



# Lipids in wastewater: problems vs opportunity

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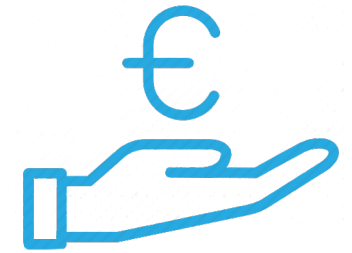
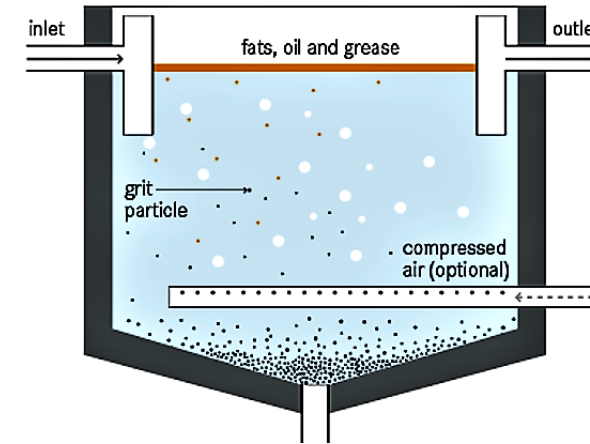
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**2021 PARTNER EVENT**

# Lipids (FOG) – operational issue for STP operators

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- 1 EUR / PE – annual cleaning of sewers and removal of blockages caused by solid lipids
  - ~ 500 mil EUR / year for maintenance of pipelines in the whole EU
- Lipids have detrimental effect on oxygen transfer to microorganisms
- Decline of microbial activity in activated sludge
- Adsorption of lipids to biomass decrease the ability of sludge to settle, foster growth of filamentous bacteria – bulking and foaming
- Lipids can be separated at the inlet (screens, grease trap) – hazardous material according to EWC

- Lipids are present in both liquid and particulate forms

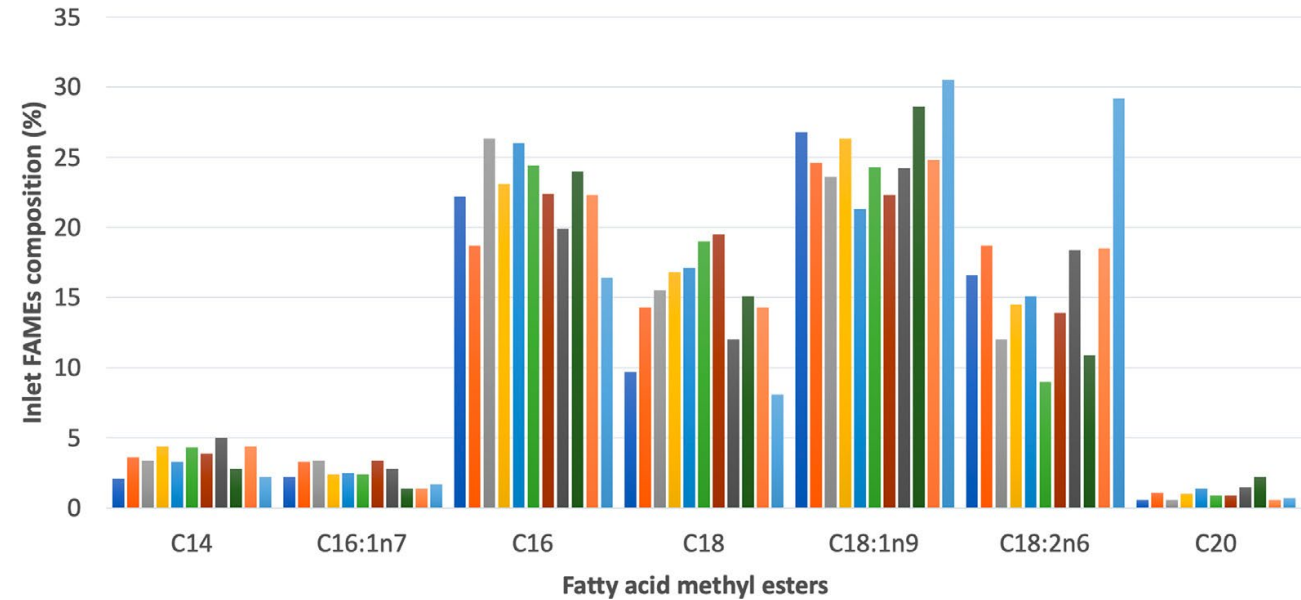
## Two possibilities:

- Larger STPs (> 25-30.000 PE) - part of lipids accumulated in activated sludge is converted to biogas in digestors and then used for **energy production**
- Smaller STPs – without digestion (lipids dissolved and partially degraded to CO<sub>2</sub>; part accumulated in sludge and then disposed) - **valuable resources being lost!**
  - **Additional costs for STPs (up to 65% of the total plant operational costs)**

**Majority of the lipid potential in sewage is currently not utilized!**

**Efficient valorisation of this waste (e.g., turning it into biodiesel) would eliminate costs conferred in its disposal, and in addition, would generate a net profit...**

- Daily load of lipids to municipal sewage:
  - 35 to 50 g/PE
  - 45 % of the lipids originates from faeces while 55 % from kitchen waste



- Most common lipids in the STP influent are C18:1 (oleic acid), C16:0 (palmitic acid), C18:2 (linoleic acid) – all known to be suitable for the production of biodiesel
- The range of LCFAs (>C12) in wastewater varies from 20 to 500 mg/l with an average value of 150 mg/l

## Overall potential:

- 50 g / PE per day = 18 kg lipids / PE per year
- In NW-Europe around 250 million people are connected to municipal sewage treatment plants
- Total load of lipids in the inflow of municipal wastewater treatment plants: 4.5 million tons per year in total
- In addition: industrial wastewater treatment plants...

## RED II (EU, 2018)

- Require fuel suppliers to deliver at least 14% of the energy consumed by transport from renewable sources

➤ **Impressive potential for biodiesel production from wastewater**



## First work on biodiesel production (Mondala et al. 2009):

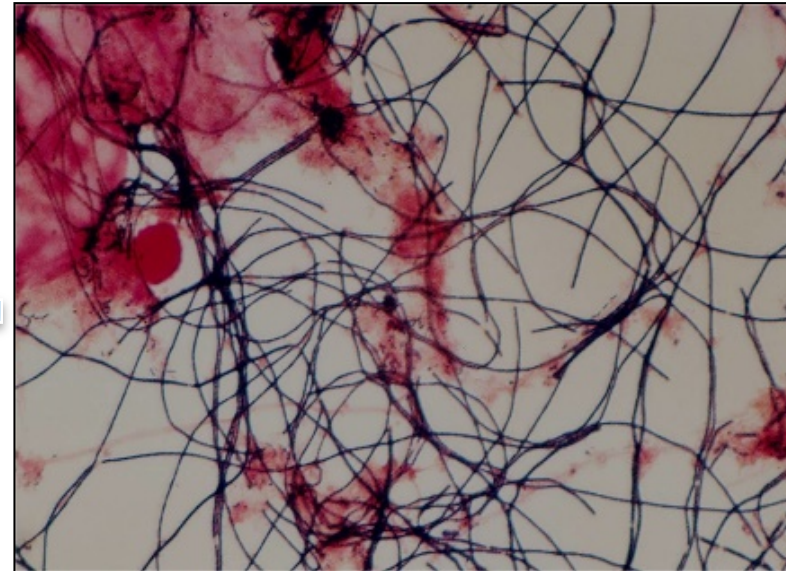
- Production of FAMEs (fatty acid methyl esters = biodiesel) from conventional sludge (primary and activated sludge) by chemical transesterification: biodiesel yield 10% FAMEs per dry biomass
- Estimated costs for production: 0.20 €/L biodiesel
- **Using biomass known to accumulate LCFAs is possible to increase the yield and to reduce the costs for biodiesel production**

