



Further reading:

- Project Ireland 2040 Annual Report 2019
- Irish water: Performance Assessment Report 2017 (CER/16/308)
- National Wastewater Sludge Management Plan

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Acknowledgments: This policy brief was prepared through the SFI Research Professorship Scheme awarded to Prof. P. Lens at NUI Galway.



Integration of different wastewater treatment technologies to boost the circular bio-economy in Ireland

Background

The ever-increasing population and their needs exert a tremendous pressure on the global economy. Therefore, it is important to manage and utilize the available resources in an astute manner for the sustainable development of any nation. In this context, wastewater plays a vital role, as its inefficient treatment can be hazardous to ecosystems and also several important nutrients can be lost¹.

In this regard, the government of Ireland has established Irish Water (IW), which is primarily involved in wastewater treatment and quality water supply. However, there are many objectives yet to be achieved by IW. For example, a recent report from the Environmental Protection Agency (EPA) stated that nearly 35 towns and villages are discharging raw wastewater in nearby rivers and the sea, which may be dangerous for the water supply². In addition to this, it was estimated that the population of Ireland will increase up to 5.7 million by 2040, which will result in an increment of the amount of wastewater and related sludge by 80%³. Therefore, development of efficient technologies for wastewater treatment and nutrient recovery is highly required.

Circular bio-economy

The concept of circular bio-economy is defined as valorisation of biomass in an integrated, sustainable and resource-efficient manner along with recycling the residual wastes to enhance the biomass value in the economy⁴. The Irish government has already taken an initiative by launching the “Project Ireland 2040” program. This program is a long term approach to boost regional connectivity, support national competitiveness and develop environmental sustainability. Like the previous years, the Project Ireland 2040 Annual Report (2020) continued its focus on development of low carbon & climate resilient society, and sustainable water & environmental resources management⁵. The policy stressed the enhancement of nutrient recovery from the waste streams and utilization of renewable biological resources. In addition to this, the Irish government has set a list of objectives in order to ensure the development and delivery of water services as per the Irish Water Services Policy Statement 2018-2025⁶. This policy mainly aims towards bringing and maintaining public water and wastewater services to acceptable international standards and engaging stakeholders. The goal is to develop efficient water treatment technologies and enhance nutrient recovery and recycling in order to implement the concept of a circular bio-economy. The right coordination among the public water sector, funding agencies, start-ups and research organizations can catalyse the translational research and innovation in Ireland and ultimately boost the economy.

Integration of different technologies to meet the bio-economy goals

In the current scenario, integration of two or more different technologies can significantly enhance the overall nutrient recovery and/or conversion of waste into bio-based value added products. Therefore, the proposed scheme is presented, which integrates anaerobic digestion, microbial fuel cells (MFCs) and downstream processes to convert algal biomass in value-added products such as biofuel, biohydrogen, bioethanol etc. (Figure 1). All these technologies are integrated in a way that the effluent from one process is utilized by the other, hence maximizing the nutrient recovery and minimizing the sludge waste. The proposed scheme will reduce the sludge production, generate biogas, bio-electricity, algae biomass and its value-added products. In addition to this, nutrients such as sulfur and selenium can also be recovered through a synergistic electrochemical and microbial approach. Transition of the proposed scheme in real world will require joint efforts from research institutes, industries and government through scaling up and field trials. Implementation of such innovations can help Ireland to be a bio-based economy and attain the goals of sustainable development.

