Spring 6-11-2014

Liquid waste treatment: can combined biological processes be really effective?

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Wastewater and Biosolids Treatment and Reuse: Bridging Modeling and Experimental Studies
June 8-14, 2014 Otranto, Italy

?? Liquid waste ??

According to the Italian legislation:
Industrial wastewaters conveyed to a treatment plant **by road** and not by sewage networks

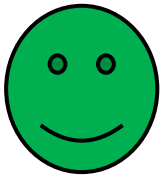
?? Liquid waste ??

Qualitative characteristics extremely variable:

- ✓ High concentration of biodegradable organic matter (e.g.: food industries)
- ✓ High content of heavy metals (e.g.: metallurgical industries)
- ✓ Surfactants (e.g.: detergent's production industries)
- ✓ Leachate from landfills
- ✓ …

Appropriate treatment

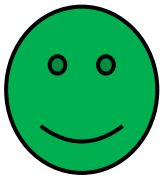
1. Physico-chemical processes



Specific treatment for specific pollutants

Complex management and costs of reagents

2. Biological processes



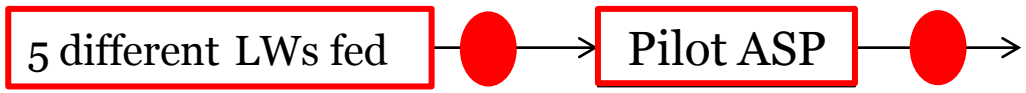
Economic benefits and better management

Inhibition of bacteria activities

Aim of the research

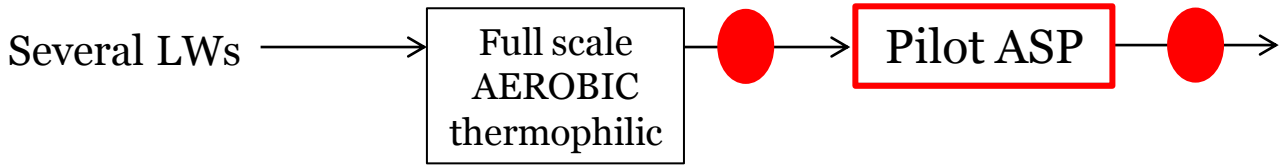
Verify the effectiveness of combined biological processes:

