

ODOROUS VOC REMOVAL BY AN ADVANCED WATER SCRUBBER IN A WASTE WATER TREATMENT PLANT

**9th IWA Odour &
26-27 October 2021 Bilbao**

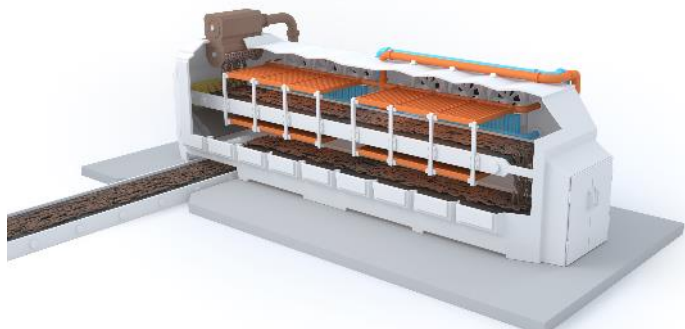
**C. GRACIAN
V. NASTASI**



Context



Odours from WWTP sludge dryers



Usual characteristics of sludge dryer non condensable

Air flow rate	1 000 to 10 000 Nm ³ /h
Temperature	30 to 50°C at 100% RH
Total VOC content	100 to 900 mg/m ³
Odour concentration	100 000 to 500 000 ou _E /m ³

ODOROUS VOC FROM SLUDGE DRYERS

Identification of most involved VOC's in sludge dryer odour (Suez R&D program) :

- Sulfide compounds (Putrid garlic, Onion, cabbage)
- Aldehydes (cocoa, coffee, fruit, green),
- Organic acids (cheese, sour, rancid),
- Aromatic compounds.

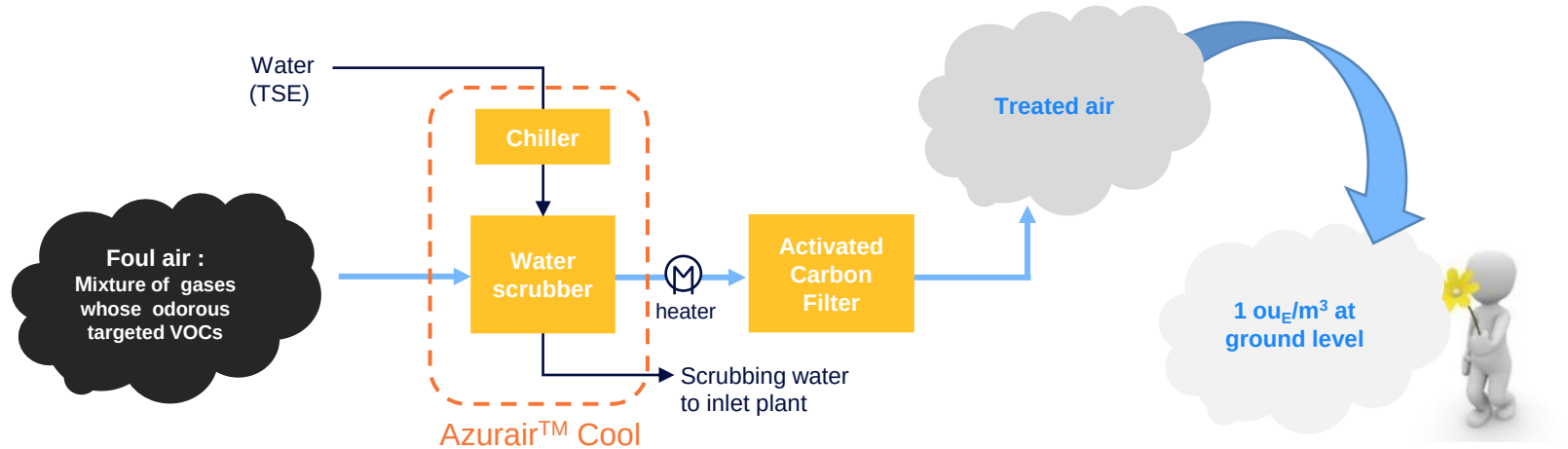
⇒ Persistent and nasty odour

Odour treatment for sludge dryers

Technology		Odour removal	VOC removal	Reagent consumption	Operation	CAPEX
Chemical absorption (Azurair™ C)						Reference CAPEX
Adsorption on Activated Carbon (Azurair™ A)						--
Biofiltration (Azurair™ B)						-
Water absorption						-
Thermal oxidation						++

Previous work

Azurair™ Cool principle



EXPECTED GAINS ARE:

- ⇒ ↗ VOC removal in scrubber due to ↗ gas solubility and ↗ gas condensation
- ⇒ ↗ VOC adsorption capacity on AC due to ↘ air humidity in inlet AC filter (↘ dew point)



