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TREATMENT OF SEWAGE WATER FOR USE IN IRRIGATION

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Abstract: Climate change and the subsequent change in agricultural conditions increase the vulnerability of agricultural water use. Wastewater reuse is a common practice around the globe and is considered as an alternative water resource in a changing agricultural environment. Due to rapid urbanization, indirect wastewater reuse, which is the type of agricultural wastewater reuse that is predominantly practiced, will increase, and this can cause issues of unplanned reuse. Therefore, water quality standards are needed for the safe and sustainable practice of indirect wastewater reuse in agriculture. Reduction of pollutants in the sewage water down to permissible concentrations is necessary for the protection of ground water and the environment. Characteristics of the sewage water generate need to be found out with reference to the following parameters; temperature, pH, Total Dissolved Solids (TDS), Chemical oxygen demand (COD), Biological Oxygen Demand (BOD), and Suspended Solids (SS). Samples are collected from raw sewage water, treated sewage water outlet to evaluate the performance of Aeration and ASP.
Keywords: Irrigation, sewage water, activated sludge process, aeration.

Introduction

Water covers three quarters of the earth's surface; It might appear that there is plenty to go around and that we will never run out of this value able resources. In reality, however, we have a limited amount of usable fresh water. Over 97% of the earth's water is found in the oceans as salt water. 2% of the earth's water is stored as fresh water in glaciers, ice caps and snowy mountain ranges. That leaves only 1% of the earth's water available to us for our daily water supply needs.

The lack of freshwater resources due to population growth and the degradation of water quality is becoming a big challenge for agricultural water. Severe droughts due to climate change and the increase in protected cultivation are making it difficult to provide a stable supply of agricultural water. As an alternative water resource, wastewater reuse for agriculture is gaining international interest. Treated wastewater, which in many ways is ideal for agricultural water, is already being widely used throughout the world, and 10% of the world's population is consuming agricultural products cultivated by wastewater irrigation.

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Disposal of domestic sewage from cities and towns is the biggest source of pollution of water bodies in India. Treatment of domestic sewage and subsequent utilization of treated sewage for a irrigation can prevent pollution of water bodies, reduce the demand for fresh water in irrigation sector and result in huge savings in terms of nutritional value of sewage irrigation.

When using treated wastewater for irrigation, water quality must be strictly controlled considering factors such as the possible accumulation of substances which are harmful for crop growth, the potential damage to soil by the transformation of its physical and chemical characteristics, and microbe infection. Using diluted treated wastewater could somewhat mitigate the side effects but nonetheless cannot prevent it from damaging the commercial value of crops. Thus, the water quality needs to be managed to ensure safe and sound crop production.

Table 1: The Environment (Protection) Rules, 1986 for use in agriculture land treated sewage waste water

PARAMETER	**Standards**
Suspended solids mg/l, Max.	200
pH Value	5.5 to 9.0
Oil and grease mg/l Max.	10
Biochemical Oxygen demand [3 days at 27^{o}C] mg/L max.	100

Materials and Methods

Sewage water collected from S.D. Agricultural University, Sardarkrushinagar, Dist Banaskantha, Gujarat, INDIA. Two different types of treatments were given to sewage water. I) Aeration and II) Activated Sludge Process (ASP).

Aeration

20 litre capacity of tank (water bottle) was used for aeration. A small hole was made at the bottom of the tank, through which rubber pipe was inserted into the tank. Another end of the pipe was connected with mini air compressor for aeration purpose. The rubber pipe and tank were tighten properly with the help of adhesive (m-seal) to prevent the leakages. The rubber pipe inside the tank was perforated for proper air distribution throughout the tank.In this tank 15 litre of raw sewage water was taken for aeration. Aeration was done for 24 hours continuously with air pressure of 0.5 kg/cm^2. It is one of the important unit operations of gas

transfer. Under the process of aeration water is brought in intimate contact with air. While doing so water absorbs oxygen from the air and dissolved gases like CO_2, H_2S gets removed.

Activated Sludge Process (ASP):

Same water tank was used for activated sludge process. 70 gm of fresh cow dung was added to the 15 litres of sewage water for growth of microbes. Aeration was done for 24 hours continuously with air pressure of 0.5 kg/cm^2.

Continuous air supply maintained DO level high for aerobic microbial growth. Dissolved organic matter was consumed by the microbes and it released CO_2 gas.

The waste water inside the activated sludge tank is called mixed liquor and its suspended solid content is known as mixed liquor suspended solids. The volatile suspended solids present in the mixed liquor are known as mixed liquor volatile suspended solids.

Microbes grow in the mixed liquor. The dissolved organic matter is consumed by micro-organisms and their number increases simultaneously the dissolved organic matter reduces. In bio-aerobic degradation of organic matter one of final product is CO_2. Dissolved organic matter is converted to CO_2 and bacterial cells in ASP.

Figure 1. Experimental Set-up

Result

Various parameters like pH, total suspended solids, BOD, COD, oil & grease content, alkalinity, total hardness, total nitrogen were observed during the experiment. All the parameters were observed for raw sewage water and treated sewage water (aeration and activated sludge process). The results obtained during the experiments are shown in table 2.

Table 2. Parameter comparison of raw sewage water, aerated sewage water, ASP sewage water and irrigation standard

Sr No	Parameter	Raw Sewage Water	ASP sewage water	Raw Sewage Water	Aerated Sewage Water	Irrigation Standard
1.	pH	8.29	8.45	8.17	8.95	5.50 – 9.0
2.	BOD, mg/lit	64.31	38.43	84.54	44.72	100
3.	TSS, mg/lit	201.95	273.37	304.77	421.32	200
4.	Oil & Grease, mg/lit	108.19	64.00	134.71	59.22	10
5.	Alkalinity, mg/lit	274.82	223.64	401.00	286.58	-
6.	Conductivity, µmho/cm	10.78	10.06	11.01	9.75	0 to 3000
7.	Total hardness, mg/lit	203.27	129.45	411.00	225.16	-
8.	Calcium Hardness, mg/lit	3.28	2.12	266.25	151.58	0 – 20

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