1. Single mesophilic (AS) treatment



2. UASB – mesophilic (AS)

3. Thermophilic – mesophilic (AS)

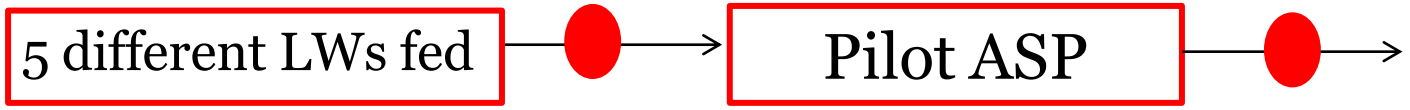


Methodology

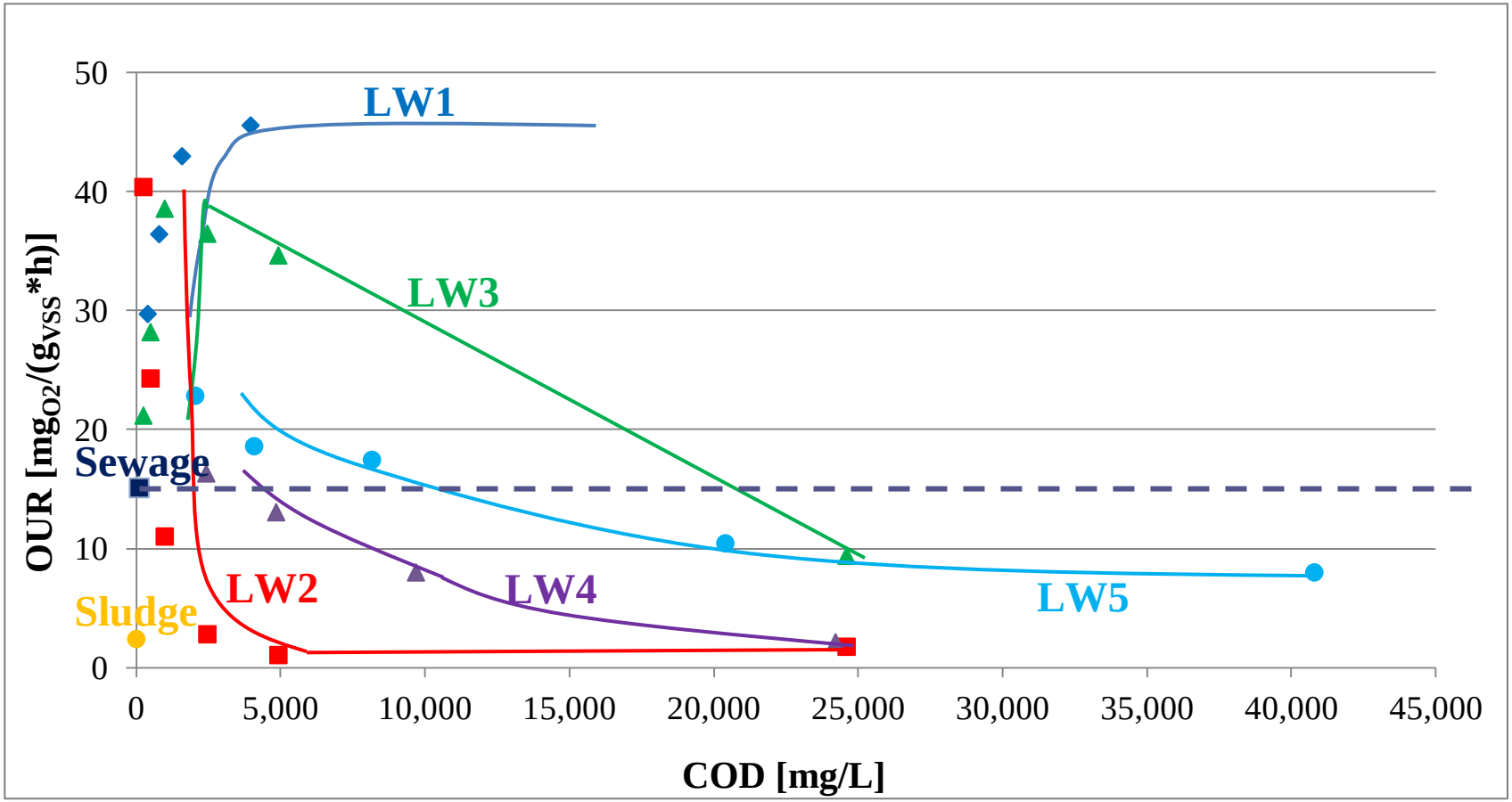
Methodology

Parameter	Liquid waste / effluent	Inlet	Oxidation reactor	Outlet
COD	✓	✓	✘	✓
BOD_5	✓	✓	✘	✓
Ammonia	✓	✓	✘	✓
Nitrates	✓	✓	✘	✓
Nitrites	✓	✓	✘	✓
Phosphorus	✓	✓	✘	✓
OUR test	✓	✓	✘	✓
AUR test	✓	✘	✘	✘
DO	✘	✘	✓	✘
pH	✓	✓	✓	✓
T	✓	✓	✓	✓
TSS	✘	✘	✓	✘
VSS	✘	✘	✓	✘
Analysis	Once	Biweekly	Biweekly	Biweekly

