OSEIDO
Engineered by nature

Flotation Tests

I. Conditions for sample collection and transport

On July 22, 2025, Oseido transported a 1,000-liter IBC, collected from the industrial site, to the laboratory. The transport was carried out under controlled temperature conditions in a refrigerated vehicle to ensure the sample was properly preserved. The IBC was then transferred to the laboratory and stored at room temperature for further testing in accordance with their protocol.

The sample had been taken on July 21, 2025, directly from the wastewater treatment plant. Three separate samples were taken during the day and then kept cool overnight prior to transport.

The characteristics measured during the various sampling operations were communicated by Mr. Picot and are presented in the table below:

	Time of collection		
Parameter	**8am**	**12pm**	**4pm**
pH	7.68	7.96	8.03
COD (mg/L)	2159.33	2141.41	1985.22
Temperature (°C)	29.5	27.64	26.76
Daily totals (m^3)	6.286	10.116	14.175

II. Context & Objectives

The study aims to assess the technical feasibility of the COLDEP process applied to agri-food effluents. The experiments aim in particular to test treatment by adding chemicals (coagulation-flocculation) and to measure various monitoring parameters: pH, dry matter (DM), suspended solids (SS), chemical oxygen demand (COD), total nitrogen (Nt), and total phosphorus (Pt).

The tests, conducted on July 23, 2025, include jar tests and flotation tests to determine the most suitable coagulants and flocculants and their optimal dosage, followed by a continuous vacuum flotation phase combined with coagulation-flocculation, carried out by injecting compressed air and dissolved air.

III. Reminder of the composition of the effluent during the analysis campaign

Parameter		COD	BOD5	TSS	NT (NTK)	PT
Measured value (en mg/L)	Average	3383,33	1550	1366,67	100,2	7,33
	Minimum	2080	1200	450	67,2	5,7
	Maximum	4940	1800	2300	133	9,6

IV. Characterization of effluents

Effluent Composition

- 24% soluble COD
- 20% highly soluble COD

- COD/BOD5 ratio = 1.82
- High proportion of nitrogen and organic phosphorus (77% and 92% respectively)

Parameter	Unit	IBC (Lab tests)	Limit values for discharge
pH	-	5,17	
Dry matter DM	mg/L	2 168	
TSS	mg/L	1 404	261,7
CODt	mg/L	2 639	813
CODs_< 1,2 µm	mg/L	626	
CODs_< 0,45 µm	mg/L	530	
% COD soluble	%	24	
BOD_5	mg/L	1 450	1 515,15
N total	mg/L	57,6	68,2
$N\text{-}NH_4^+$	mg/L	13,1	
P total	mg/L	7,1	10,8
$P\text{-}PO_4^{3-}$	mg/L	0,6	

The measured values are around the averages, but are generally closer to the minimum values recorded during the analysis campaign.

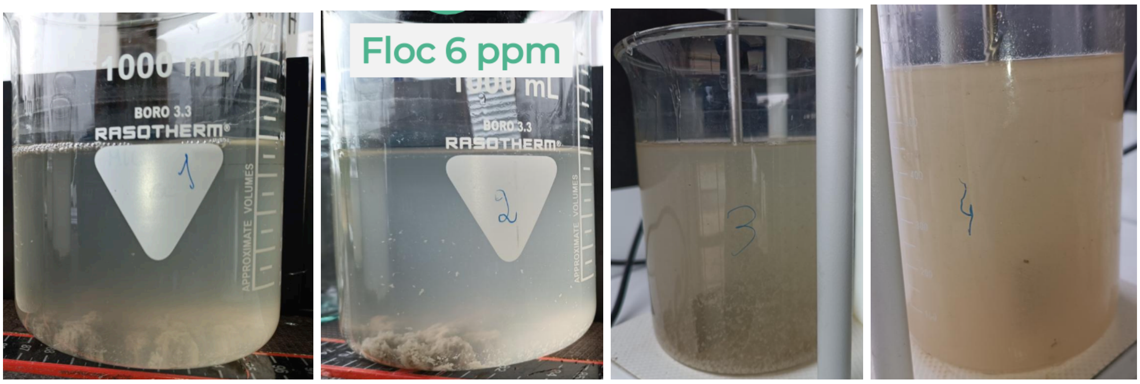
The COD measured on site before transportation is lower than that obtained in the laboratory, while the pH of the sample taken on site was higher than that measured in the laboratory.

