## A Novel Hybrid Coagulation-Intermittent Sand Filter for the Treatment of Dairy Wastewater



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# Introduction

Increasing herds size led to increase in dairy wastewater (DWW) volumes in farms Current disposal method of Land application is not sustainable and causing pollution to water bodies Therefore, Treatment and reuse may be is a sustainable option Intermittent sand filter (ISF) is a potential treatment Aimed to :

✓ Use ferric chloride (FeCl3) in a coagulationsedimentation process as a pre-treatment step for ISFs Assess this combined pilot-scale coagulation-ISF system for DWW treatment and compare to a conventional ISF system (without pre-treatment) Compare indicators of clogging for this hybrid system to the conventional ISFs (without pre-treatment), using

**Objectives** 

method for DWW, however it has shortcomings such as: clogging, phosphorus breakthrough, large surface area

a range of physical and chemical analyses.

### **Materials and Methods**



Table 1. Experimental phases and conditions						
Operation	Phase	Weeks	Waste	OLR	HLR	Dosing
			source	(g m <sup>-2</sup> d <sup>-1</sup> )	(L m <sup>-2</sup> d <sup>-1</sup> )	frequen
mode				Mean ± SD	Mean ± SD	cy
Same OLR	1	4	Raw DWW	30 ± 6	6 ± 1.5	4
		1 to 7	Supernatant	30 ± 6	$20 \pm 4$	
	2		Raw DWW	15 ± 5	$3.0 \pm 0.75$	4
		8 to 29	Supernatant	15 ± 5	10 ± 2	
Same HLR	3		Raw DWW	55 ± 8	10 ± 2	4
		30 to 35	Supernatant	15 ± 5	$10 \pm 2$	
	4	36 to 43	Raw DWW	$110 \pm 10$	$20 \pm 4$	8
			Supernatant	30 ± 6	20 ± 4	

Performance of ISFs were monitored weekly for COD, TSS, TP, TN Moisture continent of sand layers was also monitored weekly

Fig 1. Experimental set-up: A) Schematic view of raw DWW system; B) Schematic view of supernatant system.

- At the end of experiment, all filters were dismantled, and the properties of the sand were characterised in 0.05 m increments to a total depth of 0.25 m below the sand surface to check clogging.



#### Fig 2. System performance: (COD,TSS, turbidity, TP)

Fig 4. SEM at the surface of ISFs (50x): a) virgin sand (control), b) supernatant ISFs, and c) raw DWW ISFs

### Discussion

- The coagulation-ISF produced better effluent quality ••• than conventional ISF (complied with EU directives)
- The coagulation-ISF system did not experience any ••• clogging or P breakthrough
- The conventional ISF encountered both clogging and ••• P breakthrough
- The conventional ISF lost 85 % of its initial infiltration ••• capacity versus 40 % for the coagulation-ISF system



- The innovative pre-treatment coagulation step improves ISF efficacy
- ✓ The coagulation-ISF requires a small area (75%) reduction in footprint in comparison to a conventional ISF)
- Pre-treatment increases the longevity of ISF and prevents clogging