First scenario:
single mesophilic treatment

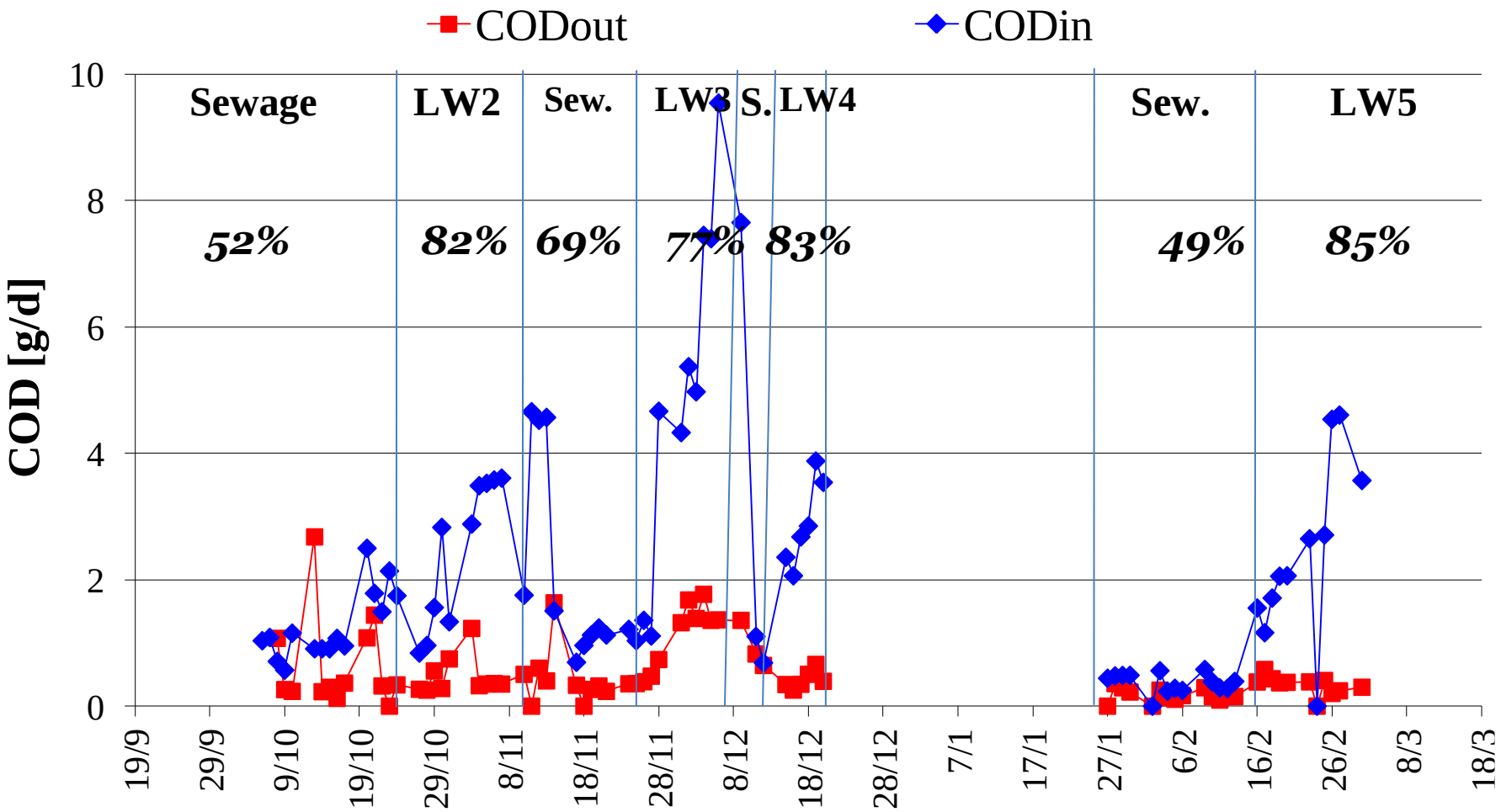


First scenario: single mesophilic treatment

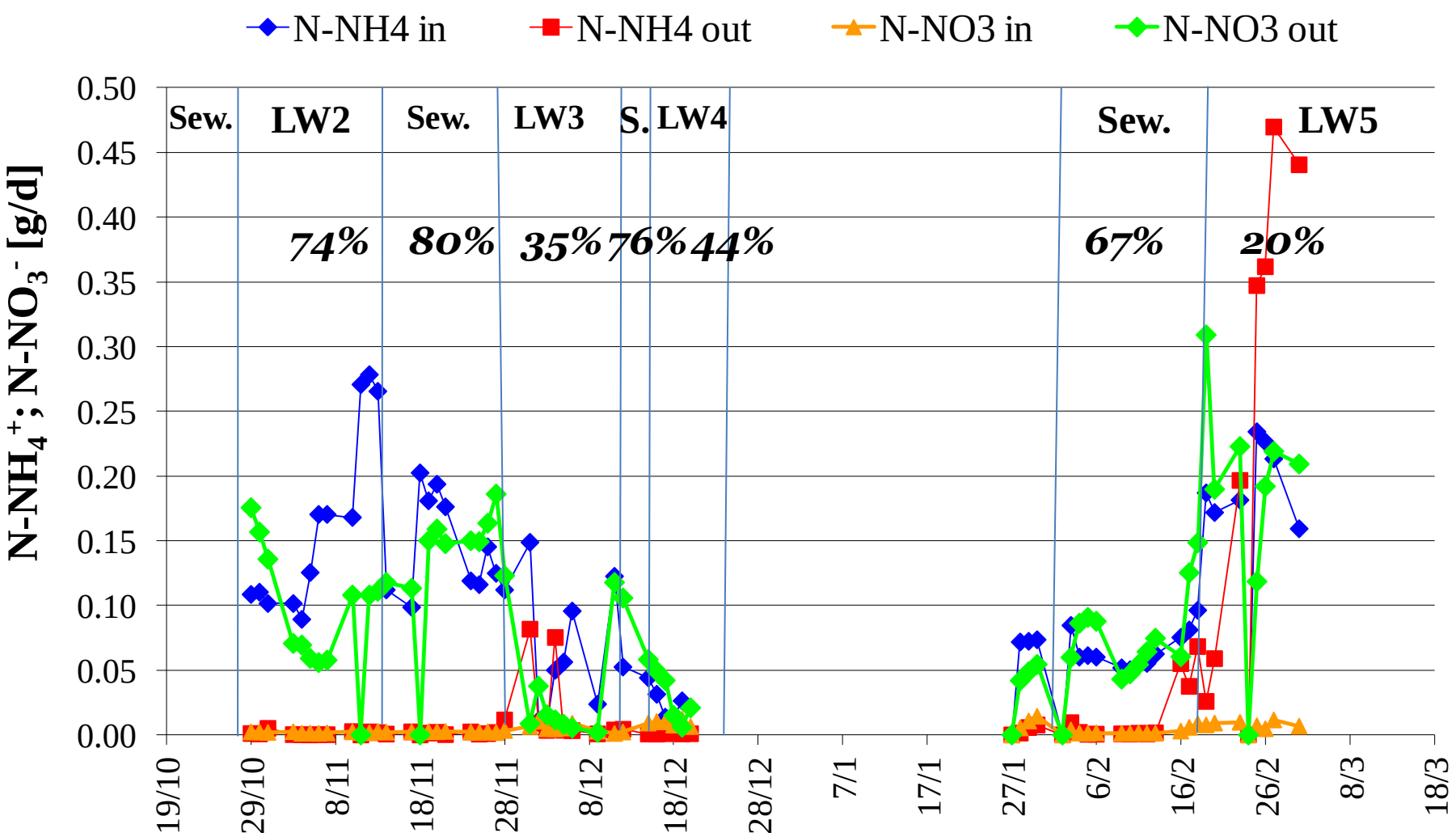


LW1: wash water from liquid waste storage tanks
LW2: chemical industry
LW3: metal industry
LW4: pharmaceutical industry
LW5: coal industry

