

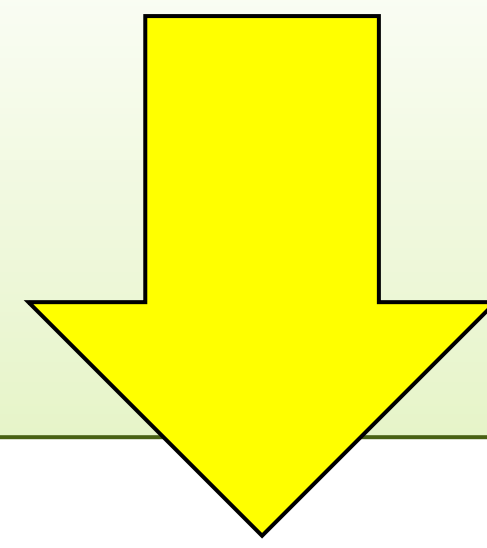
Monitoring and behaviour of organic pollutants in sewage sludge after the anaerobic digestion process

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Introduction

Emerging pollutants are receiving an increasing attention with respect to their toxicological properties and behaviour in the environment. They include compounds such as **additives**, **detergents**, **plasticizers**, **fungicide**, **pesticides** and **pharmaceuticals** that are not currently covered by existing water-quality regulations. Most of these pollutants end up in the environment after consumption and incomplete elimination in **wastewater treatment plants (WWTPs)**. Until now, research has mainly focused on monitoring these pollutants in influent and effluent wastewater, not paying attention to **sewage sludge**.



“Emerging Pollutants”