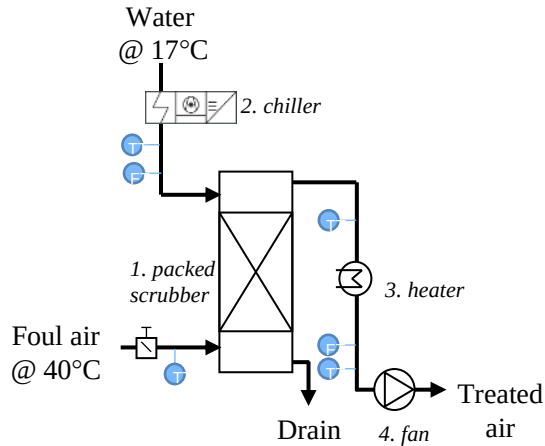
DROP OF AC CONSUMPTION

Azurair™ Cool - Pilot test

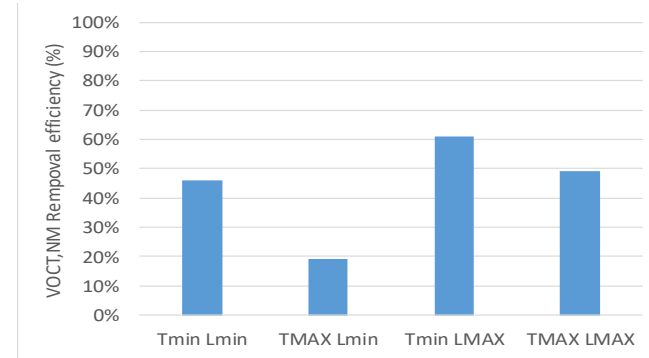
Patented

Pilot plant :

- 2 months on a digested sludge drying facility
- 1/10 scale (500 m³/h at 40°C and 100% RH)
- Influence of 2 factors on VOC_{T,NM} removal efficiency
 - Water temperature : 10 to 17°C
 - L/G mass ratio : 3 to 5
- Factorial plan 2² DOE with 4 repetitions of 1 exp.



Results :



VOC_{T,NM} removal :

- Water at 17°C and L/G at 3 (usual conditions) = 20 %
- Water at 10°C and L/G at 3 = 45%
- Water at 10°C and L/G at 5 = 60%

REX on 1st industrial Azurair™ Cool

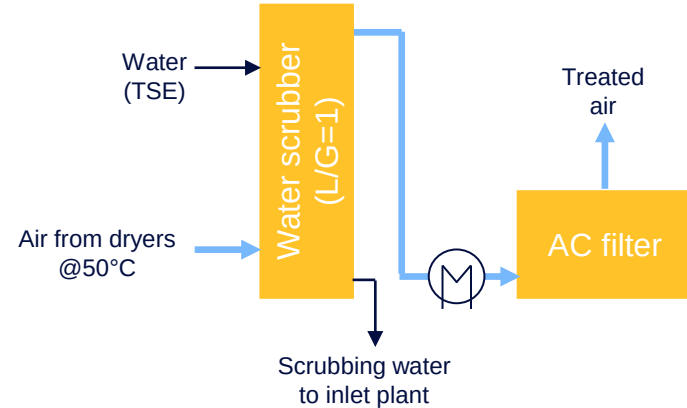
REX on the first Azurair™ Cool implemented - Context

Context :

- 300 000 pe WWTP
- Biological sludge drying
- 4 odours treatment lines with 1 dedicated to non condensable from dryers
- Urban and high sensitive area
- Odour complaints

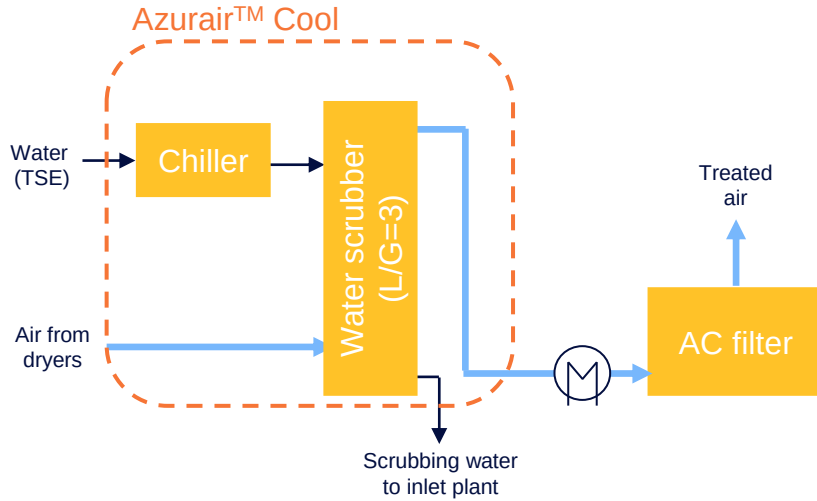


Dryer odour treatment line :



- Design not adapted to high VOC load and water content
- ⇒ Requires too frequent AC replacement
- ⇒ Odour in environment mainly due to dryer

REX on the first Azurair™ Cool implemented : the equipment



- Supplying higher water flow rate for scrubbing
- Implementation of a chiller to cool scrubbing water