First scenario: single mesophilic treatment



First scenario: single mesophilic treatment



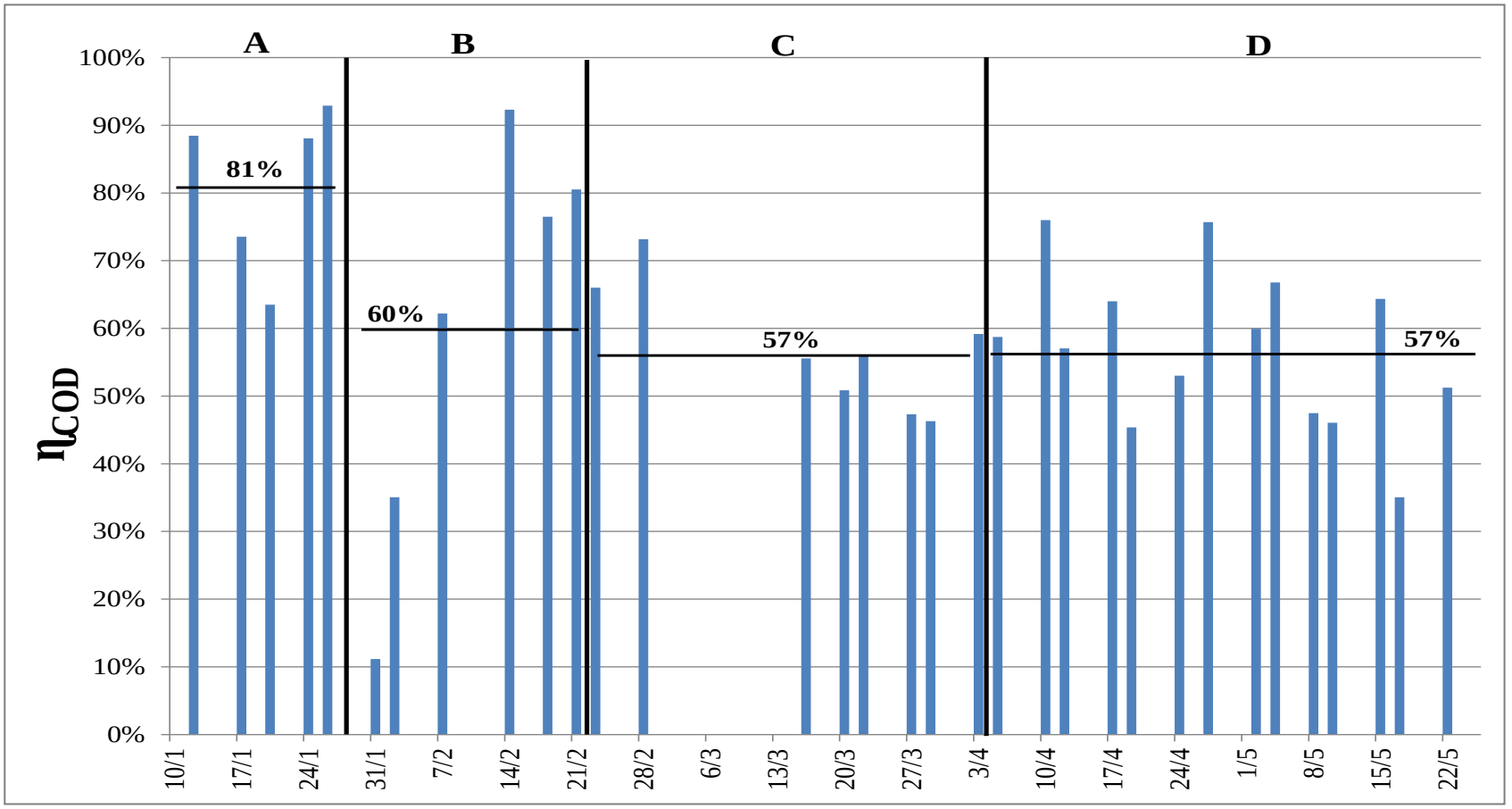
First scenario: single mesophilic treatment

LW	BOD_5/COD	OUR	AUR	Pilot ASP
1	0.23		-	-
2	0.49	 (1:50)	 (1:10)	
3	0.30	 (1:10)		
4	0.16	 (1:100)		
5	0.22	 (1:50)		

Second scenario:

UASB – mesophilic treatment

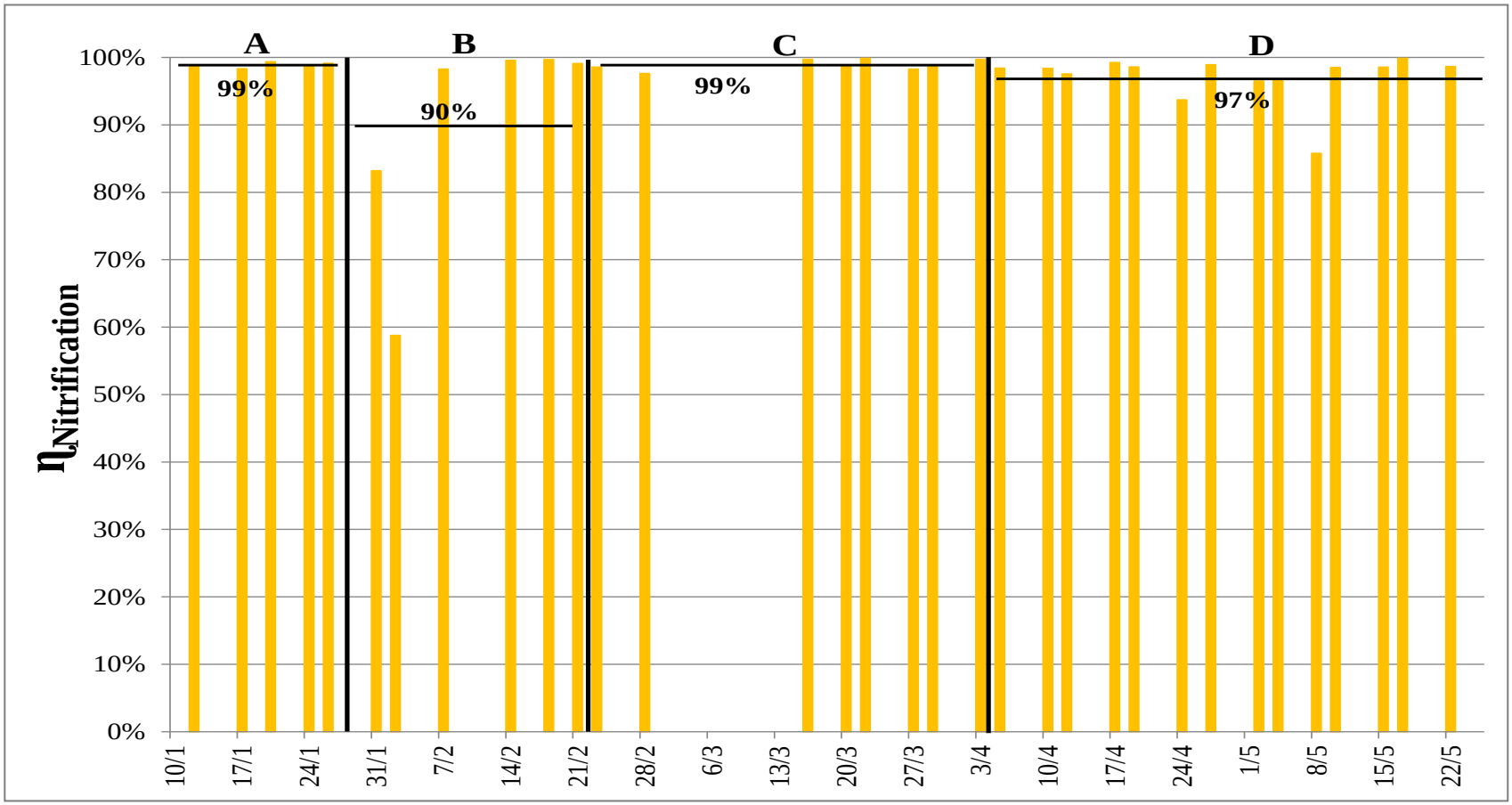
Second scenario: UASB + mesophilic



A: 100% sewage **B**: 70% sewage + 30% UASB effluent **C**: 40% sewage + 60% UASB effluent

D: 100% UASB effluent

Second scenario: UASB + mesophilic



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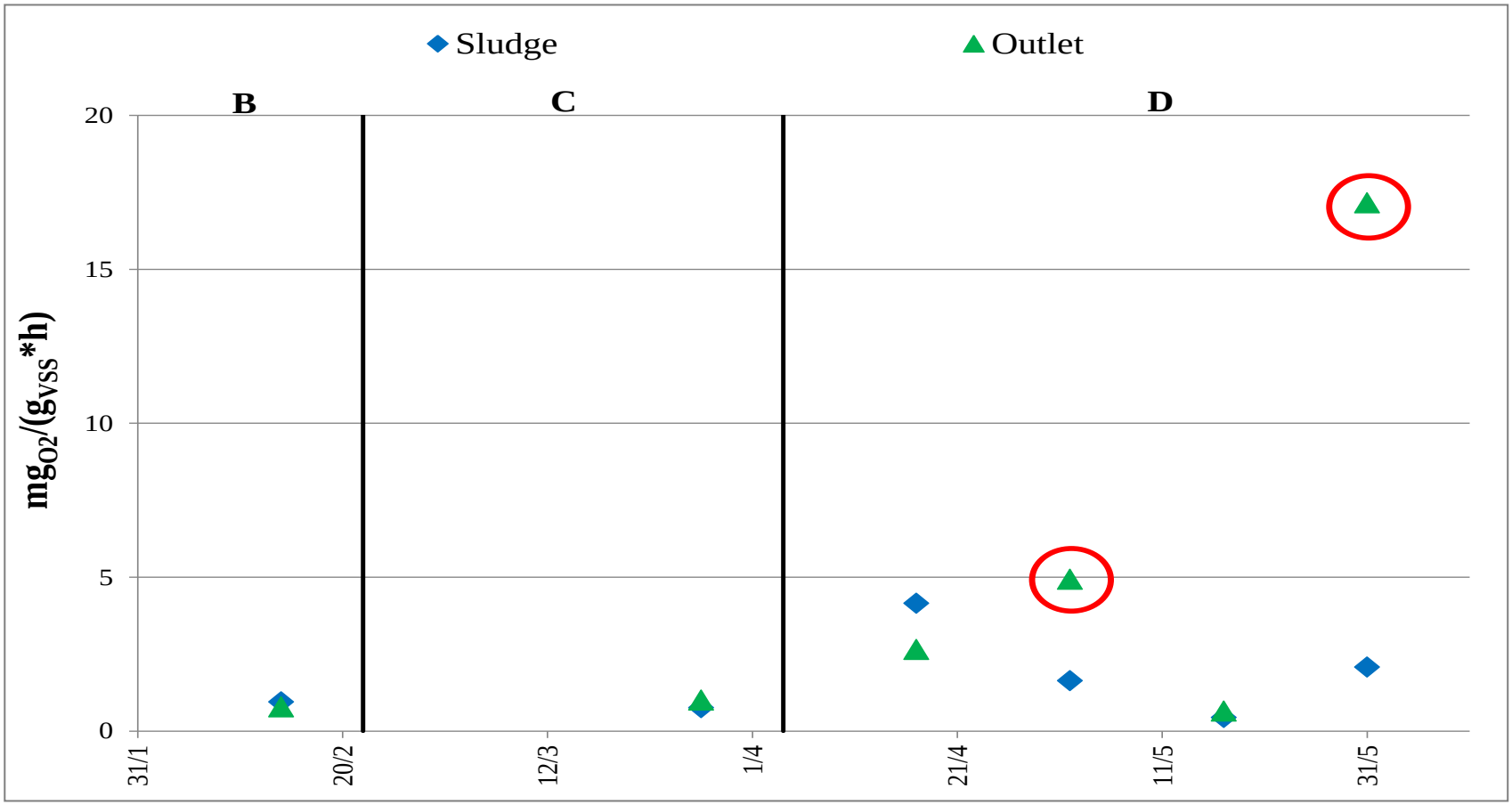
Second scenario: UASB + mesophilic