Plasticizers



Additives, detergents

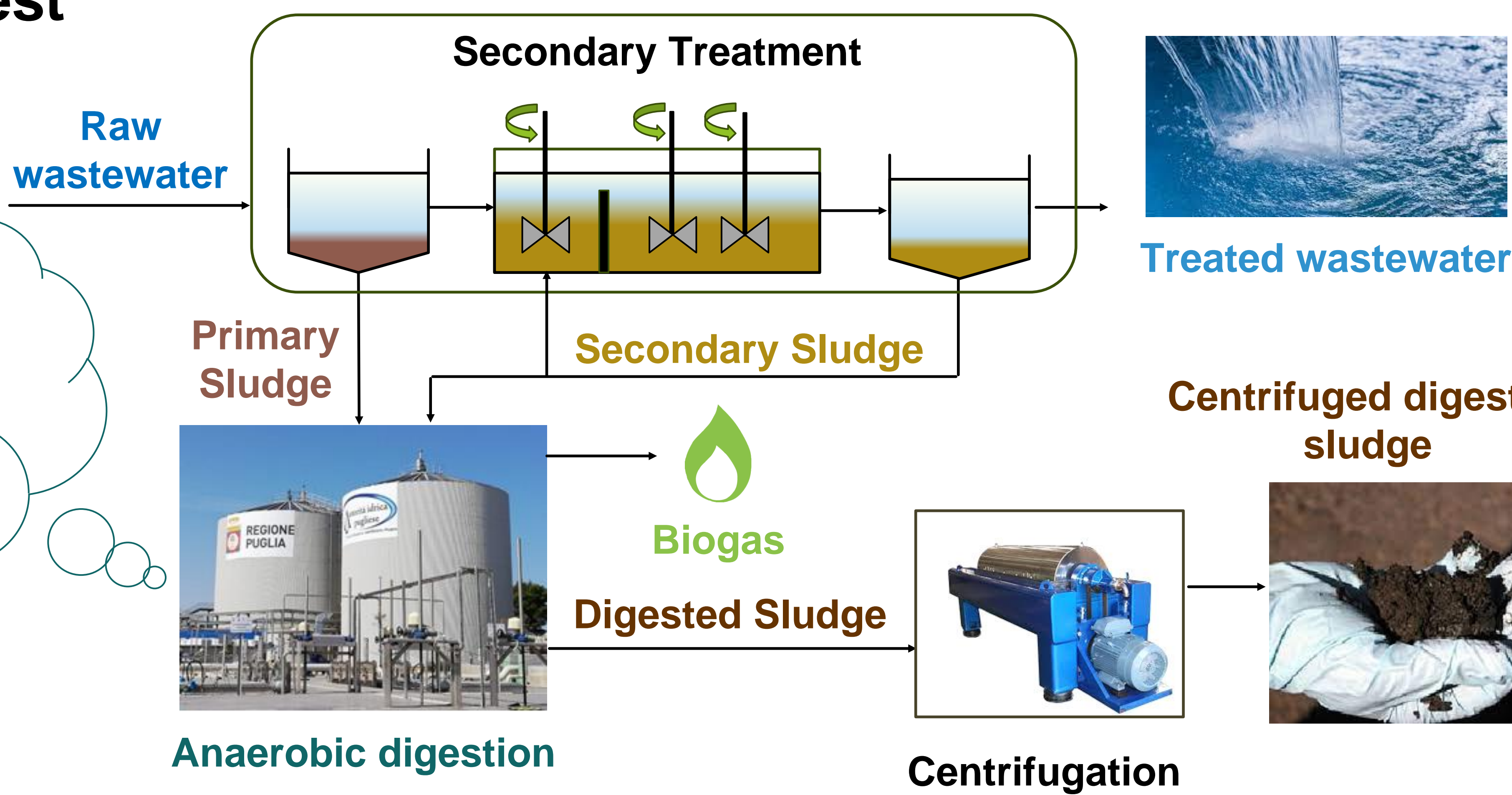
Fungicide pesticides



Pharmaceuticals

Sewage sludge is the final residue resulting from the WWTP from domestic, industrial or mixed settlements. One of the possible alternatives to landfilling is to use it as a soil improver for the benefit of agriculture. For these reasons, the European Union has developed a sector-specific regulation promoting and supporting the use of **sewage sludge in agriculture** as an alternative **to incineration or landfilling**

WWTP Bari Ovest



Anaerobic digestion has been widely used an effective biological treatment to stabilize organic substrates in sewage

However, due to the complexity of the samples, a detailed analysis protocol should be used to identify and quantify the organic pollutants before allowing their reuse

