

REUSE OF LAGOON EFFLUENTS IN AGRICULTURE BY POST-TREATMENT IN A STEP FEED DUAL TREATMENT (SFDT®) PROCESS

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ABSTRACT

Waste stabilization ponds are commonly used as efficient means of wastewater treatment relying on little technology and minimal, albeit regular, maintenance. Their low capital and operating costs and ability to handle fluctuating organic and hydraulic loads have been valued for years in rural regions and in many tropical countries wherever suitable land is available at reasonable cost. The major limitation of this form of treatment is the high effluent total suspended solids (TSS) concentrations mainly due to high concentrations of algal cells in the finished effluent. The presence of such algae can impose serious constraints on effluent reuse potential, which is particularly important in water-scarce regions. According to WHO and other guide lines reuse waters should bear less than 1 parasitic eggs or protozoa per liter and/or contain less than 2 NTU. Moreover, current re-use standards call for almost SS-free waters for agricultural reuse. Since pond effluents contain considerable amounts of algae, they are generally unable to satisfy stringent water-quality standards required for disposal or for reuse in irrigation.

The objective of this study was to remove turbidity originating from algae present in oxidation pond effluents by an easy and inexpensive method. For this reason, a novel lab-scale Step Feed Dual Treatment (SFDT)® process was developed. The efficiency of the trickling filter (TF) unit within the system in removing algae and organic matter was investigated in this work. The hydraulic loading rate, HLR (0.5-2-4 m³/m².day), influent COD (150-550 mg/l) and influent Chl-a concentrations (250-600 µg/l) were selected as operational variables. It was observed that, in general, removal percentages for turbidity, Chl-a, SS and COD increased considerably with the decreasing hydraulic loading rate. In conclusion, trickling filter produced clear effluents, with less than 2 NTU, for most of the cases.

The generic conception of the SFDT process is shown in Fig. 1. The experimental set up used to simulate SFDT process in the laboratory is shown in Fig. 2. The experimental set-up was consist of an algae tank, an influent tank, a pump and a trickling filter column. The model trickling filter was dosed by a pump from the influent tank with synthetic wastewater containing differing concentrations of algae. Twelve sets of experiments were conducted as shown in Table 1. Results of experiments were analysed both graphically, for example as shown in Fig. 3, and statistically. According to the results obtained the DFDT process was found able to remove over 98 % algae, suspended solids, COD and NTU at fairly high organic loading rates an produced sparkling clear effluent.

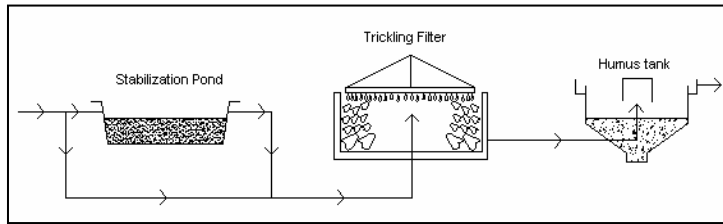


Figure 1. Schematic representation of Step Feed Dual Treatment (SFDT)

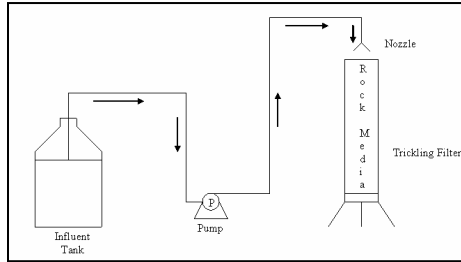
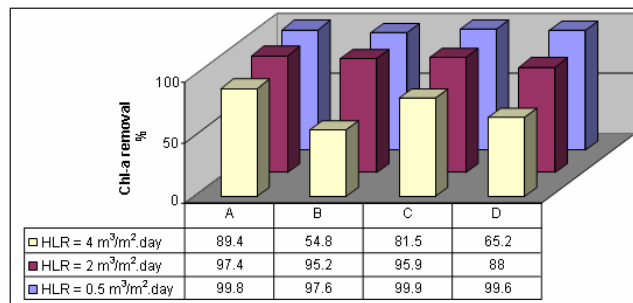


Figure 1. Schematic representation of the experimental set-up

Set #	HLR $m^3/m^2.day$	COD _{inf} mg/L	Chl-a _{inf} $\mu g/L$
1	2	550	250
2	2	150	250
3	0.5	150	250
4	0.5	550	250
5	2	550	600
6	2	150	600
7	0.5	150	600
8	0.5	550	600
9	4	150	600
10	4	150	250
11	4	550	600
12	4	550	250

Table 2. Experiment sets



A: COD=150 mg/L, Chl-a= 250 $\mu g/L$; B: COD=150 mg/L, Chl-a= 600 $\mu g/L$; C: COD=550 mg/L, Chl-a= 250 $\mu g/L$;
D: COD=550 mg/L, Chl-a= 600 $\mu g/L$

Figure 3. Chl-a removal in TF in SFDT