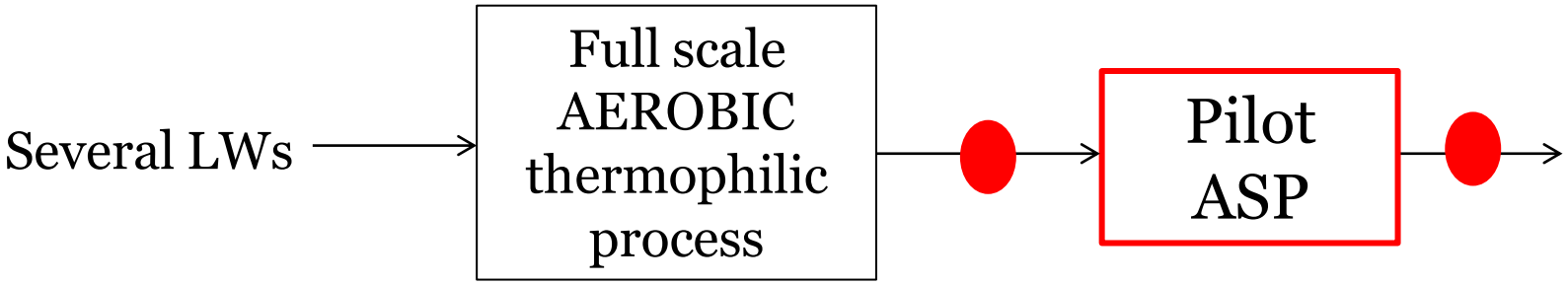


A: 100% sewage **B**: 70% sewage + 30% UASB effluent **C**: 40% sewage + 60% UASB effluent

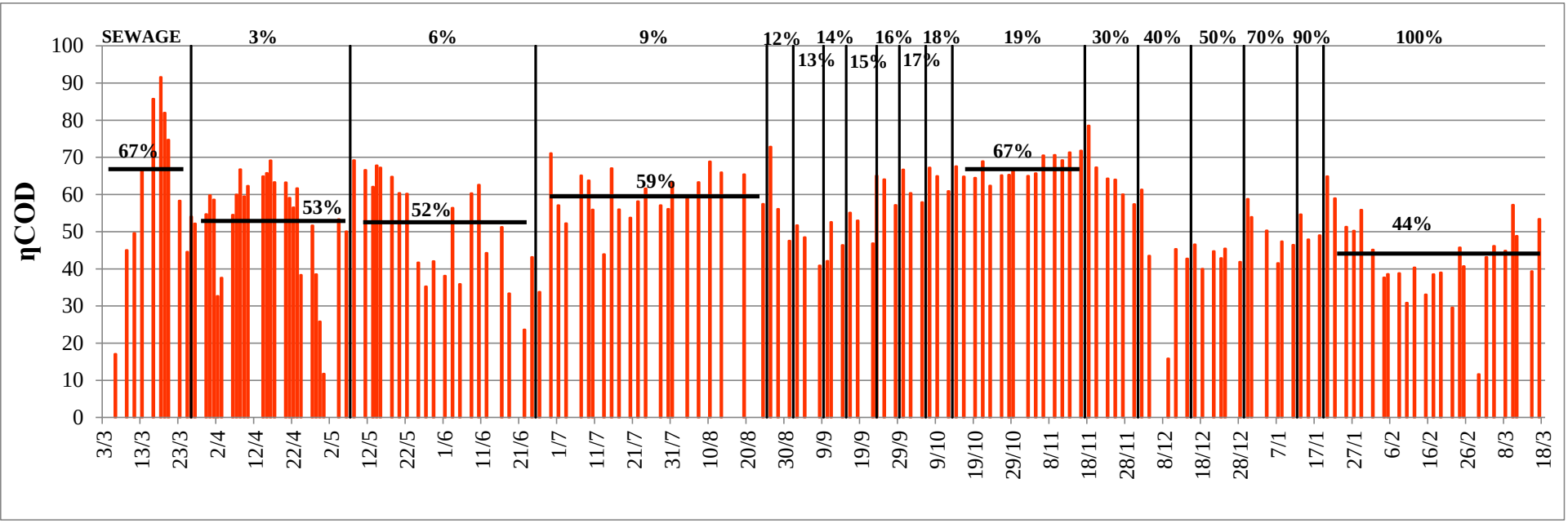
D: 100% UASB effluent

Third scenario:

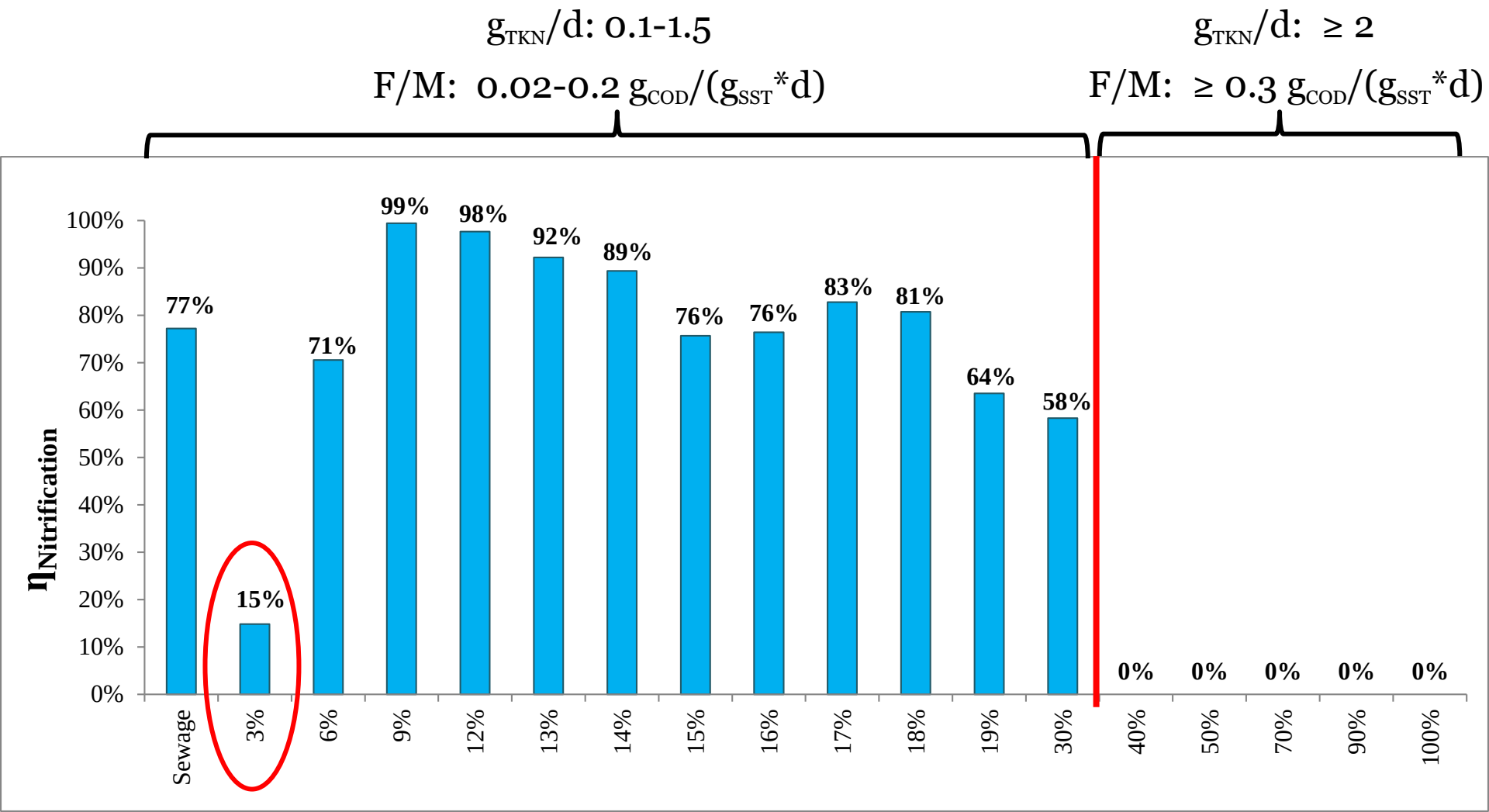
thermophilic – mesophilic treatment



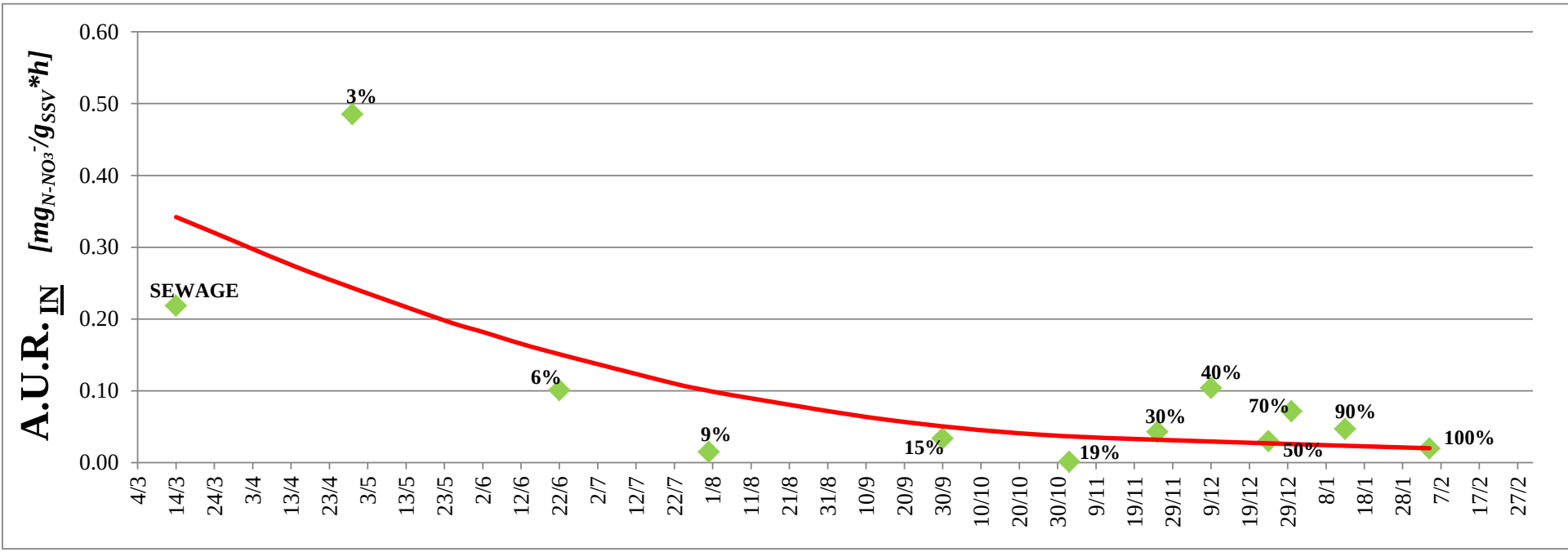
Third scenario: thermophilic + mesophilic



