Implementing Circular Economy in the livestock sector by using purple phototrophic bacteria. SEMPRE-BIO and DEPURHOB approach

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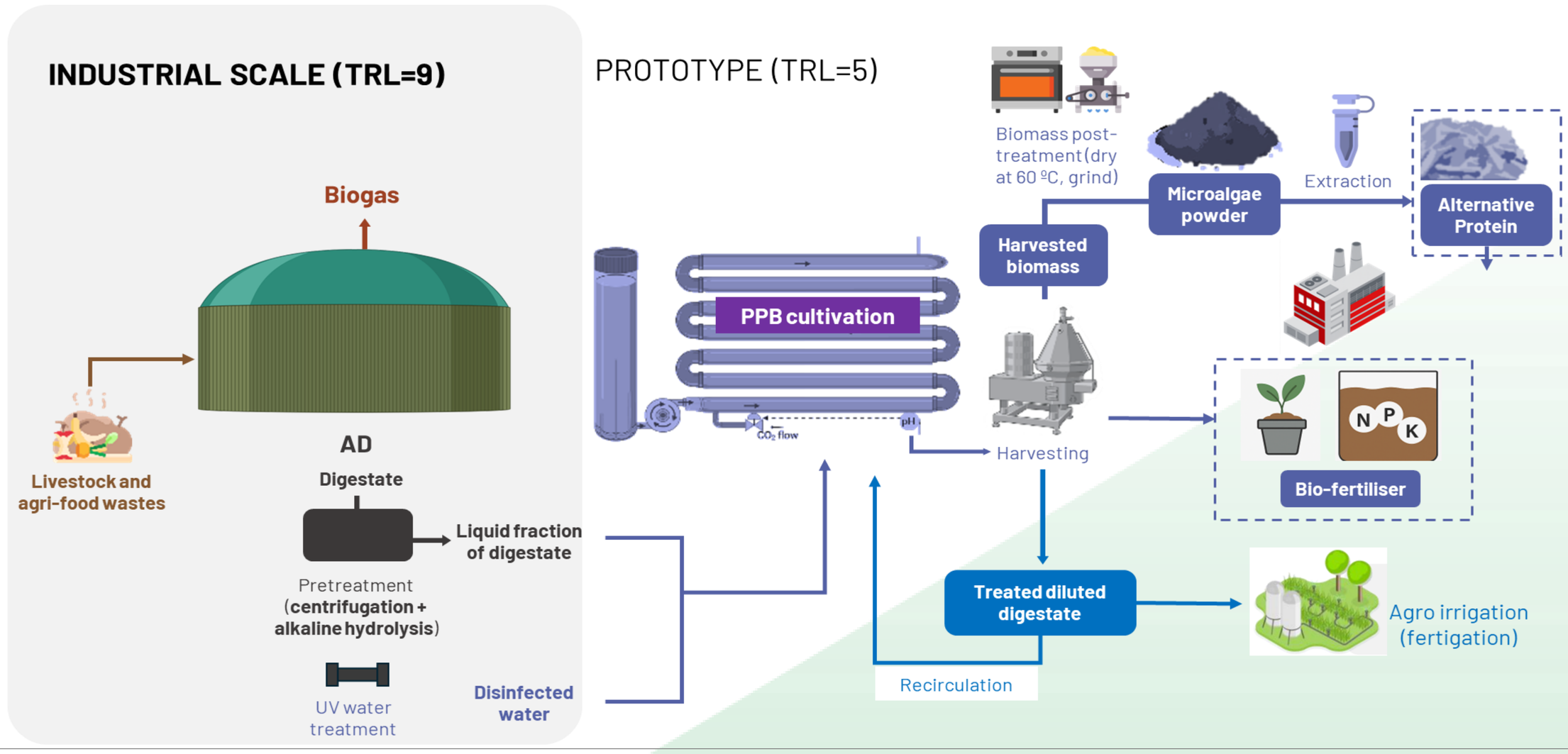
Introduction:

Anaerobic digestion (AD) is a sustainable technology for **livestock waste** management. AD poses the challenge of valorising **DIGESTATE** streams, which are rich in nutrients (N,P,K), but their mismanagement poses risks of diffuse pollution. The **SEMPRE-BIO** and **DEPURHOB** projects aim to develop sustainable bioprocesses based on **Purple phototrophic bacteria (PPB)** to contribute to **Circular bioeconomy** by producing **ALTERNATIVE PROTEIN** and **BIOFERTILISERS** from **food waste and livestock digestates**.



Main results:

PPB showed high growth rates in 10% (v/v) diluted digestate (up to 4.1 d^{-1}) and typical nutrient consumption (COD: N:P ≈ 100:7:2). But with 50% diluted digestate, growth rates decreased to 0.7–0.8 d^{-1}. Inhibitory factors such as increased pH (>8.7), high organic load (9.80–15.59 g COD·g VSS^{-1}), and accumulation of free ammonia (157–159 mg·L^{-1} $N\text{-}NH_3$) restricted the efficiency of the process.