# Conclusion – background for our lipid-pilot

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Bulking and foaming  
is a common **PROBLEM**  
in municipal WWTPs

*Microthrix parvicella* is  
known to be responsible for  
foaming and bulking

*Microthrix parvicella* can accumulate  
long chain fatty acids (LCFAs) that can  
be harvested for biodiesel production  
**OPPORTUNITY**

**Selection of *Microthrix parvicella* as a lipid accumulator in municipal WWTP for the production of biodiesel**

A microscopic view of a biological sample, likely a tissue section or a culture. The image shows a complex network of thin, light-colored fibers or cells, possibly collagen or a similar extracellular matrix component. There are numerous small, dark, granular structures scattered throughout the field, which could be nuclei, pigments, or other cellular components. The overall appearance is that of a dense, interconnected network of fibers and small particles. The text "Questions?" is overlaid in the center of the image in a bold, black, sans-serif font.

**Questions?**





# Short description of STP Audun-le-Tiche

Amélie Léger  
SIVOM de l'Alzette

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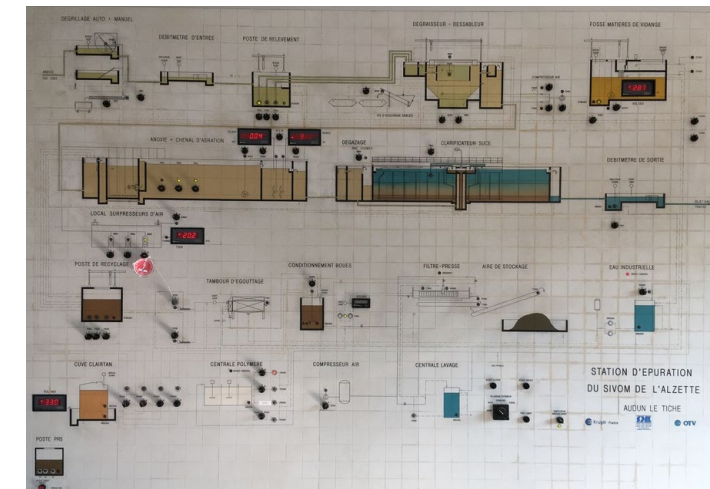
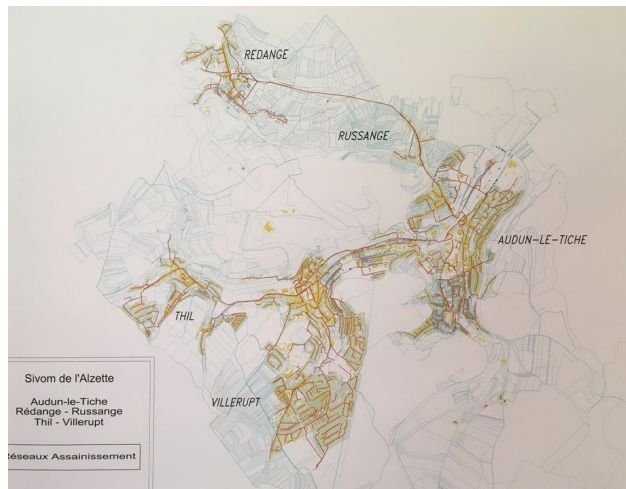
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# SIVOM de l'Alzette

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- STP collecting and treating sewage for ~20k people
- Located in Audun-le-Tiche (FR) close to Esch-sur-Alzette (LU)
- Connected villages Villerup, Audun-le-Tiche, Thil, Russange and Rédange
- 6 people working at STP under president and a board of 9 elected people from the area
- Sludge activated STP with aerobic sludge stabilisation
- Capacity 24500 PE
- Operated since 1997
- Combined sewerage system