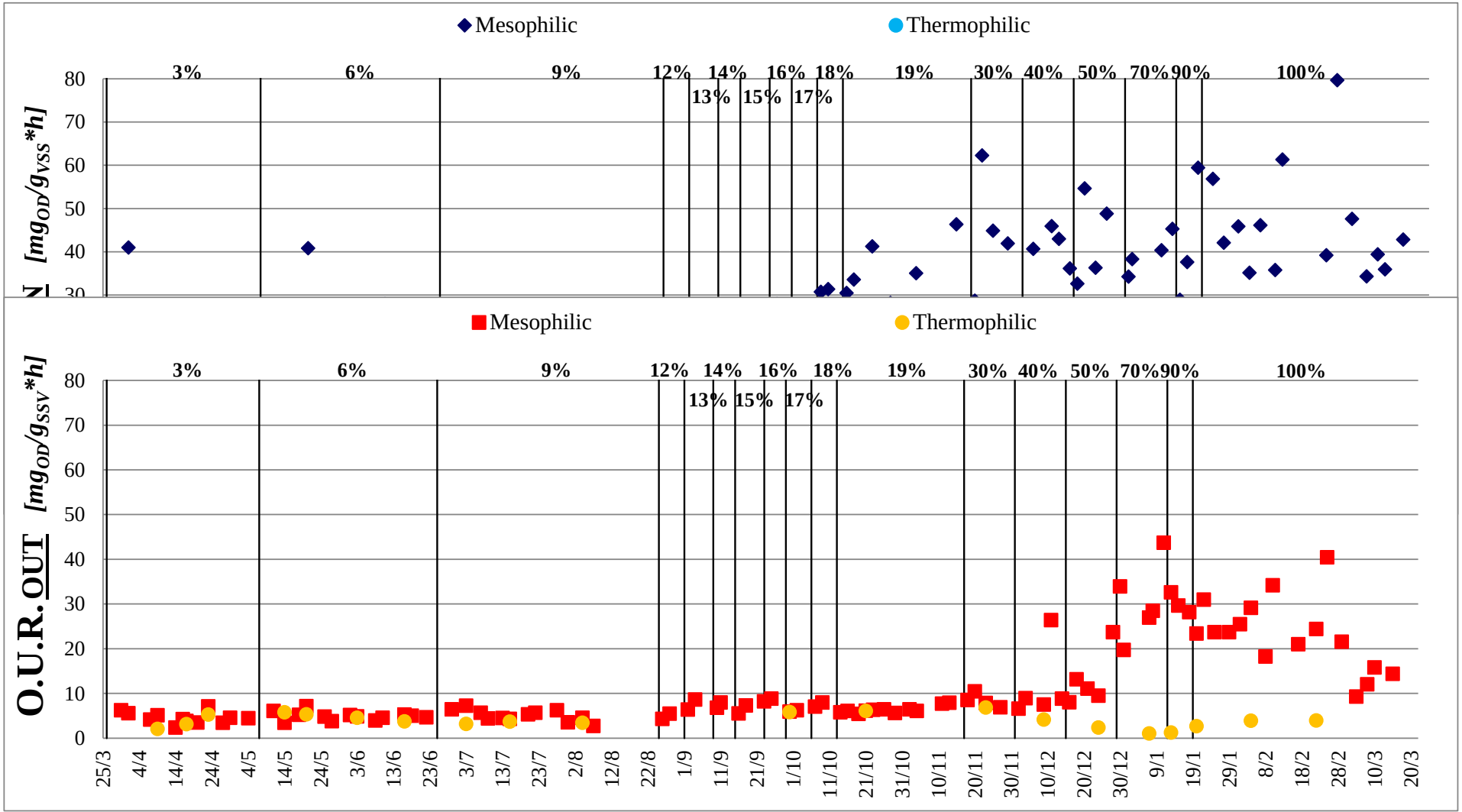
Third scenario: thermophilic + mesophilic



Third scenario: thermophilic + mesophilic



Third scenario: thermophilic + mesophilic



Conclusions

- **1st scenario** clearly determined as heterogeneous characteristics of liquid wastes are often a limiting factor for biological treatment. OUR and AUR tests demonstrated to be extremely useful for highlighting the possible inhibition of the activated sludge.

- **2nd scenario** highlighted as the synergy amongst UASB and ASP was effective. Even feeding the 100% of UASB effluent, the ASP did not show relevant criticisms in the removal of both COD and ammonia.

- **3rd scenario** provided interesting results regarding the synergy of advanced and conventional processes. This combination demonstrated to be really effective for the treatment of liquid wastes as long as the feed water was characterised by 30% of thermophilic effluent and 70% of sewage wastewater (above this ratio, nitrifying bacteria were inhibited, despite a slight decrease of COD removal).

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Thanks for your attention!!!