V. Jar Test and Flotation Test Results

The reagents were selected by OSEIDO following tests carried out on site in June 2025, using Hydrex 6701 coagulant and Hydrex 6181 flocculant. The application and choice of the optimal dose were determined based on the structure and stability of the floc as well as the clarity of the supernatant. Jar tests were conducted after neutralization of the coagulant, with dosages ranging from 35, 55, 75, and 100 ppm, followed by a flocculation phase until the best compromise was obtained. Finally, flotation tests were carried out, with and without prior neutralization of the effluents, in order to refine the selection of the optimal operating conditions.

<u>Jar-test</u>

The jar tests carried out at different coagulant concentrations are presented below (beakers 1 to 4: 35, 55, 75, and 100 ppm). After flocculation, the evaluation focused on the clarification of the supernatant and the robustness of the flocs. Based on these observations, the concentration of **55 ppm** was selected as the most suitable.



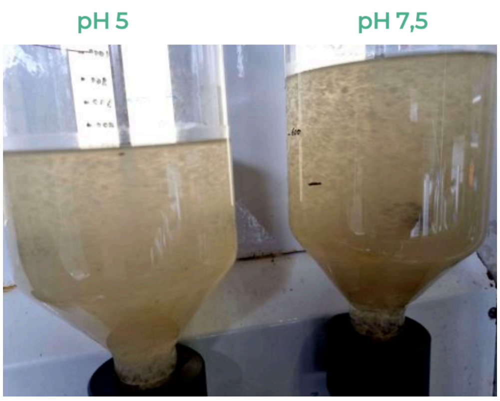
beaker 1 → 4 corresponding respectively to concentrations of 35, 55, 75, and 100 ppm

<u>Flottatest</u>

The flotation tests were carried out using combination No. 2, corresponding to a dose of 55 ppm of coagulant combined with 6 ppm of flocculant. The effect of pH was studied under two different conditions. Without neutralization (pH = 5.0), the flocs obtained were fragile and not very resistant. However, with effluent neutralization (pH adjusted to 7.5), the flocs formed were more robust and stable. This neutralization was achieved by adding 30% soda at a rate of 410 mL/m³ of effluent.

Based on these results, it was decided to continue the pilot tests with prior neutralization of the effluent in order to guarantee the effectiveness of the treatment and the pilot.

Photos: Coagulation - Flocculation in progress



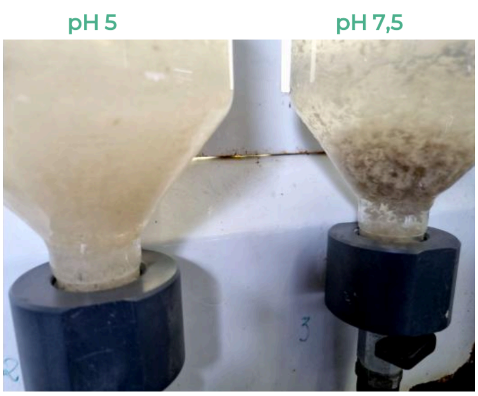
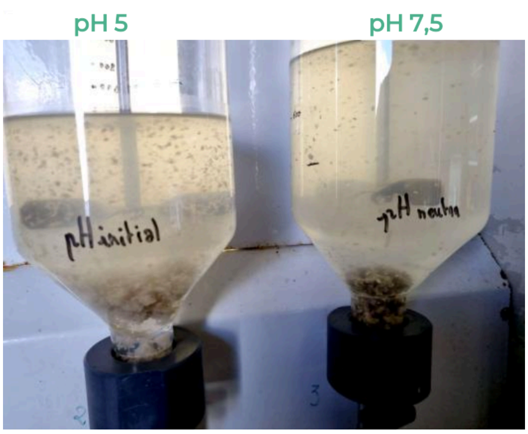
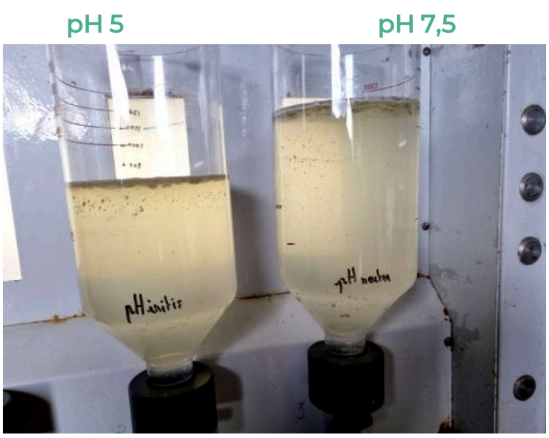


