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Sustainable Management of Fat, Oil and Grease (FOG) Waste – A Global Challenge

By Thomas P. Curran

While we are now experiencing some local inconvenience in Dublin city centre due to planned works to facilitate the construction of the “Luas Cross City” line, we should spare a thought for those who endure emergency roadworks in cities around the globe. While some urgent repairs are required occasionally for communication and water networks, there is a growing problem of emergency works and traffic diversions caused by sewer blockages in large cities due to “fatbergs” - a term that has been coined over the past decade or so to describe large conglomerations of fat, oil and grease (FOG).

Fatbergs are particularly prevalent in the UK and often hit the headlines when they are compared in the media to the size of a double-decker bus or jumbo jet. The largest one to date (15 tonnes) was found in Kingston, London in 2013 and it took six weeks to repair the damaged sewer. While some estimates suggest that FOG is the primary cause of blockages in 50-75% of cases, there is also another major influencing factor with Non-Flushable Products (NFPs) such as sanitary towels and “flushable” wipes which may end up in the sewer. Resulting inconveniences and damage may include sewer overflows into water bodies, flooding of property and emergency roadworks with traffic diversions to remove the fatbergs. The direct cost of removing fatbergs in the UK is estimated to be in the region of €20 million, however, if further costs relating to traffic diversion, sewer maintenance and overall environmental damage were taken into account, the overall figure would be much higher.

The problem of sewer blockages is being exacerbated by the global population growth which is concentrated in urban areas as shown in Figure 1. While the urban population has overtaken the rural one in recent years, the projected future growth will be in cities. The global urban population is expected to reach 66% of the total by 2050. This comes at a time when there is a major focus on the Food-Water-Energy Nexus. More food, water and energy are required to meet demand and these issues are inextricably linked. Indeed, fat, oil and grease waste is connected here too.
Fat, oil and grease (FOG) enters the sewer network, mainly as a by-product from food service outlets (restaurants, etc.) and domestic households. The food processing industry produces FOG also, but this is typically removed from on-site effluent as part of licence conditions. Within sewers, FOG forms a hardened solid in pipes as a result of physical and chemical property changes that occur, thus reducing capacity and increasing the risk of overflow. The problems threaten human health and environmental quality, and add unnecessary cost for remediation. In addition, it is estimated that 25% of municipal sewage treatment costs can be attributed to the FOG component.

When considering the growing urban population and the rising expenditure in food service outlets (e.g. in the U.S. as shown in Figure 2), the number of sources and quantity of FOG are projected to increase. One could highlight other related public health issues here such as obesity linked to diet. Indeed, the FOG waste entering the sewer network and forming deposits is analogous to cholesterol being laid down along human arteries, resulting in reduced blood flow and more serious blockages over time.

The obvious solution as with any waste is to minimise it at source, regardless of whether that is in a food service outlet or in the home. Elimination of fat, oil and grease is challenging unless diets and cooking habits change dramatically. An interesting aspect of FOG generation is that it can vary across the diets of a typical multicultural society found in cities. While a meat-based diet is an obvious source of fat (e.g. residues on cooking utensils, cutlery and plates), there is also an abundance of sauces and dips in a wide variety of meals. Grilling is one option to reduce FOG residues but if using a frying pan, it should be heated to the desired level before adding cooking oil. This will reduce the oil quantity required. When
cleaning up, residues should be allowed to cool in order to be removed and be placed in the appropriate food waste bin.

In food outlets, the management of FOG is more challenging due to the quantity of food being prepared and served to meet consumer needs. While staff training is essential, the installation of passive grease interceptors and active recovery units in the kitchen greywater outlet pipes can provide a technical solution. Although the equipment is typically designed to a European (EN 1825-1&2:2004) or US (PDI-G101) standard, doubts remain over how useful the equipment tests are in relation to actual operating conditions with intermittent flows of varying temperature and wastewater content. The residence times in the units also vary. Excessive use of detergent can make FOG removal more difficult due to emulsification. Bio-additives are sometimes dosed into the wastewater pipe of commercial kitchens in order to degrade FOG.

While fatbergs continue to make news headlines in some parts of the world, the good news is that FOG source control programmes are very effective. Such programmes require food service outlets to hold a trade effluent discharge licence, install and maintain grease trap systems, and introduce best management practices to reduce the quantity of FOG entering the sewer network. Cities such as Dublin and Stockholm have achieved reductions in sewer blockages by a minimum of 95% by implementing FOG source control programmes. The Dublin City programme has been running since 2008 and with increased compliance, the number of blockages has dropped from 1,000 to 50 per year and there has been no major blockage since 2010. Dublin can now be considered as one of the leading cities in the world in avoiding fatbergs by managing FOG in a sustainable manner.

Further efforts have been made across the EU in the domestic sector with voluntary collection schemes for Used Cooking Oil (UCO). One European project (recoilproject.eu) found that it was possible to collect 2.5 litres per household per month. A central collection point such as at a school is preferable for collecting UCO from domestic sources.

Despite the problems it can cause, FOG has significant potential for reuse as a resource in the production of bioenergy and bio-based products. UCO is already widely collected from food service outlets and transformed into biodiesel; the process is considered to be a mature technology. Fat, oil and grease residues can also be used in animal by-products rendering plants or anaerobic digestion. FOG can end up in composting streams, although this is not particularly desirable. Further research and innovation is required to develop commercial opportunities in the area of biopolymers and biochemicals and there is no doubt that this aligns well with the creation of green jobs in the Knowledge-Based Bioeconomy that the EU desires.

When considered from this viewpoint, the options for processing fat, oil and grease waste are quite considerable. However, this highlights that recovery at source is critical to capture the raw material so that downstream processes can add value to it. Integrated solutions that minimise FOG generation, enhance its collection and promote its valorisation as a resource for energy and high-value materials will reduce greenhouse gas emissions and create jobs; these should be key considerations for managing fat, oil and grease waste in a circular economy within the context of sustainable urbanisation.
Further Information

Currently, there are two research projects being carried out at University College Dublin on this topic.

**Project 1:**

Critical evaluation of Dublin City Council’s Fats, Oils and Grease (FOG) Programme and an investigation of the potential to implement similar initiatives internationally

Researcher: David Gibbons

**Project 2:**

Development of a National Strategy for Recovery and Utilisation of Fats, Oils and Grease (FOG) from Food Service Outlets (FSOs)

Researcher: Tom Wallace

The co-ordinator of the projects is Dr. Tom Curran (tom.curran@ucd.ie), UCD School of Biosystems and Food Engineering, University College Dublin, Belfield, Dublin 4.

The employment partner is Mr. Michael O’Dwyer, Evolution Environmental Services, The Guinness Enterprise Centre, Taylor’s Lane, Dublin 8.

Project web site: http://ssu.ie/research/fog

Twitter: @FOGWaste

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