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Algae and Duckweed Based WastewaterTreatment: An Option

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ABSTRACT

Algae and duckweed based wastewater stabilizations ponds for wastewater treatment was carried out at experimental model. The study hoped to contribute towards improved environmental management through improving the quality of effluent being discharged into natural waterways. This was to be achieved through the development and facilitation of the use of Algae and duckweed based wastewater stabilizations ponds to achieve less consumption of electricity. A model of three pond (sedimentation pond , Algae and duckweed pond) in series of experimental work., the three ponds had the same area (1.8 x 0.6 x 0.08) . Waste water quality information was collected in following chemical, physical and bacteriological parameters included: pH, biological oxygen demand, chemical oxygen demand, Dissolve oxygen . The Algae and duckweed based waste stabilization ponds 80 -90 % successfully for the treatment of wastewater .

Introduction

Rapid population growth and increased urbanisation over the years have led to quantum increase in generation of domestic sewage in India. The amount of sewage generated in most cities and towns of the country has exceeded the capacity of the available treatment systems. The pollutants present in urban wastewater and their concentrations are a function of the degree of urbanisation, water availability, *etc*., that largely comprise, dissolved and suspended solids, microbes and other organic matter. Several natural, innovative and alternate approaches of biological treatment of wastewater have been evaluated over the years for their economical viability, operational ease and system sustainability. Further, aquacultures are known to have high capacity of biological purification of organic waste water suggested recycling systems using Algae and duckweeds based treatment of municipal wastewater. Algae is help to photosynthesis process, Duckweeds (small free floating plant) are promising for use in sustainable wastewater treatment.

The present study attempts to evaluate the efficacy of anAlgae and duckweed based wastewater treatment system. in reduction of wastewater parameter in domestic sewage during the process of biological treatment efficiency of the system.

Materials and methods

An aquaculture-based sewage treatment system integrating Algae based and duckweed based wastewater treatment plant.

Experimental work in this search included the following tests:-

1- Biochemical oxygen demand (BOD).
2- Chemical oxygen demand (COD).
3- Dissolved Oxygen (DO).
4- pH.

Description of oxidation ponds and the arrangement of the ponds in the model The experimental model contains A Algae based and duckweed based biological treatment system was established adjacent to the comprised a sedimentation tank (1.8 x 0.6 m, depth 0.08 m), Algae Pond (1.8 x 0.6 m, depth 0.08 m) , duckweed ponds (1.8 x 0.6 m, depth 0.08 m) as situated in series for growing Algae and duckweeds (Fig. 1). The sedimentation tank was constructed before the a Algae based and duckweed based pond.

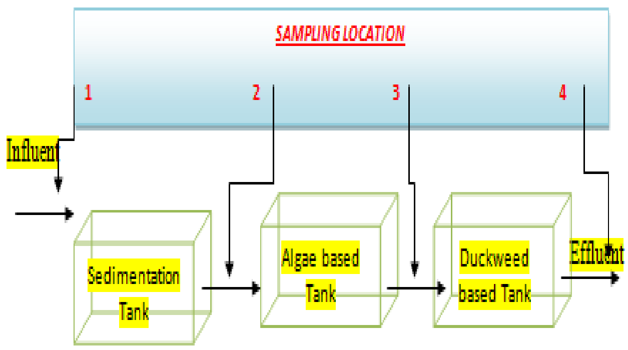

Fig 1. Layout of Pond Model

Results and discussion

The water temperature during the period of study varied greatly, which however, was influenced mainly by the seasonal changes, with lower values (20 ^{o} C to 24.5 °C) during December to January and higher values (35 ^{o} C to 45.5 °C) during April to June, up to 33.5 °C during rest of the period. Though variations in water temperature mainly associated with the atmospheric temperature and weather condition.

pH

The water pH at the source remained within a narrow range (6.79-7.2) through the study period (Fig. 2), while at the outlet, it was in the range of 7.3 -7.81 (Table 1).