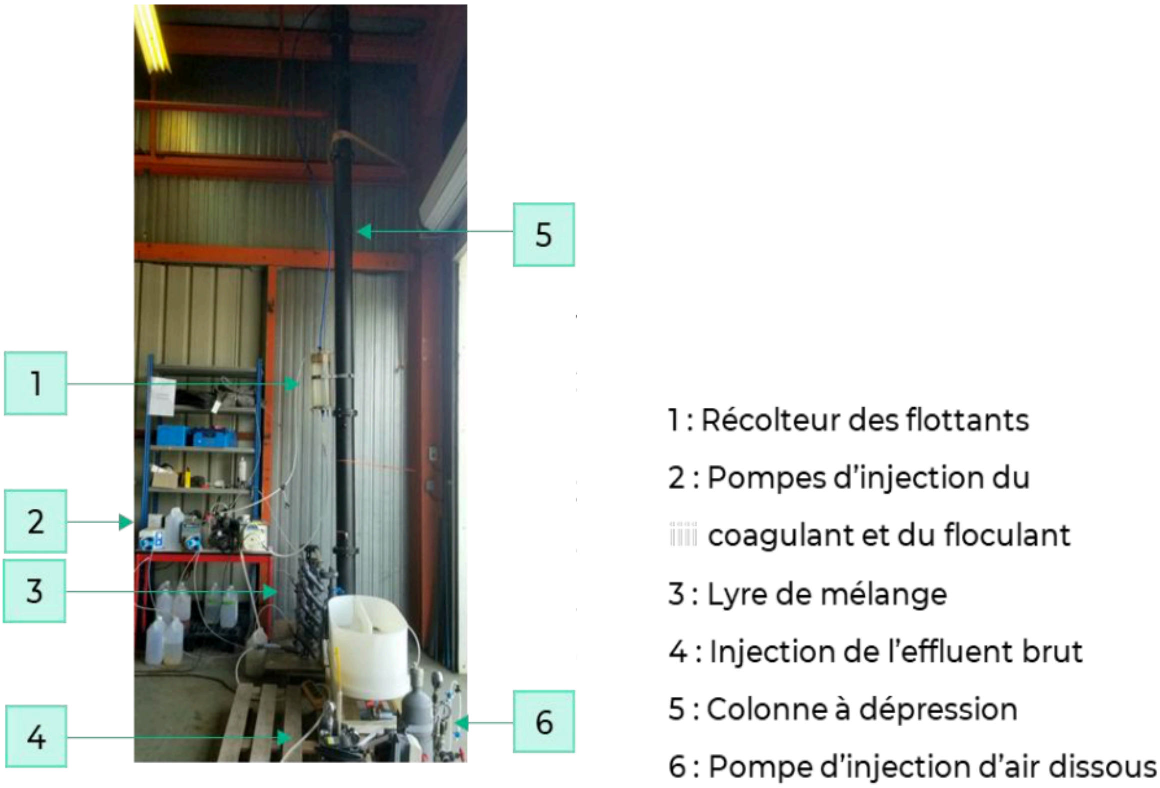
Photo: Before white water injection **Photo: after white water injection**





VI. Coldep Process Principle

The Coldep process has been evaluated through continuous pilot tests. It can operate without the addition of reagents or, conversely, with controlled injection of coagulants and flocculants via a mixing nozzle. Flow circulation is ensured by injecting air at the base of the column in two ways: either by compressed air delivered via a compressor and a membrane diffuser, or by dissolved air obtained using a Nikuni pump that uses drinking water as the injection fluid.



VII. Summary of tests performed

The first tests conducted without adding reagents, using only compressed air, showed no conclusive results: no self-flocculation was observed and no floating material could be collected.

Tests with the addition of reagents were then conducted. In compressed air, the turbulence generated proved to be too great, causing the flocs to break up and return to the effluent. With the use of dissolved air, flocs formed, but their low resistance made it difficult to maintain a stable regime.

To overcome this limitation, it was necessary to increase the flocculant dose to 8 ppm.

VIII. Results obtained

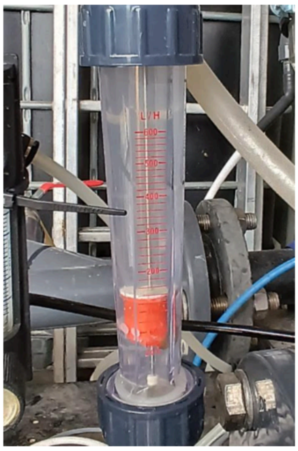
<u>Exploitation of results in air below</u>