Chiller

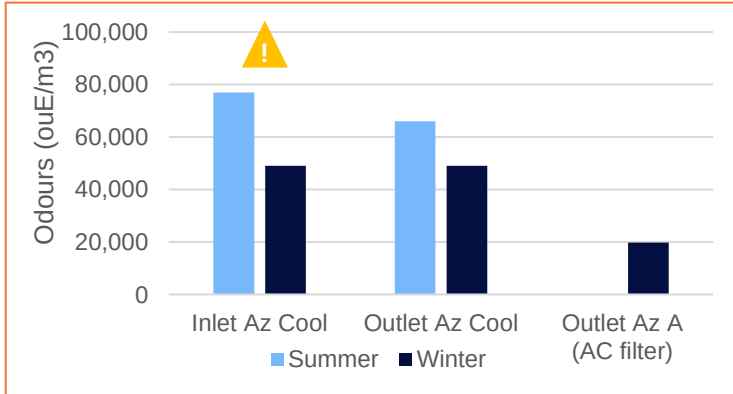
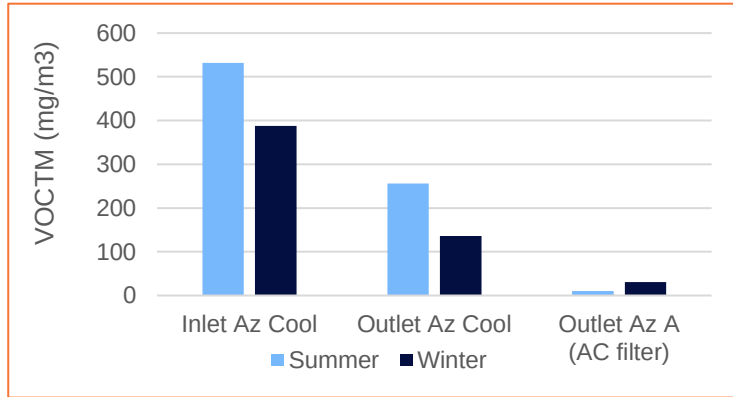


Water scrubber and heater



Activated Carbon filter

REX on the first Azurair™ Cool implemented - Results



Minor value due to high humidity content in air sample

	Parameter	Summer 2020	Winter 2021
General conditions	Ambient temperature (°C)	29 ±2	17 ±2
	Industrial water temperature (°C)	28 ±1	19 ±1
Conditions of air treatment line	Time from last change of AC	9 days	3 months
	T of cooled water °C (after chiller)	24 ±1	15 ±1
	Air flow rate treated (Nm³/h dry basis)	2100 ±100	2500 ±100
	T of foul air (°C)	48 ±1	51 ±1
	Liquid flow rate (m³/h)	9 ±1	10 ±1
VOC removal efficiency in Azurair Cool (%)		56%	68%
Odour removal efficiency on overall line (%)		> 99%	> 70%

VOC removal efficiencies higher than pilot ones due to:

- higher foul air temperature in the industrial unit (50°C) than in the pilot test (37°C),
- different nature of VOC released by biological and digested sludge during drying.

REX on the first Azurair™ Cool implemented – Economical balance

Theoretical balance	Initial treatment line	Treatment line with Azurair Cool
AC consumption per year	reference	reference - 30 k€
Electricity consumption per year	reference (fan and heater)	reference + 8 k€ (fan, heater and chiller)

⇒ **NET GAIN : 22 K€/YEAR OR 110 K€ ON 5 YEARS**

⇒ **RETURN ON INVESTMENT < 5 YEARS**
(chiller and construction costs << 110k€)

Conclusion

Azurair™ Cool, an advanced water scrubber

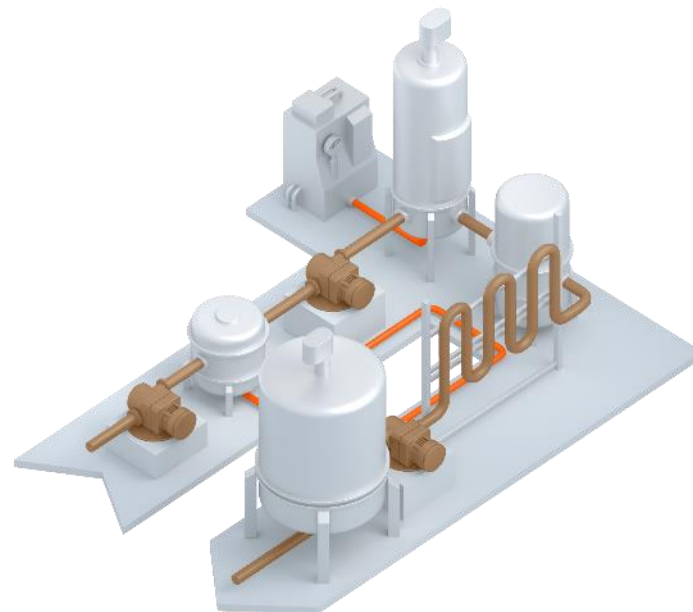
⇒ Pilot test

- Faisability
- key design values

⇒ First implementation is a success (higher than expected)

- Odour impact reduction
- ROI < 5 years

⇒ Development of this techno for other sludge thermal treatments such as THP or HTC



Dehydris™ Ultra
(Hydrothermal carbonization, HTC)

GRACIAS

