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Effectiveness of coconut fibre media in biological wastewater treatment for rubber factory effluent

by

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DECLERATION BY AUTHOR

The work described in this thesis was carried out by me under the supervision of Mr. W. M. Thurul, Thurul Safe Environment, Chilaw Road, Nainamadama, Prof. P. A. J. Yapa, Senior Lecturer, Uni. of Sri Jayawardenapura, Nugegoda and Dr. C. K. Jayasinghe, Deputy Director Research, Rubber Research Institute, Dartonfield, Agalawatta and a report on this has not been submitted in whole or in part to any University or any other institution for another Degree/Diploma.

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Dedicated to my loving parents,

Saminda and Kavindu

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ABREVIATIONS

AF	Anaerobic filters
BOD	Biological oxygen demand
CAD	Covered activated ditch system
COD	Chemical oxygen demand
d	Day
DMRT	Duncan multiple range test
DO	Dissolved oxygen
DRC	Dry rubber content
HDPE	High density polyethylene
MLSS	Mixed liquor suspended solids
OLR	Organic loading rate
PVC	Poly vinyl chloride
RCCR	Rubberized coir carrier reactor
RSS	Ribbed smoked sheet
SS	Suspended solids
SSA	Specific surface area
TSS	Total suspended solids
UASB	Up-flow anaerobic sludge blanket
UV	Ultra violet
vss	Volatile suspended solids

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ABSTRACT

The Central Environmental Authority of Sri Lanka has identified the natural rubber industry as one of the most significant water polluting industries in Sri Lanka and it discharge about 18 million kg of COD to the environment annually (Anon, 1992b). With the new legislations, almost all the rubber processing factories are faced with difficulties of finding out a suitable treatment for their factory effluent.

Maintaining an adequate amount of active biomass is the key to a safe, stable operation of a biological treatment system. Bio-brush media was developed to become a low cost media with all ideal characteristics that lead to a low cost anaerobic treatment system known as Covered Activated Ditch (CAD) system. Therefore, the main objective of this study was aimed to optimise the treatment efficiency of CAD systems by selecting the best packing strategy of Bio-brush medium.

Five (50, 100, 150, 200 and 250 m^2/m^3) and four (25, 50, 75 and 100 m^2/m^3) specific surface areas (SSA) were set with 10cm and 15cm diameter Bio-brush media respectively and were subjected to run under four different organic loading rates (0.5,

1.0, 2.5 and 3.5 CODkg/m^3/d). The reactors with the highest SSA always showed fast start-up and highest treatment efficiencies. At the same time 100m^2/m^3 SSA was set with three diameters (5, 10 and 15 cm) of Bio-brushes and run under the same organic loads introduced in the above, to see the effect of diameter of Bio-brush media on treatment efficiency.

When increasing the SSA of media, the COD removal efficiency increased under all four OLRs. The treatment efficiency of rectors decreased with increasing OLRs. COD removal efficiency increased when the diameter of the medium is increased except under 1.0 COD kg/ m^3/d OLR. During this OLR the highest performance was shown by the Bio-brush media with 10 cm diameter.

With the results obtained, the reactor set with 200 m^2/m^3 SSA using 10 cm diameter Bio-brush media run under 1.0 CODkg/m^3/d OLR was chosen as the best combination for rubber factory effluent treatment. COD, pH and SS of reactor with above combination was about 100 mg/L, 6.7 - 7.2 and 26 - 43 mg/L (except in day 38) respectively after maturation and these values were within the maximum desirable levels stipulated by the Central Environmental Authority of Sri Lanka.

Nitrogen content of the effluent and the reactor pH affected the treatment efficiency. Chemicals, which were used during rubber processing also lowered the treatment efficiency. Long start-up periods observed during the treatment with higher organic loading rates could be lowered by pH correction of the reactors. Continuous removal of the suspended solids from the reactors avoids clogging of the reactors.