# ZERO EFFLUENT SOLUTION FOR DETERGENT INDUSTRY

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**( 06/8833 )**



**This dissertation is submitted in partial fulfillment of the requirements for the degree of Master of Science in Environmental Management**

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## DECLARATION

I declare that this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any University or other institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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## Supervisor's declaration

This is to certify that this thesis submitted by D.H. Dayananda is a record of candidate's own work carried out by her under our supervision. The matter embodied in this thesis is original and has not been submitted for the award of any other degree.

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## ABSTRACT

Reuse of industrial wastewater is an important strategy for reducing freshwater consumption and wastewater generation as well as minimizing the potential impact of effluent on the environment. From an economic perspective, wastewater reuse reduces the costs of freshwater consumption and wastewater disposal.

Wastewater is to be adequately treated prior to disposal. Surfactants including detergents are refractory organics that resist conventional treatment methods and therefore need an advance wastewater treatment. However, the cost of wastewater regeneration and treatment rises exponentially with increasing contaminant removal efficiency. In order to balance these competing cost factors wastewater disposal costs vs. wastewater regeneration and treatment cost has to be considered.

This case study of the zero effluent solution provides experience in cost effective management of effluent as a resource, with minimizing the potential impact of effluent on the environment. The overall objective was to recycle wastewater as a resource for liquid detergent manufacturing process. Special attention is being given to control of unpleasant odour, maximization of reuse of surfactants and establishment of proper hygienic conditions in treated effluent.

The results of wastewater characterization showed that the concentration of the organic matter is very high, expressed as COD ranging from 6,200 mg/l to 34,400 mg/l, while the biodegradable portion was very low, since BOD/COD ratio was low. These values indicate that organic compounds are not easily subjected to biological treatment. In order to ensure the maximum reuse of surfactants and other important chemicals only physical treatments were adopted. They were aeration, filtration followed by UV disinfection.

Two major limiting factors in the case of reuse wastewater were identified specific to this case study. (ie. Unfavorable odour experienced in collection sumps and contaminated with pathogenic micro organisms.) The proposed treatment can successfully solve these issues ensuring maximum reuse of important constituents in the effluent. More than this, it can reduce TSS up to 5μ particle size, which is more beneficial in reuse for production process. The treated effluent is best for use in coloured products.

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## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| BOD | : | Biological Oxygen Demand |
| COD | : | Chemical Oxygen Demand |
| DO | : | Dissolved Oxygen |
| TSS | : | Total Suspended Solids |
| VOC | : | Volatile organic chemicals |
| NTU | : | Nephelometric Turbidity Units |
| µS | : | Micro siemens |
| UV | : | Ultra Violet |
| gpm | : | gallons per minutes |
| IDB | : | Industrial Development Board |
| ITI | : | Industrial Technology Institute |
| SLSI | : | Sri Lanka Standards Institute |
| MSDS | : | Material safety data sheets |
| MPN | : | Most probable number |
| LABSA | : | Linear alkyl benzene sulfonic acid |
| ABS | : | Alkyl benzene sulfonate |
| NPV | : | Net profit value |
| IRR | : | Initial rate of return |
| B/C | : | Benefit to cost ratio |