



Engineering Solutions to Offset Waste Problems

Dr Tom Curran

UCD School of Biosystems & Food Engineering



TECHNOLOGICAL



HEALTH



ENVIRONMENTAL



ACADEMIC



TRAINING



ECONOMIC



SCIENTIFIC



POLITICAL

SUMMARY

Waste can cause problems. When fats, oils, grease and sanitary products congeal in a sewer, it can build 'fatbergs' that slow and clog sewers, resulting in backed up pipes, environmental damage and expensive and dangerous operations to clear the blockage.

Dr Tom Curran at UCD is making strides in the fight against fatbergs, working on prevention and detection. His research has shown high levels of compliance among businesses to prevent fatbergs, which saves Dublin millions of Euros each year in sewer management and wastewater treatment costs.

“The project is mapping waste streams from food commodities such as milk, meat, barley, wheat and rice and the value to be recouped from them”.

Fathoming Fatbergs

Fatbergs can cause serious disruption and damage when they clog sewers. Restaurants are often a potential source for the fats, oils and greases that help to build fatbergs, and in 2008, Dublin introduced measures where restaurants needed to fit grease traps to capture the material before it could cause a problem. Dr Curran and postgraduate David Gibbons have analysed the impact of those guidelines, and found that the overwhelming majority of food outlets complied.

Fatbergs can also grow thanks to flushed products such as sanitary wipes, ear buds and nappies and from fats, oils and greases sluiced from domestic kitchens.

Dr Curran is helping to build greater awareness about prevention and he is also developing a mapping and sensing system to forewarn that a fatberg is growing. The mapping system will identify areas of high risk in the sewer system, and sensors will monitor key aspects such as sewage flow rate and level and the production of gases. “We are hopeful that the system could indicate a blockage early on, and this would require less intervention to remove it,” explains Dr Curran.



Waste Mapping

It's not just fatbergs that accumulate and cause problems, Europe also faces a mountain of 700 million tonnes of waste from the agri-food industry each year. In a bid to make more sustainable use from such waste Dr Curran co-ordinates AgroCycle. The 26-partner Horizon 2020 project started in 2016 under the leadership of Professor Shane Ward from UCD and Dr Curran has now taken on the role.

"The project is mapping waste streams from food commodities such as milk, meat, barley, wheat and rice and the value to be recouped from them," explains Dr Curran. "We have to work out the best route to take with these products and their waste."



Knowledge to Foil Fatbergs

Thanks to the research carried out at UCD by Dr Curran and Mr Gibbons, we know that introducing regulations for restaurants to fit appropriate grease traps in Dublin was broadly effective. "We showed that there was more than 90% compliance among businesses with the directive between 2008 and 2014," explains Dr Curran. "And in that time, there was a 95% reduction in recorded fatbergs in Dublin."

The research on fatbergs at UCD has shown that Dublin City Council saves an estimated annual €1.2 million in sewer operation and management costs. In addition, preventing approximately 1,000,000 million litres of oil and grease from entering the sewers has saved an estimated €2.40 per litre in wastewater treatment costs.

Mr Gibbons now works with SwiftComply, a company that supports restaurants looking to comply with waste directives that was set up as a result of the project and which was the **Irish winner of the Green category in the Startup Europe Awards in 2017.**

Dr Curran is now working with agencies in the UK to **help food businesses understand and comply with fatberg-fighting guidelines**, by creating wider awareness among kitchen staff about the consequences of fats, oils and greases getting into the sewers.

Prevention is just one arm of avoiding the economic and human cost of fatbergs, and Dr Curran **secured a Fulbright-TechImpact award** to develop a monitoring and detection system for fatberg growth in sewers.

Working with the the CONNECT SFI Research Centre based in Trinity College Dublin and with world-renowned fatberg expert Prof Joel Ducoste at North Carolina State University, Dr Curran is building and testing low-cost monitors that can be deployed in high-risk areas for fatberg accumulation.

"We hope that by using a suite of low-cost sensors we can recognise patterns that tell us trouble is building, and get in there early to prevent the damage," he says. "I would expect that the cost of such a monitoring system would be about one-tenth of the cost of current monitoring approaches."

