaced from 6 to 12 inches apart. Drip tape is usually used to irrigate vegetable crops and gardens but can be buried to irrigate crops such as cotton or corn.

- Deciding on which system installation is best for farm or field irrigation requires a farmer to consider many different things: water source, budget, crops being grown, watering requirements, setup and convenience, and numerous other factors. When considering the purchase of a new farm irrigation system, it is so helpful to work with a company that provides farm irrigation system supplies and repair services, a company that can help a farmer make the best choices for their individual farm irrigation needs.
- With this type, water is delivered at or near the root zone of plants, drop by drop. This method is the most water efficient of irrigation.

Figure 3 Before growth stage

A low-cost "farm-kit system" with a 1000 litres water tank can service up one-eight of an acre. Simple drip irrigation (in contrary to high tech drip irrigation systems) uses low-cost plastic pipes cut to the appropriate lengths laid on the ground to irrigate vegetables, field crops and orchards. Small holes in the hose allow water to drip.

7.2. IMPORTANCE OF DRIP IRRIGATION

The available water for agriculture is decreasing day by day due to increase in population, industrialization, and short rainfall.

Figure 4 After growth stage

7.3. ADVANTAGES OF DRIP IRRIGATION&. DISADVANTAGES OF DRIP IRRIGATION

ADVANTAGES OF DRIP IRRIGATION

- Increase in production & productivity.
- Improves quality and ensure early maturity of the crops.
- Water Saving up to 40% – 70%.
- Controls weed growth, saving of fertilizer (30%) and labour cost (10%).
- Control diseases.
- Use of saline water is possible if it does not harm the crop.
- Soil erosion is eliminated.
- Suitable for uneven / undulating land.
- High Water Use Efficiency.
- Reduces greenhouse emissions

DISADVANTAGES OF DRIP IRRIGATION

- Expense specially initial cost is high.
- The lifetime of the tubes used in drip irrigation can be shortened by the sun causing wastage.
- May cause clogging if water is not filtered correctly.
- Problems in moisture distribution.
- Salinity problem.
- Germination problem.
- High skills are required.

7.4. REUSE OF INDUSTRIAL WASTE WATER

- agriculture
- landscape
- public parks
- golf course irrigation
- cooling water for power plants and oil refineries
- processing water for mills, plants
- toilet flushing
- dust control,
- artificial lakes
-

CONCLUSION

In wastewater treatment process is one of the most important environmental conservation processes that should be encouraged worldwide. Most wastewater treatment plants treat wastewater from homes and business places. Industrial plant, refineries and manufacturing plants wastewater is usually treated at the onsite facilities. These facilities are designed to ensure that the wastewater is treated before it can be released to the local environment. Some of the water is used for cooling the machines within the plants and treated again. They try to ensure that nothing is lost. It illegal for disposing untreated wastewater into rivers, lakes, oceans or into the environment and if found culpable one can be prosecuted. Drip irrigation has the potential to increase productivity in fruit, vegetable and crops significantly besides conserving resources such as water, fertilizer, power, labour etc as compared to conventional irrigation practices. The economic analysis revealed that drip irrigation was found to be a profitable and efficient technology for fruit, sugarcane and vegetable crops with gain and higher than customer cost of capital. To reduce leaching losses and by maintaining the soil health the technology is proved to be an environment friendly technology. Water is generally used for agriculture, but more preference are not given to waste water and take yield from to these method. Wastewater is treated from industries used as drip irrigation process. It is only suitable at near industry sides where it can be passed easily to the land \ Farm. So water can be stored in a canal formation in underground, treated and then supplied to the land which is very important for our future due to lagging of water at present\Future days.

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