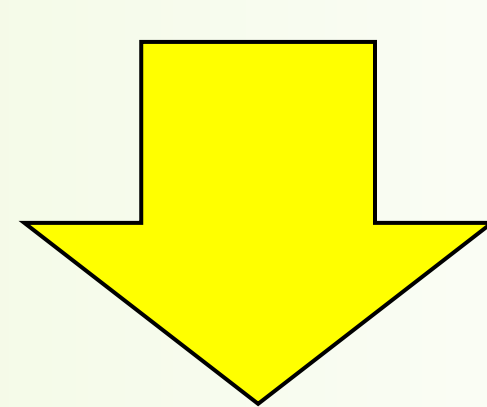
Use in agriculture

Emerging pollutants



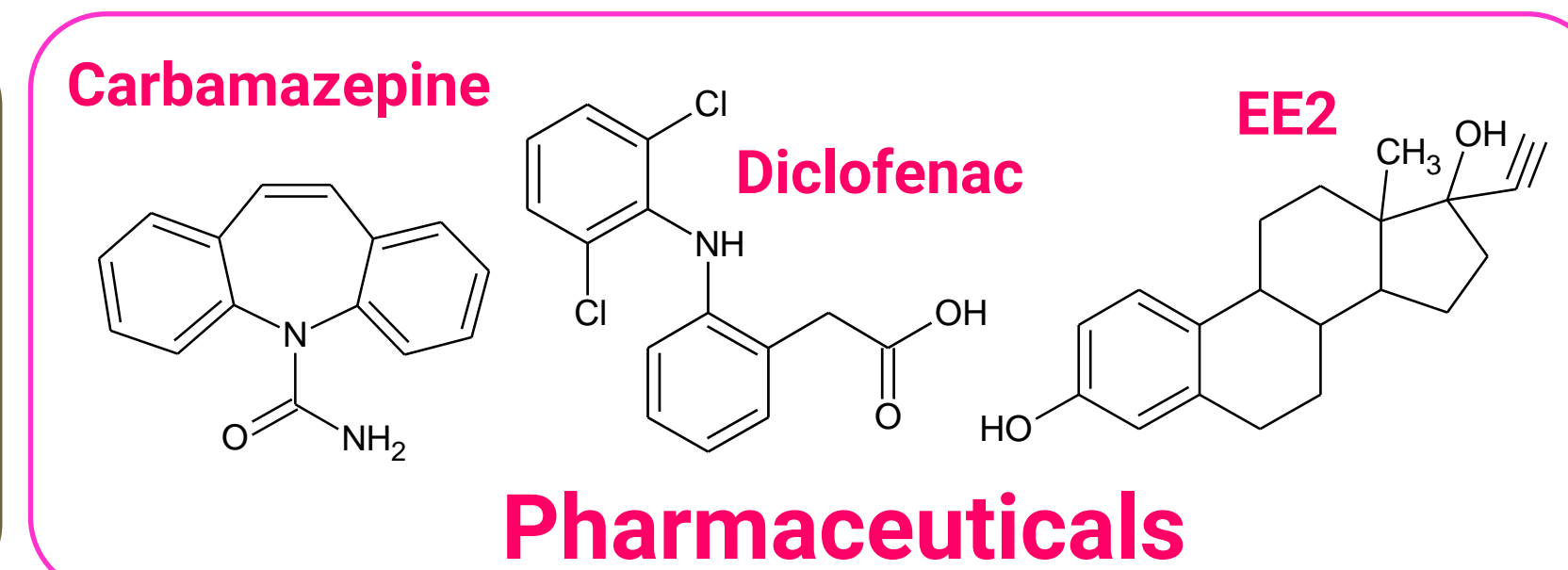
