Fats, oils and greases (FOG): From problem to resource

Introduction

- Fats, oils and greases (FOG)
  - describe a variety of lipid-rich material originating from food preparation and cooking processes
  - cause operational problems in all parts of wastewater systems, from sewers to sewage treatment works (STWs) contributing to blockages, increased maintenance and costs
  - collectable at several points in a wastewater catchment to be further used for energy recovery
  - The aim of this work is to clarify the variation among collectable FOG in regards to their physicochemical properties and their bio-methane potential

Collection

- Household
  - FOG collected monthly from 30 domestic properties
- Restaurant
  - FOGs collected from a grease removal unit fitted under washing sink of restaurant (serving British food)
- Sewers
  - FOG deposits, also referred as “fatberg”
- Sewage pumping station
  - FOG accumulate at the water surface in sewage pumping stations (SPSs)
- Sewage treatment works
  - Grease-rich aggregates accumulating at inlet of STWs
- Sewage sludge
  - Usually treated via anaerobic digestion at STW and producing biogas
  - Collected after being thermo-hydrolysed

Characterisation

- Results showed that FOG have high value for energy recovery (Fig. 2)
- However, FOG found in sewers, SPS and STW are not free of contaminants (e.g. plastics, stones and grits) which could cause damage to the anaerobic digestion process or conversion into biodiesel challenging

What the FOG?

- Lipids: 1.01 Lg VS⁻¹
- Proteins: 0.50 Lg VS⁻¹
- Carbohydrates: 0.41 Lg VS⁻¹
- Calorific values:
  - Lipids: 9.90 kcal.g⁻¹
  - Proteins: 4.00 kcal.g⁻¹
  - Carbohydrates: 4.00 kcal.g⁻¹

How much energy is that?

- 2,679.07 kcal.kg⁻¹
- 419.85 kcal.kg⁻¹

Anaerobic co-digestion?

- Simultaneous digestion of two or more substrates (e.g. FOG and sewage sludge)
- Increase the biogas generation and improve plant’s economics

Conclusion

- FOG are desirable substrates for anaerobic co-digestion: FOG collected at source could be more valuable than other FOG wastes for biodiesel conversion (i.e. less contaminants)
- Harvesting these resources in kitchens before they reach the sewers would have significant benefits both in terms of avoiding sewer incidents (e.g. blockage and flooding) and energy recovery
- Further work is needed to evaluate the economics associated with developing collection schemes at source