DairyWater: Sustainability and resource efficiency for the Irish dairy processing industry

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- Irish dairy industry
- DairyWater project
  - Wastewater treatment technologies
  - Water use
  - Environmental assessment
- DairyWater summary
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Irish dairy industry

- Raw milk production in Ireland: 5.4 billion litres from 17,000 dairy farmers

Irish dairy industry

- World’s 10th largest dairy exported
- Exports 85% of products manufactured

Irish dairy board exports under the names *Kerrygold*, *Dubliner Cheese* and many more

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Irish dairy industry

- European milk quotas were abolished (Mar ’15)
  - Resulting in a potential increase of 50% in domestic raw milk production
  - Increase in water usage: from 13.5 billion litres to ???
- Many plants at water emissions limit
  - Irish Environmental Protection Agency (EPA)
- New technologies sought to maintain profits and adhere to regulations
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DairyWater project

- Aim: Develop sustainability and resource efficiency for the Irish dairy processing industry
- €1 million project funded by the Department of Agriculture, Food and the Marine (DAFM)
- Comprises 5 research institutions: NUI Galway; Trinity College Dublin; University College Cork; Athlone IT; Teagasc
- Includes a project advisory board which include representatives from EI, EPA, Teagasc and industry stakeholders
DairyWater project

**Wastewater treatment technologies**

- Molecular analysis of IASBR technology
  - Lead Organisation: NUIG
  - PI: Prof. Xinmin Zhan

- Nanotechnologies for dairy wastewater treatment
  - Trinity College Dublin

- Secondary treatment of wastewater using IASBR technology
  - NUI Galway

- Tertiary disinfection systems for water reuse and rainwater harvesting
  - Advisory board: Industry collaborators
  - Industry stakeholders

**Water use**

- Environmental assessment of Irish dairy processing industry

**Environmental assessment**

IWRA: World Water Congress XV
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Wastewater treatment technologies

- Development of an Intermittently aerated sequencing batch reactor (IASBR)
  - Uses biological methods to remove nutrients
  - Reduction in energy use due to reduced aeration
  - Nitrogen removal via nitrite not nitrate
  - Alkalinity remains stable due to alternating periods of nitrification and denitrification
  - Initial laboratory scale experiments
  - Pilot-scale experiments on dairy processing sites planned
Wastewater treatment technologies

- Molecular microbial ecology studies using advanced pyro-sequencing techniques
  - Performed at the Environmental Research Institute (ERI) in UCC
  - To determine the shift of the microbial ecological structure IASBRs
- The use of nano-materials to remove nutrients and heavy metals from water and wastewater
  - Performed at the Centre for Research on Adaptive Nanostructures and Nano-devices (CRANN), TCD
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Water reuse and rainwater harvesting

- Tertiary treatment technologies for dairy wastewater effluent
  - Pulsed UV (PUV) treatment
  - Ozone treatment
- Water reuse efficiency within the Irish dairy sector
  - Tertiary treatments implemented to inform water reuse potential (e.g. condensate)
- Rainwater harvesting potential
  - Potential use of on-site stormwater
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Environmental assessment

- Perform a detailed environmental LCA for manufacture of main dairy products:
  - Fluid milk
  - Cheese
  - Butter/milk powder

- Estimate environmental sustainability key performance indicators (KPIs) for the Irish dairy processing industry

- Presented at WWCXV on Tue: ‘Water consumption and direct energy usage in the Irish dairy processing industry’

GWP of dairy products processed in Rep. of Ireland²

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Questions???

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