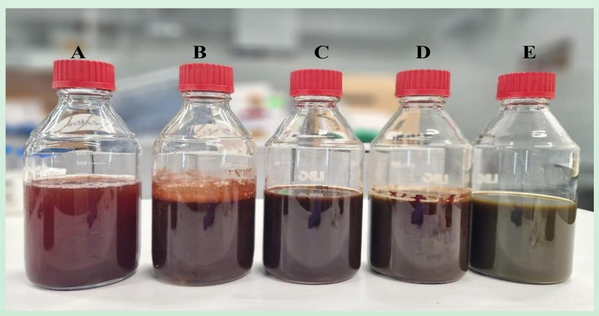


Fig. 1: PPB grown in diverse diluted digestate streams.

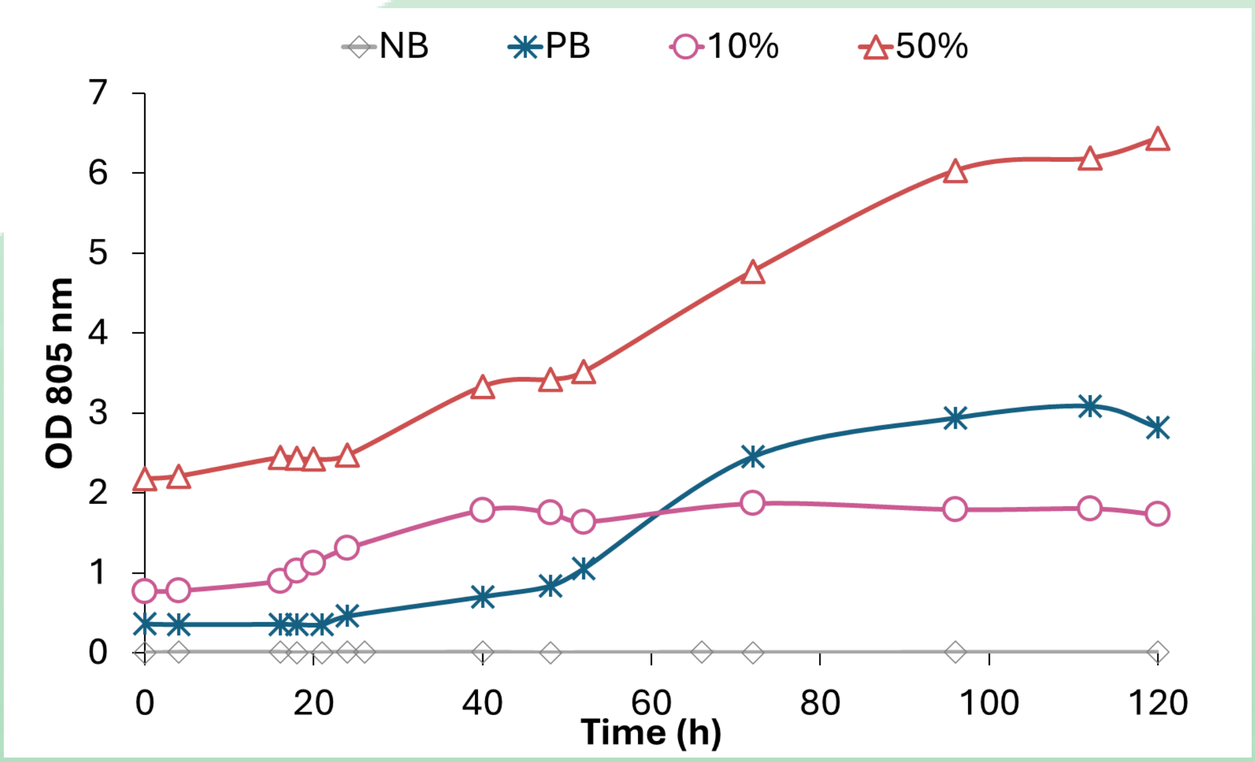


Fig 2. Growth curves at 805 nm for PPB cultures. NB: negative-blank. PB: positive-blank. 10%: digestate 10% v/v. 50%: digestate 50% v/v.

	N(%)	P2O5(%)	K2O(%)	Corg(%)
BP	6.4	1	2.8	33
10%	5.7	1	2.7	39
50%	4.8	0.9	5.7	27

Legal reguirements (Regulation 2019/1009): Corg>15%; N+P+K>4%

Future work:

- Process upscaling (outdoor)
- Testing fertilising capacity of PPB
- Legislative barriers of digestate
- Patent analysis
- Market analysis

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SEMPRE-BIO

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