During a recent visit to Raleigh to work with Professor Ducoste, Dr Curran presented at a conference in Detroit and he met with several key personnel involved in fatberg prevention in the USA and Canada. Through these contacts he is **building a large network of experts and test sites** with a view to securing funding into the future.

Turning the Waste Cycle for Good

In AgroCycle, Dr Curran is contributing to an important European research priority by **developing ways to tackle the hundreds of millions of tonnes of waste and by-products from the agri-food industry.** "That might be inedible peels, rotten fruit and vegetables or spoiled milk or meat," he explains. "By mapping out the waste production and coming up with ways to make it valuable through useful products and services, we are supporting the development of the bioeconomy and the circular economy."



European and Chinese partners on the 8-million-Euro project are using potato pulp to make food packaging and biocomposites and seeking to generate power from waste. "We have partners on the project developing microbial fuel cells, and we are looking at how best to implement anaerobic digestion of farm waste to produce renewable sources of biogas, heat and electricity," says Dr Curran.

By identifying these and other efficient ways to sustainably reduce food waste, Agrocycle will contribute to policy formulation in the agri-food sector at EU level and help to address the impact of human population growth and the need for more intensive food production against a backdrop of climate change.

In the shorter term, the project has **developed an online marketplace for those who are interested in re-using waste**, launching it at the National Ploughing Championships in Ireland. “The online platform allows waste producers, such as farmers, food processors and retailers to connect with people who are interested in using that waste,” explains Dr Curran. “That could be the biotech industry or those who could use power from anaerobic digestion.”

Research References

Wallace, T; Gibbons, D; O’Dwyer, M; Curran, TP (2017) ‘International evolution of fat, oil and grease (FOG) waste management - A review’. *Journal of Environmental Management*, 187:424-435. <https://doi.org/10.1016/j.jenvman.2016.11.003>

Murphy, E; De Boer, IJM; van Middelaar, CM; Holden, N; Shalloo, L; Curran, TP; Upton, J (2017) ‘Water footprinting of dairy farming in Ireland’. *Journal of Cleaner Production*, 140 (2):547-555. <https://doi.org/10.1016/j.jclepro.2016.07.199>

Gibbons, D., Curran, T.P., O’Dwyer, M. (2014) Developing GIS maps to monitor sewer blockage risk from fats, oils and grease (FOG) in Dublin city. *Science and Solutions for a Sustainable Environment*, UCD, Dublin.

Curran, Thomas P. (2015) Sustainable Management of Fat, Oil and Grease (FOG) Waste - A Global Challenge. *Sustainability Ireland*, Dublin. <https://researchrepository.ucd.ie/handle/10197/7212>

AgroCycle is a ca. €8 million (ca. €7 million from the European Commission, ca. €1 million from the Government of The People’s Republic of China) Horizon 2020 research and innovation project addressing the recycling and valorisation of waste from the agri-food sector. <http://www.agrocycle.eu/>

SFI Connect Research Centre: <https://connectcentre.ie/>

Curran, TP; Broderick, C; Ducoste, J. (2018). Preliminary tests of sensors to detect sewer network blockages. ASABE Annual International Meeting, Detroit, USA, July 29 – August 1, 2018. <https://dx.doi.org/10.13031/AIM.201801691>

Kelleghan, DB; Hayes, ET; Everard, M; Curran, TP. (2019). Mapping ammonia risk on sensitive habitats in Ireland. *Science of the Total Environment*, 649:1580-1589. <https://doi.org/10.1016/j.scitotenv.2018.08.424>

Awards

ASABE Superior Paper Award - American Society of Agricultural and Biological Engineers <http://hdl.handle.net/10197/5239>

SwiftComply: Irish winner of the Green category in the Startup Europe Awards in 2017.

StartUp Europe Awards (SEUA) is an initiative of the European Commission and Finnova Foundation, supported by the President of the European Parliament, the President of the Committee of the Regions, the Vice-President of the Economic and Social Committee and several members from the European Parliament.

Fulbright TechImpact Award 2017-2018

Fulbright TechImpact Scholar Awards are research grants to complete short-term, non-commercial projects and research in the U.S. They are designed to respond to the potential and pace of Information and Communications Technologies (ICT).