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Table 1. pH Parameters Value of Different Sampling Stations of the Treatment System

Parameter	*Inlet @ Sedimentation*	*Outlet @ Sedimentation*	*Inlet @ Algae Pond*	*Outlet @Algae Pond*	*Inlet @ Duckweed Pond*	*Outlet @ Duckweed Pond*
January	6.79	6.79	6.79	7.31	7.31	7.5
February	6.82	6.82	6.82	6.95	6.95	7.3
March	6.89	6.89	6.89	7.34	7.34	7.81
April	6.92	6.92	6.92	7.2	7.2	7.45
May	7.11	7.11	7.11	7.45	7.45	7.65
June	7.2	7.2	7.2	7.41	7.41	7.76
July	6.92	6.92	6.92	7.35	7.35	7.68
August	6.98	6.98	6.98	7.32	7.32	7.64
September	6.85	6.85	6.85	7.3	7.3	7.43
October	7.01	7.01	7.01	7.39	7.39	7.56
November	6.99	6.99	6.99	7.45	7.45	7.65
December	6.95	6.95	6.95	7.25	7.25	7.51

Table 2. Dissolve Oxygen Parameters Value of Different Sampling Stations of the Treatment System

Parameter	Inlet @ Sedimentation	Outlet @ Sedimentation	Inlet @ Algae Pond	Outlet @Algae Pond	Inlet @ Duckweed Pond	Outlet @ Duckweed Pond
January	1	1	1	4.85	4.85	5
February	1.25	1.25	1.25	4.8	4.8	4.9
March	1	1	1	4.2	4.2	4.8
April	0.8	0.8	0.8	4.25	4.25	4.55
May	0.7	0.7	0.7	4.15	4.15	4.5
June	0.85	0.85	0.85	4.45	4.45	4.7
July	0.9	0.9	0.9	4.65	4.65	5.2
August	1	1	1	4.7	4.7	5
September	1.2	1.2	1.2	4.95	4.95	5.1
October	1	1	1	4.95	4.95	5
November	1.2	1.2	1.2	3.97	3.97	4.9
December	1.25	1.25	1.25	4	4	5

Table 3. Biological Oxygen Demand Parameters Value of Different Sampling Stations of the Treatment System

Parameter	*Inlet @ Sedimentation*	*Outlet @ Sedimentation*	*Inlet @ Algae Pond*	*Outlet @Algae Pond*	*Inlet @ Duckweed Pond*	*Outlet @ Duckweed Pond*
January	165	164	164	37	37	16
February	170	169	169	40	40	12
March	175	175	175	47	47	15
April	177	177	177	43	43	17
May	176	175	175	44	44	13
June	169	168	168	45	45	12
July	139	136	136	30	30	8
August	128	122	122	25	25	6
September	117	113	113	33	33	10
October	135	134	134	34	34	14
November	145	144	144	33	33	10
December	158	156	156	36	36	17

Table 4. Chemical Oxygen Demand Parameters Value of Different Sampling Stations of the Treatment System

Parameter	Inlet @ Sedimentation	Outlet @ Sedimentation	Inlet @ Algae Pond	Outlet @Algae Pond	Inlet @ Duckweed Pond	Outlet @ Duckweed Pond
January	270	270	270	110	110	55
February	268	268	268	109	95	38
March	275	275	275	108	108	45
April	286	286	286	105	105	43
May	290	290	290	101	98	50
June	282	282	282	98	48	48
July	266	266	266	96	96	54
August	238	238	238	90	90	42
September	248	248	248	89	89	40
October	268	268	268	110	110	56
November	260	260	260	109	109	50
December	265	265	265	112	112	55

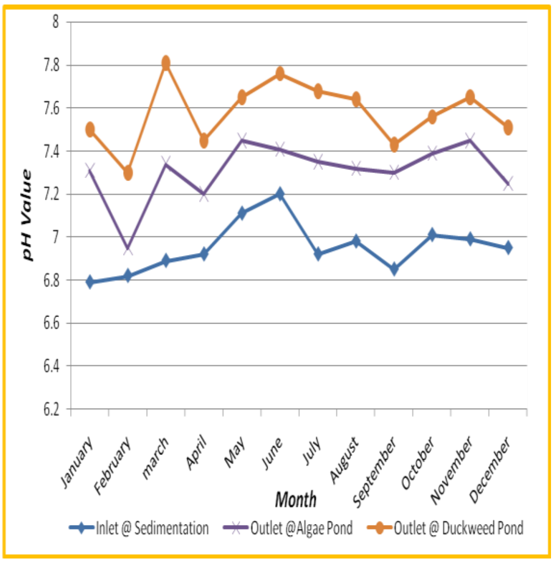

Fig 2. Variations in pH contents at different sampling stations of the treatment system

Dissolve Oxygen (DO)- The dissolved oxygen concentration is an important index of water quality and the average dissolved oxygen values of the treatment system registered a gradual increase from source (0,7 – 2.25 mg /litre) through the study period (Fig. 3) to outlet (4.5 – 5.2 mg /litre) (Table 2).