Coag – floc confirmée en lyre de mélange

Récupération des flocs dans la mousse

Effluent

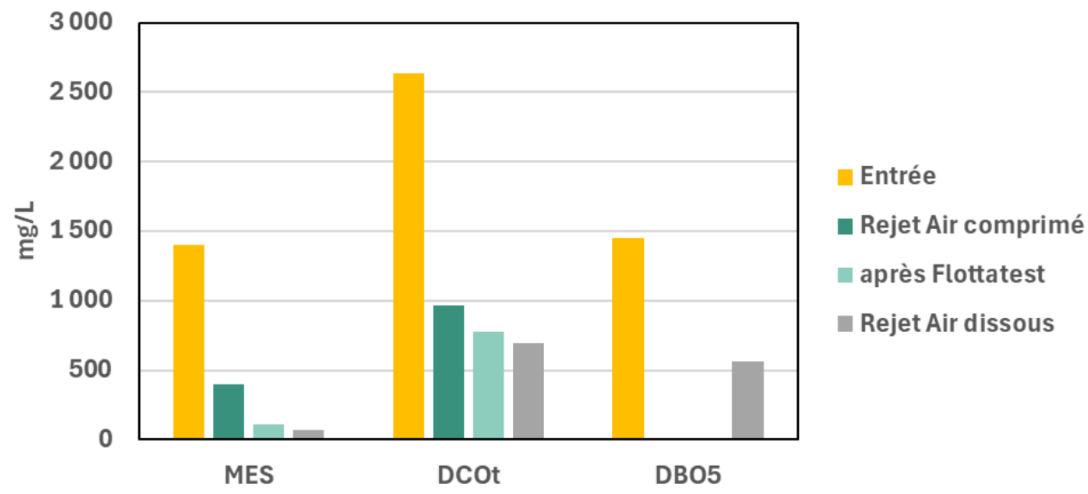
Rejet



Boues

Summary of all results

Conditions					Continuous Compressed Air		Continuous Dissolved Air				Discharge limits
Parameter	**Unit**	**IBC raw**	**After flottatest**	**Reduction**	**Inlet**	**Outlet**	**Inlet**	**Outlet**	**sludge**	**Reduction**	
pH	**-**	5,17	-	-	5,17	7,5	5,17	7,5	-	-	
MS	**mg/L**	2 168	-	-	2 168	-	2 168	-	44654	-	
MES	**mg/L**	1 404	110	92,5%	1 404	399	1 404	71	-	95%	< 261,7
DCOt	**mg/L**	2 639	779	70,5 %	2 639	969	2 639	698	-	74%	< 813
DCOs_< 1,2 µm	**mg/L**	626	-	-	626	-	626	567	-	9%	
DCOs_< 0,45 µm	**mg/L**	530	-	-	530	-	530	551	-	0%	
% DCO soluble	**-**	24%	-	-	24%	-	24%	81%	-	-	
DBO$_5$	**mg/L**	1 450	-	-	1 450	-	1 450	563	-	61%	< 1 515,15
N total	**mg/L**	57,6	-	-	57,6	-	57,6	31	-	47%	< 68,2
N-NH$_4^+$	**mg/L**	13,1	-	-	13,14	-	13,1	14	-	0%	
P total	**mg/L**	7,1	-	-	7,1	-	7,1	1,4	-	80%	< 10,8
P-PO$_4^{3-}$	**mg/L**	0,6	-	-	0,59	-	0,6	0,07	-	89%	



Les DBO$_5$ après flottatest et avec air comprimé n'ont pas été réalisées

IX. Synthesis

The tests revealed well-formed, structured flocs, but these were not very robust. Their formation and behavior were validated through jar tests and flotation tests. To improve their resistance and the overall effectiveness of the treatment, it was necessary to readjust the dosages, resulting in higher flocculant consumption (increased by a factor of 3 to 4) and effluent neutralization.

The pilot tests proved successful, with significant reductions: 95% of suspended solids, 74% of total COD, 61% of BOD$_5$, 47% of total nitrogen, and 80% of total phosphorus. The COD removal rate observed during jar tests, flotation tests, and the VAL process is similar, confirming the consistency of the results (COD/TSS). No COD stripping was detected, as expected.

However, the performance of the process depends on the pilot scale and could be optimized when implemented on a full scale. The quantity and quality of white water remain improvable at this scale, as does the residence time in the process. Improving the concentration of floats and the removal of TSS also represents a potential lever for increasing the efficiency of the process on a large scale.

The discharge values after treatment are below the Discharge Limit Values (DLVs) for the five parameters studied. This result, which is in line with expectations for the proposed solution, confirms that flotation is an effective option for treating this type of effluent and can, in this case, replace biological treatment.