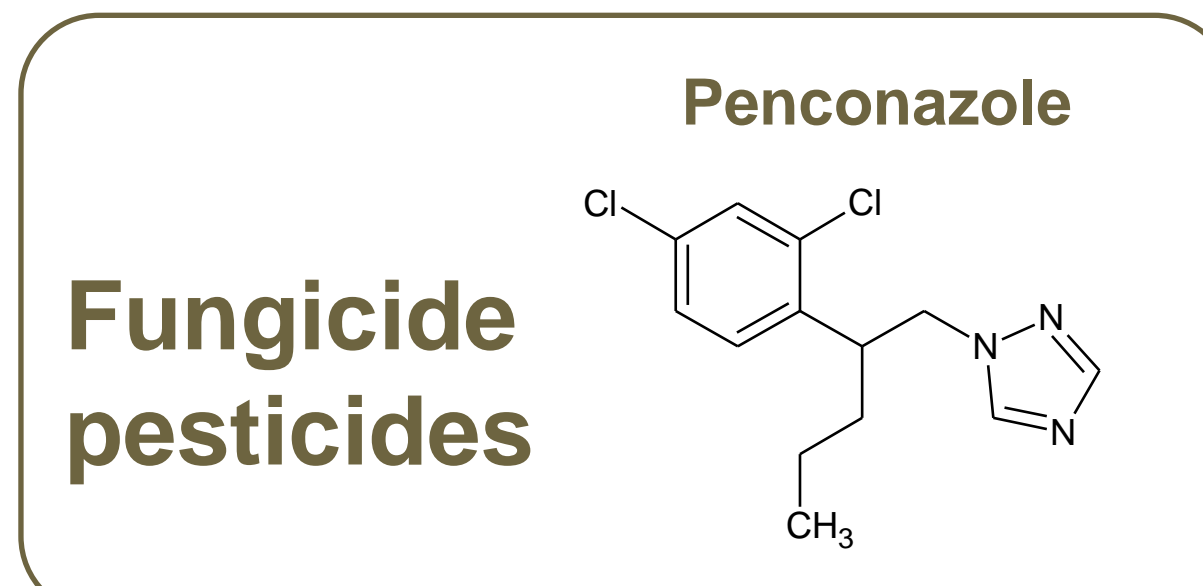
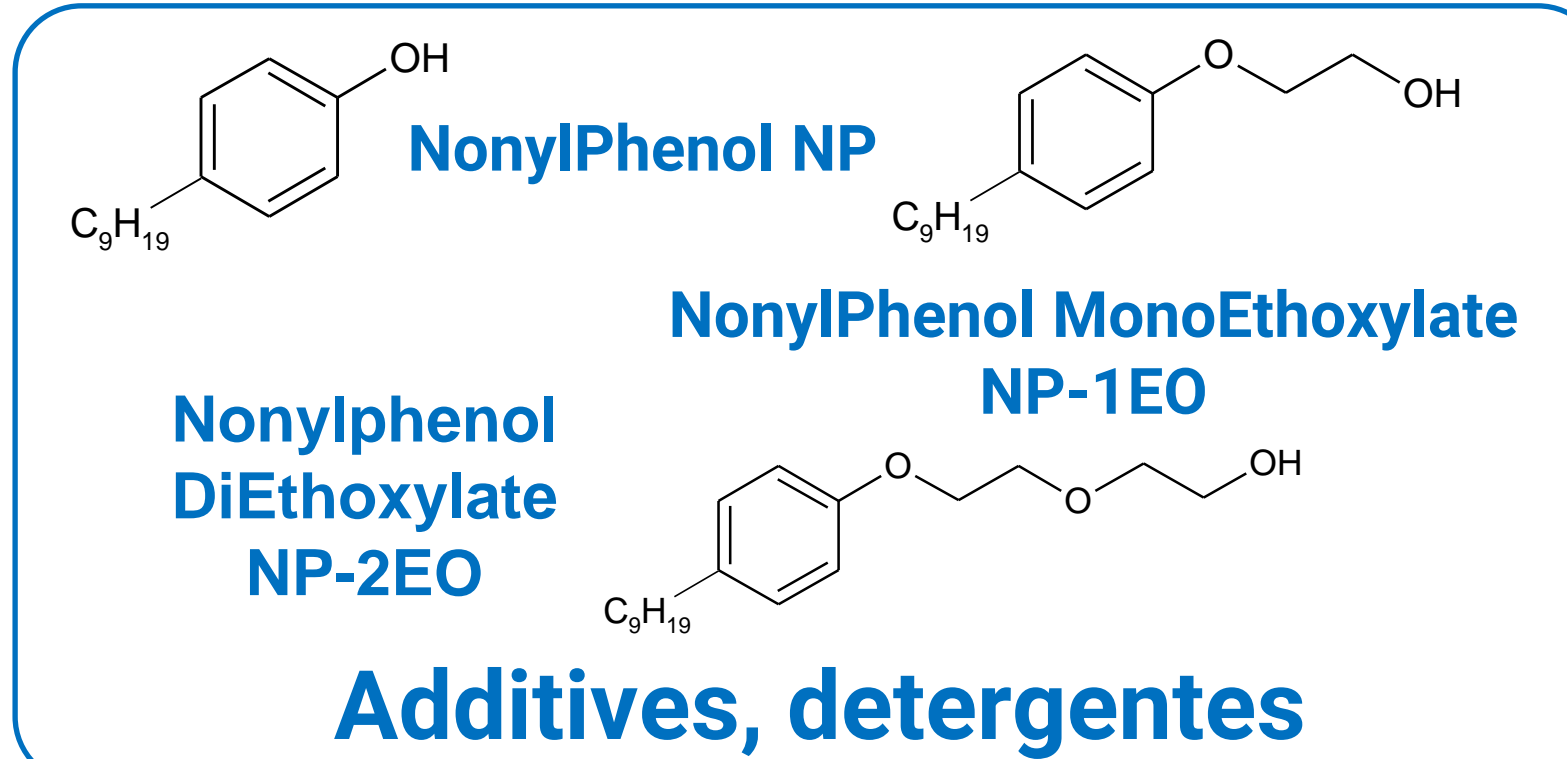
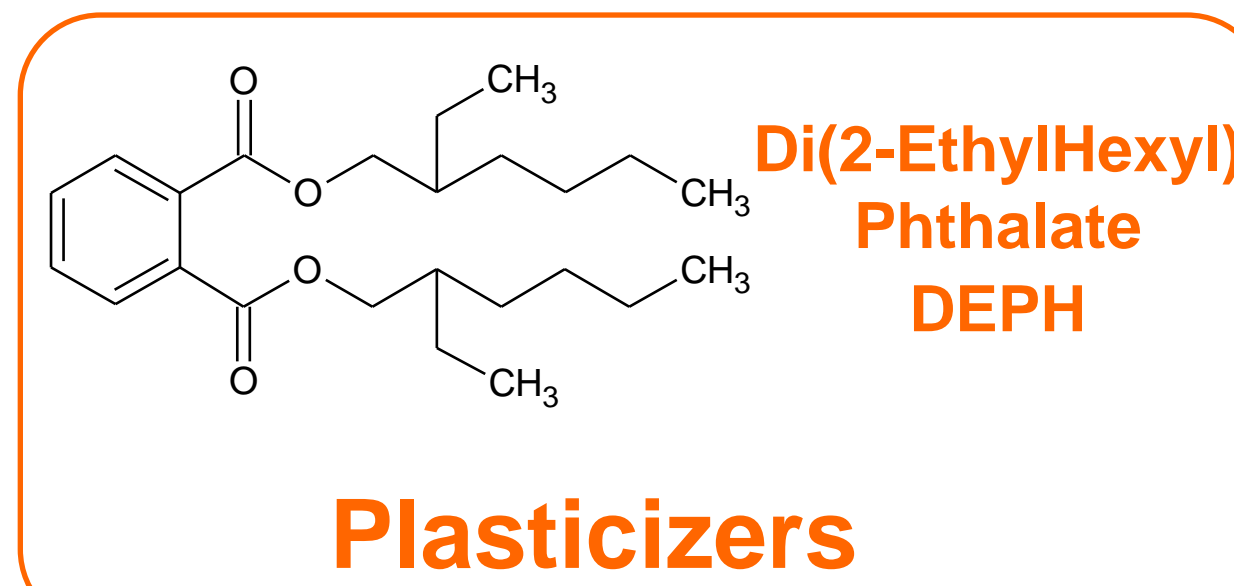
Aim of work