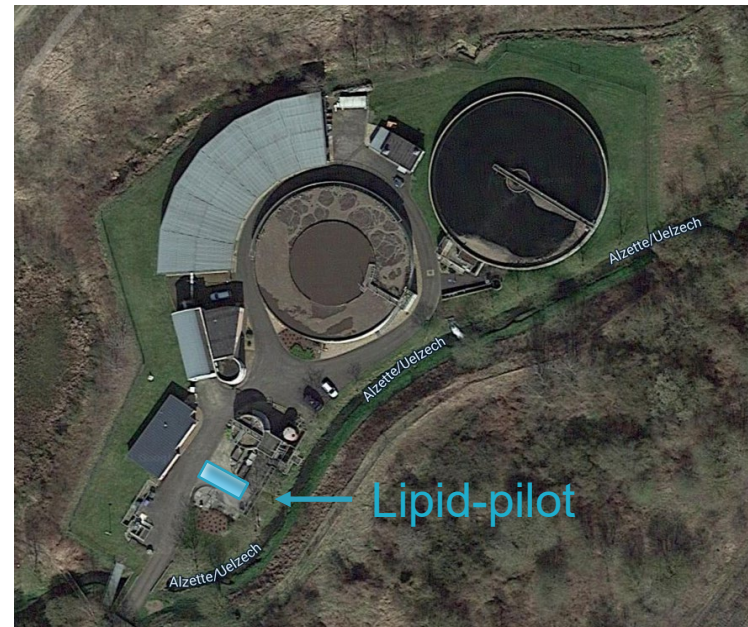
# SIVOM participation in WoW! Project

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## Lipid-pilot location at SIVOM

- Shipping container installed near the inlet channel of the STP
- Since 2018 ongoing research on the lipid accumulation from urban sewage to develop the technology (University of Luxembourg)
- Installation (tanks, sensors, pumps etc.) to verify the potential to produce biodiesel from urban sewage

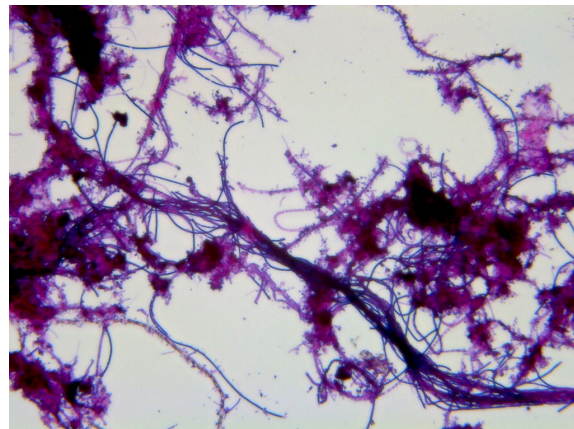


# Challenges to overcome

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- Authorization of the State services (police de l'eau)
  - Operational diagram of the pilot, design and functioning
  - Details of the lipid accumulation process
  - Possible impacts on the wastewater treatment processes
- Assurance that no filamentous bacteria will enter the biological basin
  - Limited risk (small size of the lipid-pilot; activated sludge already contains some filamentous bacteria)
  - Chlorine dose into the discharge tank to destroy filamentous bacteria before sending back to the water line
  - Any problems with filamentous bacteria since the pilot is in operation



# Practical difficulties with the pilot installation

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- Transportation and set-up
- Finding a suitable site to accommodate a 12 x 2.5m shipping container
- Maintaining access to all STP facilities
- Close to the STP inlet
- Flat surface
- Powering the pilot



A microscopic view of a biological sample, likely a tissue section or a culture. The image shows a complex network of thin, fibrous structures, possibly collagen fibers, and numerous small, dark, granular particles scattered throughout. The overall appearance is that of a dense, interconnected network of biological material. The text "Questions?" is overlaid in the center of the image.

Questions?