SEQUENCING BATCH REACTOR TREATMENT OF GARMENT FACTORY EFFLUENTS IN SRI LANKA: AN EMPIRICAL VALUE FOR AERATION FACTOR

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Abstract

Most factories located outside the DOI industrial zones in Sri Lanka do not have proper sewage treatment systems and due to the high number of employees these factories are always encountered with the problem of handling large quantities of low strength sewage generated from lavatories, canteens and kitchens. In such factories sewage is usually handled using conventional septic tank - soakage pit systems. Such systems are commonly found infested with insects, and promote further breeding. They cause nuisance due to obnoxious odor, and is a major cause for severe ground and surface water pollution. It has been noted that these factories have critical problems of handling sewage during rainy season, especially when the factor)' is located in areas with high ground water table such as a marshy land or near a surface water body.

To solve the problem of handling septic tank effluents. Sequencing Batch Reactor (SBR) treatment plants have been provided in several factories due to their lower cost arid minimum use of land area. Most of these plants produce effluents of quality far better than what is stipulated by the Central Environmental Authority (CEA) effluent standards. Parameters such as BOD are sometimes being reduced even down to undetectable levels which are rather unnecessary. Moreover, it has been noted by the industry that there may be possibilities to cut down the monthly electrical cost by operating the treatment plants at optimal levels of treatment. On the other hand, treatment plant contractors have noted that the bid prices were relatively high due to over-treatment specified and set under conventional design criteria.

Over-treatment and possibly higher than necessary, raw-BOD value for design purposes, seem to be the problem areas. Therefore, it is important to find a better value for aeration factor expressed in terms of oxygen dissolved in clean water (ODCW), for the use in calculations of aerobic sewage treatment plant designs, treating septic tank effluents. The lengthy calculations needed for designing aeration tanks and selection of number and type of aerators are therefore perceived to be correctly, easily and quickly done if a proper empirical value for aeration factor is available. ITic research was therefore carried out with the following objectives:

1.A reasonably accurate value for the oxygen requirement in oxidation of 1 kg of BOI)

(Aeration factor) used in design calculations.

2.To propose a reasonably correct value for septic tank effluent BOD for garment factories.

3.To calculate the cost saving with a new value of aeration factor both operational and capital.

It was found by the experiments carried out in this research, and samples taken simultaneously elsewhere that the average septic tank effluent BOD was around 250 mg/1 and ranged between 186 mg/1 to 284mg/l against the previously used value of 300 mg/1 which is 17% less.

The aeration factor used for carbonaceous oxygen in designing above SBR plants was 4kgOi/kg BOD and the value proposed in literature for various other countries range from 1- 2.5 kg02/kg BOD depending on temperature fluctuations. This research suggests 3.5 kg02/kg BOD, as an appropriate value for respiration factor in treating septic tank effluents from Sri Lankan garment factories. This is a reduction of 12.5% in oxygen requirement compared to previously used value.

The effect of application of above two parameters in the form of electrical power and capital saving were approximately 27% and 25% respectively for the particular SBR design used for them research.

DECLARATION

I hereby declare that the work included in this dissertation, in part or whole has not been submitted for any other academic qualification at any institution.

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BOD – Bio-chemical Oxygen Demand

BOI – Board of Investments

BPR – Biological Phosphorus Removal

CEA – Central Environmental Authority

COD – Chemical Oxygen Demand

COR – Carbonaceous Oxygen Requirement

DO – Dissolved Oxygen

GL – Ground Level

MCRT – Mean Cell Residence Time

MLSS – Mixed Liquor Suspended Solids

ODCW – Oxygen Dissolved in Clean Water

PHB – Poly-Hydroxy-Butyrate

SBR – Sequencing Batch Reactor

SOTR – Standardized Oxygen Transfer Rate

SRT – Solids Retention Time

SS – Suspended Solids

STP – Sewage Treatment Plant

TKN – Total Kjeldahl Nitrogen

VSS – Volatile Suspended Solids

WL – Water Level

WWTP – Wastewater Treatment Plant