The aim of this work was to assess the behaviour and potential elimination of **organic pollutants** after anaerobic digestion in a sewage sludge treatment system



Primary Sludge and Centrifuged Digested Sludge obtained after the anaerobic digestion were screened by gas-chromatography coupled to mass spectrometry (GC-MS) for the identification and quantification of major organic pollutants present

“Emerging Pollutants”



Results and discussion

Analysis of “emerging pollutants” for Primary and Centrifuged Digested Sludge

Emerging pollutants	Concentration dry sludge (ppm)	
	Primary sludge	Centrifuged Digested sludge
Nonylphenol (NP)	22.4 ± 0.1	27.2 ± 0.1
Nonylphenol Monoethoxylate (NP-1EO)	3.0	3.9
Penconazole	< LOD	< LOD
Carbamazepine	< LOD	< LOD
Diclofenac	< LOD	< LOD
Nonylphenol Diethoxylate (NP-2EO)	6.2 ± 0.1	8.6 ± 0.1
Diethyl hexyl Phthalate (DEHP)	53.6 ± 0.1	63.7 ± 0.1
17α-Ethynylestradiol (EE2)	< LOD	< LOD

LOD = 50 ppb

Increasing concentrations in digested sludge



Nonylphenol (NP), Nonylphenol Monoethoxylate (NP-1EO), Nonylphenol Diethoxylate (NP-2EO) and Diethyl Hexyl Phthalate (DEHP) have been identified as the main contaminants present

Most of the pollutants analysed showed an increase in their concentration after the anaerobic digestion, indicating that they were preferentially adsorbed on solid particles without being subjected to any degradation process.

Conclusions

In this work, the concentrations of the main organic pollutants were detected in the primary and digested sludge obtained from the WWTPS of Bari Ovest. Increasing their concentrations in digested sludge highlights that the anaerobic digestion is not sufficient to remove the contaminants present that remain adsorbed on the sludge surface. Further integrated processes will be developed to promote their degradation.

Acknowledges



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