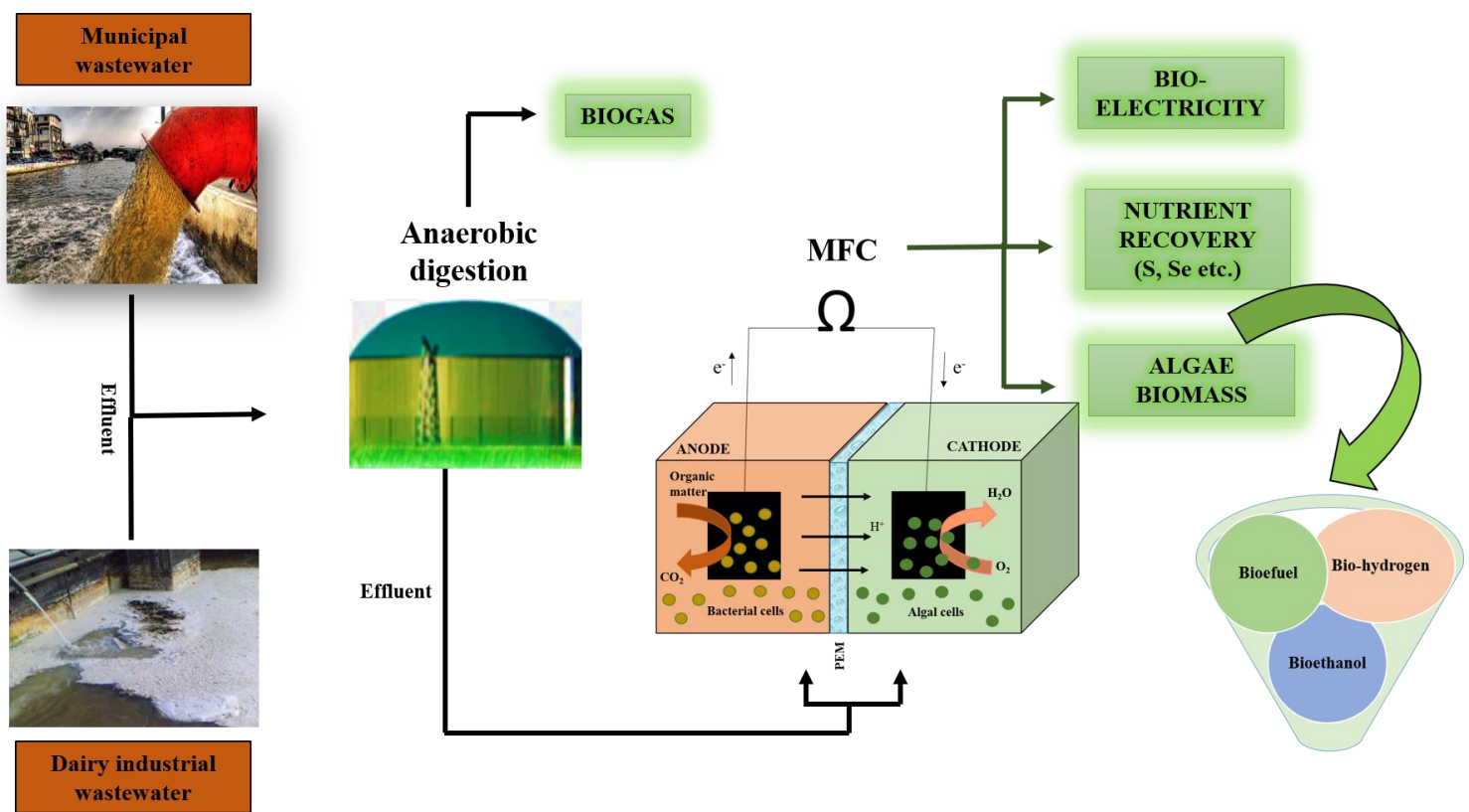


Figure 1: Illustration showing the integration of anaerobic digestion, microbial fuel cell and downstream processes.

The data reference links can be found below:

1. Nan, X., Lavrnjic, S., & Toscano, A., (2020), Potential of constructed wetland treatment systems for agricultural wastewater reuse under the EU framework. *Journal of Environmental Management*. 275, 111219.
2. <https://www.irishtimes.com/news/environment/raw-sewage-flowing-into-rivers-and-sea-in-35-places-across-ireland-1.4406687>
3. <https://www.water.ie/projects-plans/our-plans/wastewater-sludge-management/Final-NWSMP.pdf>
4. <https://www.gov.ie/en/publication/9a7e1-the-bioeconomy/>
5. <https://www.gov.ie/en/collection/47215-project-ireland-2040-annual-reports/>
6. <https://www.gov.ie/en/publication/49364-water-services-policy-statement-2018-2025/>