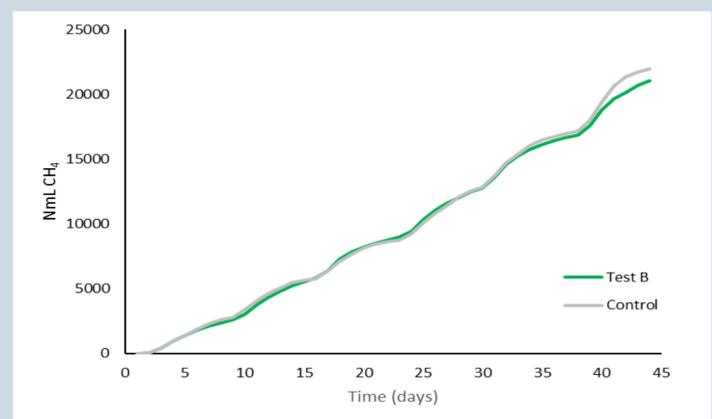
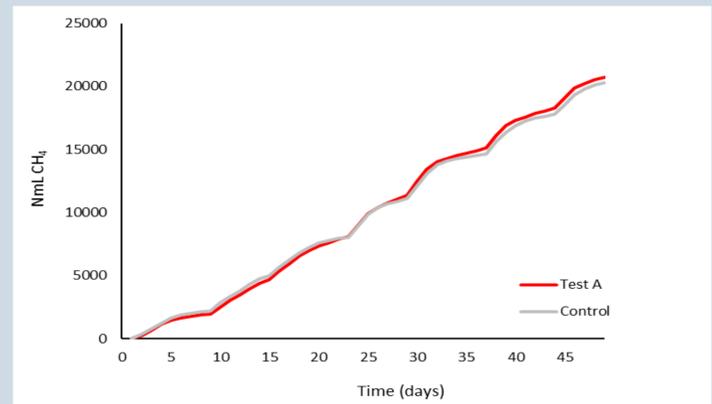


Anaerobic co-digestion is a suitable treatment for solid lubricant waste from steel wire drawing

Co-digestion of solid lubricant waste and municipal sewage sludge produces a specific amount of biomethane comparable to the one deriving from sewage sludge alone (around 400 NL/kg_{SV}). The resulting digestate has heavy metal concentrations complying with the Italian rules for agricultural use. Therefore, anaerobic digestion followed by agricultural use of digestate could be a sustainable option from both economic and environmental aspects to manage lubricant waste.



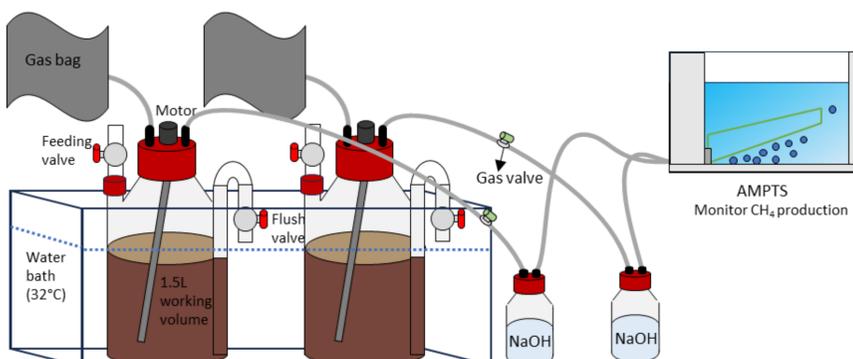
Introduction

In the framework of the **STAR** (Stearato dai processi di Trafilatura del filo di Acciaio come Risorsa) project, funded by the Italian Ministry of the Environment, the valorisation of **stearate based solid lubricant waste** from wire drawing process as an energy source is investigated.

As for anaerobic digestion, preliminary tests determined a biomethane production potential (BMP) in the range 500-900 L/kg_{VS}, much higher than the production from animal waste (around 400 L/kg_{VS}). On this basis, co-digestion of the waste with mixed sludge from wastewater treatment was tested in semi-continuous mode.

Materials and Methods

- **Hydraulic Retention Time:** 3 weeks
 - **Control:** mixed sludge from WWTP
 - **Test A:** mixed sludge + lubricant waste (10% VS)
 - **Test B:** mixed sludge + lubricant waste (20% VS)
- Lubricant waste accounted for 10% or 20% of the total VS in the test reactor feed, ensuring equal VS loading in test and control reactors
- **Organic Loading Rate:** 1 g_{VS}·L⁻¹·d⁻¹
 - **Automatic Methane Potential Test System** for real-time biomethane monitoring



- **weekly**, 0.5 L digestate were replaced with **fresh substrate**
- after 2 HRTs, **heavy metals** in the digestate were analyzed in duplicate by **ICP-OES**

The lubricant waste that underwent co-digestion was a composite **sample**, representative of the waste produced by nine wire drawing companies (174 tonnes/y).

Proximate analysis	%	std.dev.
Humidity	2.0	0.2
Volatile solids	55.0	2.7
Ashes	43.0	

Results

The cumulative biomethane production was > **20 NL** both with 10% (test A) and with 20% (test B) waste dose in 2 HRT, with no significant difference from the control.

In test A, the lubricant waste addition did not lead to heavy metal concentrations in the digestate exceeding the Italian regulatory thresholds set for agricultural use. Therefore, the use of digestate for agricultural purposes is not restricted under these conditions.

mg/kg _{dw}	Control		Test A		limit
Zn	67.20	62.40	234.30	261.60	2500 ^a
Cu	41.70	39.30	50.70	56.10	1000 ^a
Ni	16.80	14.40	19.20	21.60	300 ^a
Pb	7.50	5.70	10.80	11.70	750 ^a
Cr	8.10	7.50	9.60	10.20	200 ^a
Se	4.92	4.29	5.24	5.94	10 ^b
Cd	nd	nd	nd	nd	20 ^b

^a law 130/2018 ^b d.lgs. 99/1992