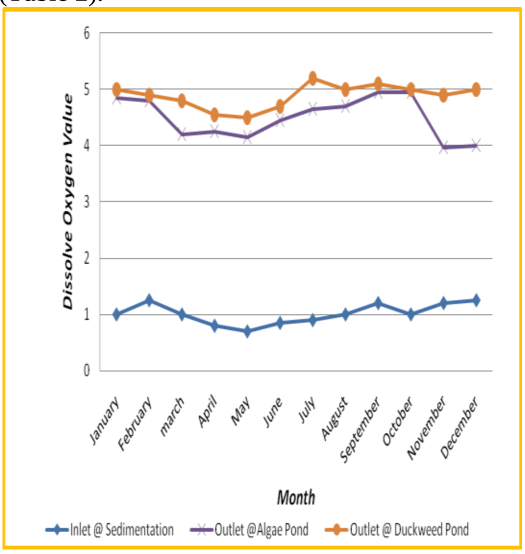

Fig 3. Variations in DO contents at different sampling stations of the treatment system

Biological Oxygen Demand (BOD) - The Biological Oxygen Demandat the source remained within a following range (117-179) through the study period (Fig. 4), while at the outlet, it was in the range of (6.0 -17.0) (Table 3).

Chemical Oxygen Demand (COD) - The chemical oxygen demand (COD) at the source remained within a following range (117-179) through the study period (Fig. 5), while at the outlet, it was in the range of (6.0 -17.0) (Table 4).

In view of the above observations, it is evident that the system offers considerable potential for biological wastewater treatment, with respect to reduction of BOD, COD. Further, DO is to maintain and also pH . The efficiency of the system makes it an ideal alternative wastewater treatment system for the tropics, especially for small cities and towns with. The efficiency of the system being a function of the temperature regime, retention time and sewage concentration, establishment of such a system in any place needs location evaluation and process standardisation.

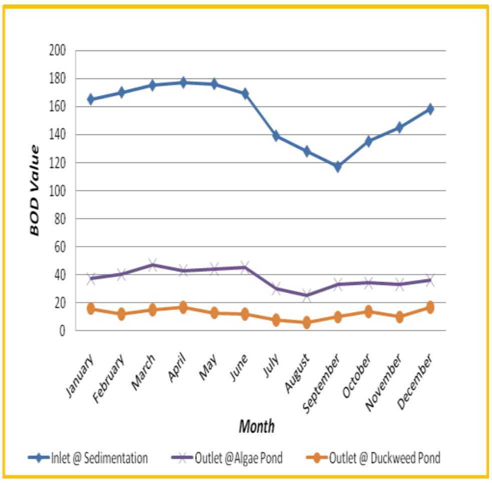

Fig 4. Variations in BOD contents at different sampling stations of the treatment system

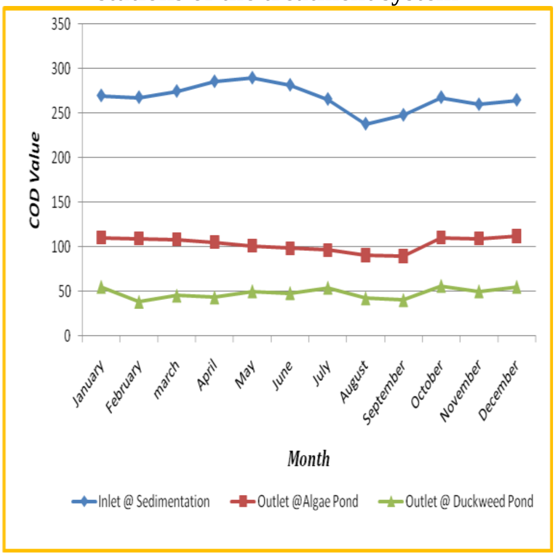

Fig 5. Variations in BOD contents at different sampling stations of the treatment system

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