

Tertiary Treatment Technologies for Water Reuse and Rainwater Harvesting in the Irish Dairy Industry.

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Abstract

This year, 2015, sees the abolition of quotas on milk production which is expected to increase the Irish dairy sector by 50% in the next five years. Legislation regarding the discharge limitations of dairy wastewater effluent is becoming increasingly stringent along with initiatives to conserve and reuse water within the industry. The use of tertiary treatment systems; ozone and UV may play a dual role of acting as end-point effluent treatment systems as well as disinfection systems to restore dairy wastewater to reusable standards within dairy plants. This study aims to address those themes.

1. Introduction

The Irish dairy sector processes approximately five billion litres of milk annually. Substantial volumes of water are utilized within the industry with water consumption ratios at approx. 2.5m³/m³ of milk processed and 14.9 m³/tonne of ingredients produced¹. Water is used in large quantities within the plant for activities such as steam generation, cooling duties and cleaning in place (CIP) with CIP accounting for the majority of water consumption in dairy plants.

Tertiary treatment technologies applicable for dairy wastewater reuse include membrane filtration, ultraviolet irradiation (UV) and ozone treatment. Membrane filtration has proven successful in the removal of pathogens² however it can be expensive and labour intensive. UV and ozone treatment may offer an inexpensive and efficient alternative by producing water of CIP standards for potential reuse. Therefore, the aims of this study are to evaluate both pulsed UV and ozone as a method of disinfection for (i) water reuse purposes within the dairy plant and (ii) the tertiary treatment of dairy effluent. The potential for on-site rainwater harvesting at dairy plants will also be investigated.

2. Dairy Industry Liaison

Site surveys were carried out at six dairy plants (DP 1 - DP 6) nationwide. Information collected included annual water consumption and water reuse practices, tertiary disinfection systems in place and rainwater harvesting potential. Dairy wastewater samples (six influent and one effluent) were also collected to determine the typical characteristics of the wastewater.

The main findings of the survey highlight;

1. Rainwater harvesting is not considered.

2. Overall, water reuse practices do not appear to be widely implemented.
3. Stricter legislation would result in microbial standards being applied to discharged effluents.

3. Laboratory Results

Preliminary tests on dairy influent suggest that dairy wastewater is contaminated with faecal pathogens and would require tertiary disinfection treatment for water reuse purposes. Figure 1 illustrates levels of standard bacterial indicators for microbiological contamination. The red line indicates the discharge limits for *E. coli* and coliform concentrations in drinking water; 0 CFU/mL.

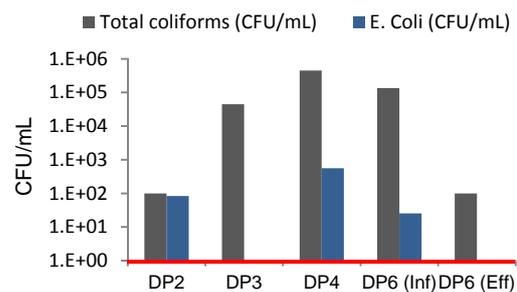


Figure 1. Total coliform and *E.coli* concentrations of dairy wastewater influent and effluent samples.

4. Future Work

Laboratory analysis will begin with investigations into potential harmful pathogens of interest in dairy water and wastewater. Both disinfection technologies will be evaluated with regards to pathogen removal efficiency. Typical dairy wastewater characteristics that may impact on system efficiency such as suspended solid concentrations will also be analysed.

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