

DairyWater: Development of a water use and waste management framework for the dairy processing industry

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Abstract

The abolition of EU milk quotas in 2015 will offer increased prospects for the Irish dairy industry. A growth of 50% in milk production by 2020 is expected. This will challenge the dairy industry and significant improvements of resource efficiency in water and energy, along with waste management systems is required. The specific goal of the project is to develop effective and sustainable technologies, which will treat dairy waste and reduce water usage in the dairy processing sector. In addition, a life cycle analysis of water use and dairy waste management for the Irish dairy processing industry will be conducted. Furthermore, this project will be in alignment with national and international policies by turning wastes into resources.

1. Introduction

With the impending rise in amount of raw milk being processed within Ireland, efforts are being made to improve the resource efficiency, in terms of energy and water usage, within dairy processing plants. New, more efficient, technologies for treating the wastewater effluent from the plants are also sought as factories are nearing their discharge limits as a result of restrictions imposed by EPA regulations.

In this project, data relating to water and energy usage and dairy wastewater samples, which are collected at a number of dairy processing plants, will be used to assess the performance of a number of novel technologies. The research aspects which are to be explored during the project are divided into three main sections:

- Dairy wastewater treatment technologies
- Water re-use and rainwater harvesting
- Life cycle assessment (LCA) and cost-benefit analysis

2. Dairy wastewater treatment

The intermittently aerated sequencing batch reactor (IASBR) technology, developed at NUI Galway, and nanomaterials technology, developed at TCD, are used

for the removing biochemical oxygen demand, nitrogen and phosphorus from the dairy effluent in order to reach the discharge standard. In addition to the laboratory scale testing, on-site meso-scale testing of the IASBR is proposed.

The shift of the microbial ecological structure in laboratory-scale and meso-scale IASBRs will be determined through molecular microbial ecology studies performed at the Environmental Research Institute, UCC. This will aid in the development of bioreactor sampling regimes to obtain representative samples from established reactors and establishment of relevant sample storage and processing protocols.

3. Water re-use and rainwater harvesting

Water reuse and rainwater harvesting technologies, integrated with pulsed UV systems developed by Athlone IT and NUI Galway, will be investigated to enable water use reduction. This study will also include the identification of tertiary treatment technologies for dairy processing wastewater to meet water re-use requirements. Furthermore, the performance of rainwater harvesting and water re-use technologies will be examined at a field-scale level within a dairy processing plant.

4. LCA and cost-benefit analysis

Environmental life cycle analysis is to be used to determine the resource, energy and water, usage and global warming potential of the Irish dairy processing sector.

Furthermore, life cycle analysis of water use and dairy waste management will be conducted to assess the advantage of using the proposed technologies. In addition a cost-benefit analysis will be undertaken to ensure the cost effectiveness of the technologies explored in the project.

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