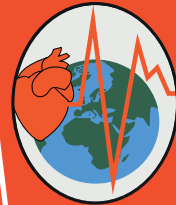
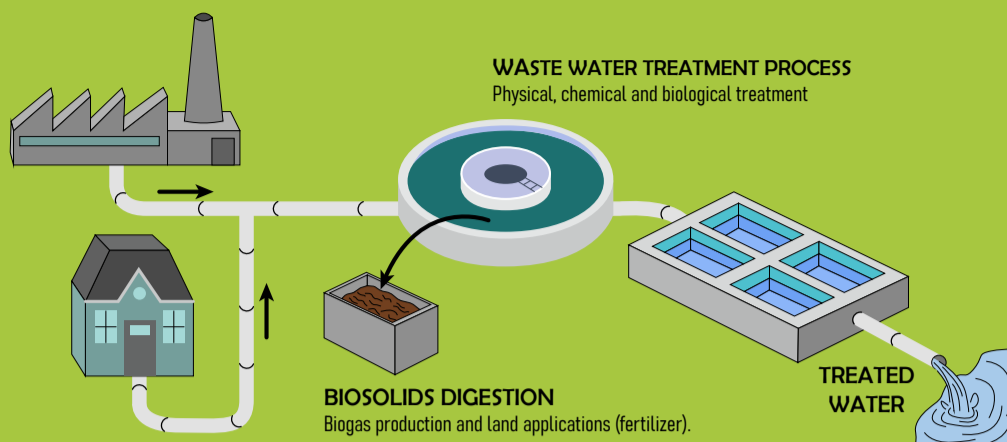


Impacts of engineered nanomaterials on wastewater treatment & biosolids valorization



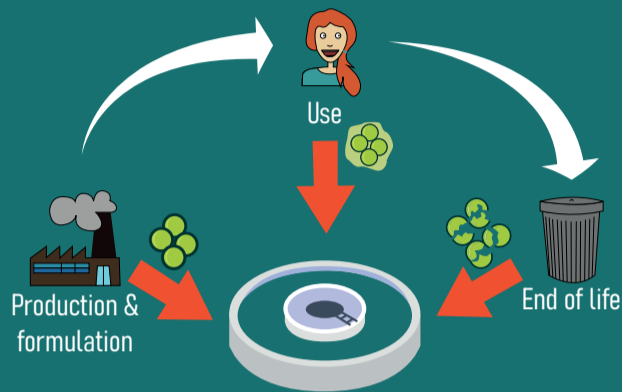
WASTE WATER TREATMENT PLANT OPERATIONS

The increasing use of engineered nanomaterials (ENMs) by industry and consumers leads to their release into waste water treatment plants (WWTP).



RELEASE OF ENMs AT SEVERAL STAGES OF THEIR LIFECYCLE

ENMs can enter the WWTP at different stages of the nano-product lifecycle:



Consequently the effect of both pristine ENMs (corresponding to the production stage), and aged ENMs likely to be released during the use or the end of life have been studied.

This project focuses on ENMs generated within SERENADE case studies:

Photocatalytic nano TiO_2 in paint

UV absorbent coated nano TiO_2 in sunscreen

Catalytic nano CeO_2 used as diesel additives

Antimicrobial nano Ag used in disinfectants

OBJECTIVE

Making sure that ENMs are efficiently treated in WWTP and that their presence does not disturb the chemical treatment of organic pollutants and biosolids digestion.

SEVERAL FEATURES ARE STUDIED

ENGINEERED NANOMATERIALS

- Aggregation
- Oxydo-reduction
- Dissolution

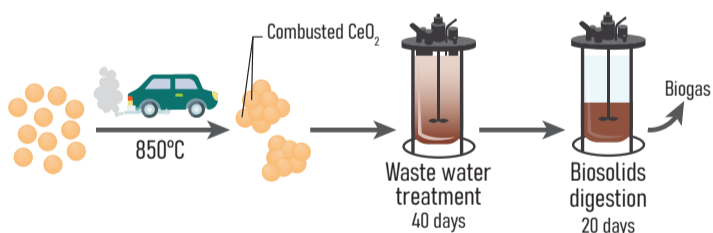
SLUDGE (BIOSOLIDS)

- pH
- Viscosity
- Microbial communities and activities
- Organic matter composition

SOME RESULTS OF THE PROJECT

Impact of CeO_2 ENMs on WWTP efficiency

CeO_2 engineered nanomaterials are used as a diesel additive. To mimic the release of diesel engines, CeO_2 ENMs have been combusted. The combusted CeO_2 is treated in bioreactors for several weeks.

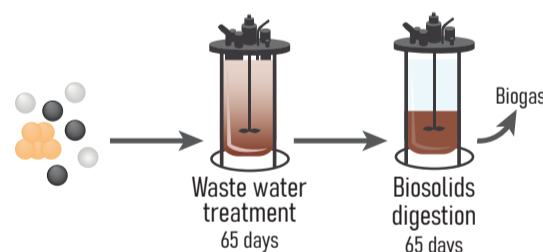


The CeO_2 ENMs did not impact the treatment of organic pollutants and both contaminants were efficiently removed from the treated water.

However the composition of the produced biogas is modified and the synthesis of methane during sludge digestion is impacted.

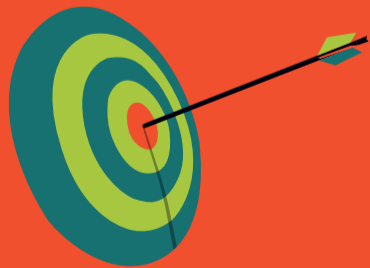
Impact of a cocktail of ENMs on WWTP efficiency

A cocktail of several ENMs (CeO_2 , Ag_2S and TiO_2) was injected in bioreactors for several months:



The cocktail did not impact the treatment of organic pollutants and all were efficiently removed from the treated water.

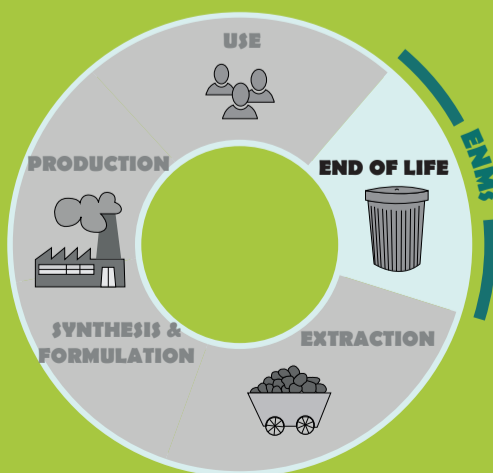
CeO_2 , Ag_2S and TiO_2 have strongly been accumulated in biosolids and the synthesis of biogas during digestion is impacted.



Whether the water is contaminated by CeO_2 ENMs or a cocktail of different ENMs, the efficiency of wastewater treatment plant is not impacted, ENMs and other pollutants are treated properly.

However the presence of ENMs may modify biogas production and the energetic valorization of sludge. Further experiments need to be performed.

LIFE CYCLE STAGES STUDIED



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