



Pure.



Atmos'fair 2011 - Paris

**The use of activated carbon in
combination with other purifying
technologies for deodorizing and VOC
removal of foul air**

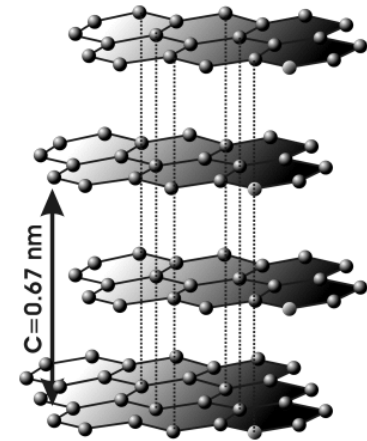
Wouter Lema, ir.



- **What is Activated Carbon**
- **Applications – Choice of technology**
- **Inventions DESOTEC**
- **Case studies**

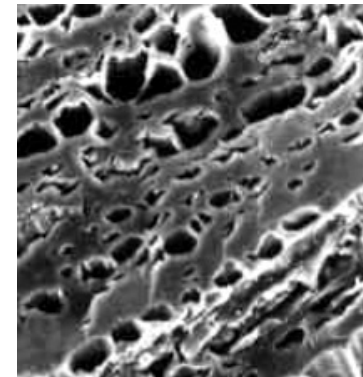
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- **Basic material = C**
- **Disorganized graphite**
- **Raw material**
- **Activation = enlarging internal surface in 3 steps:**
Dehydration – Carbonation – Activation



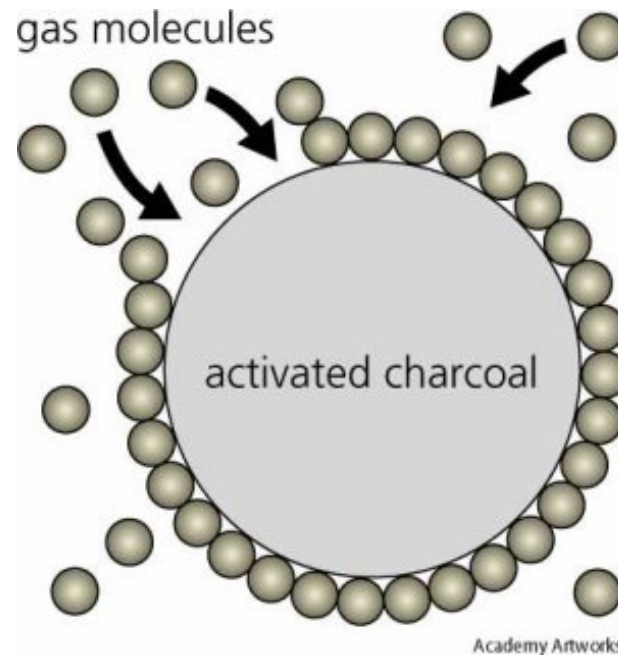
What is A.C.?

- **Result:**
Making pores & enlarging surface=
More adsorption capacity!



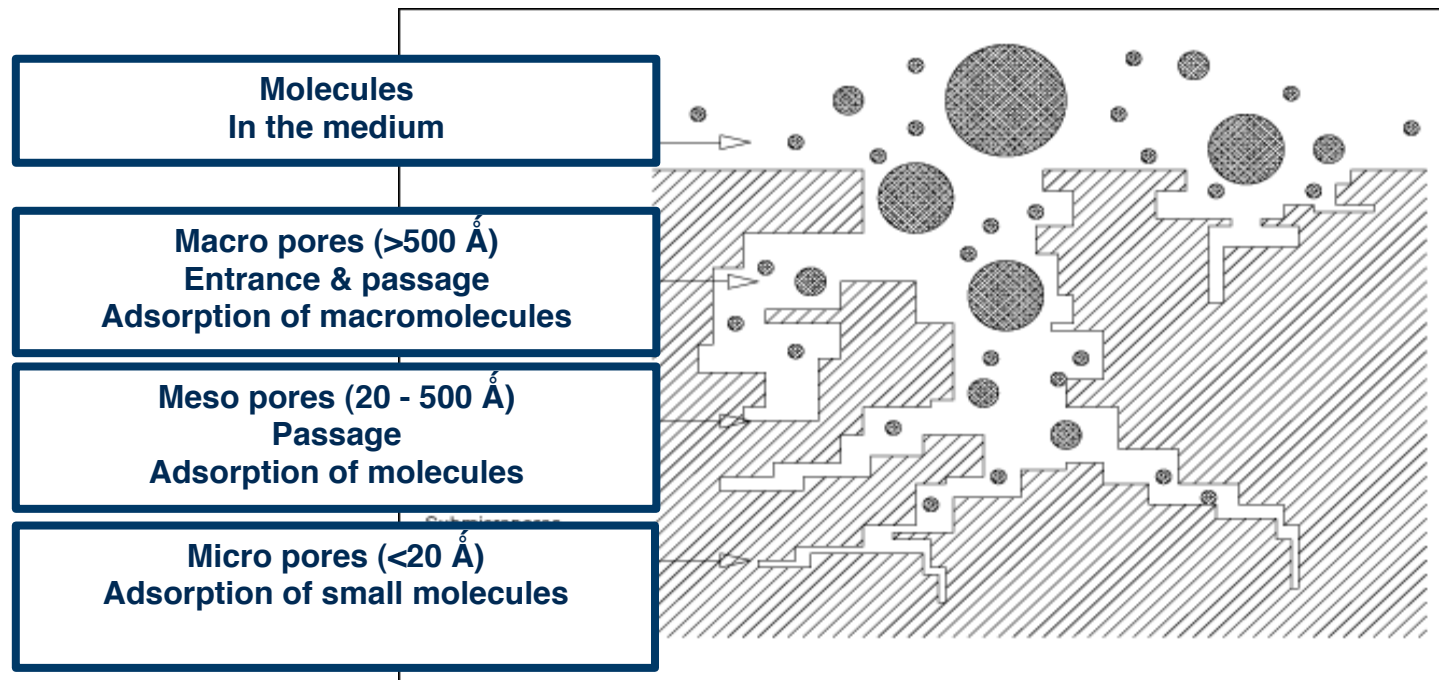
What is A.C.?

- **A.C. = ADSORPTION product for organics**



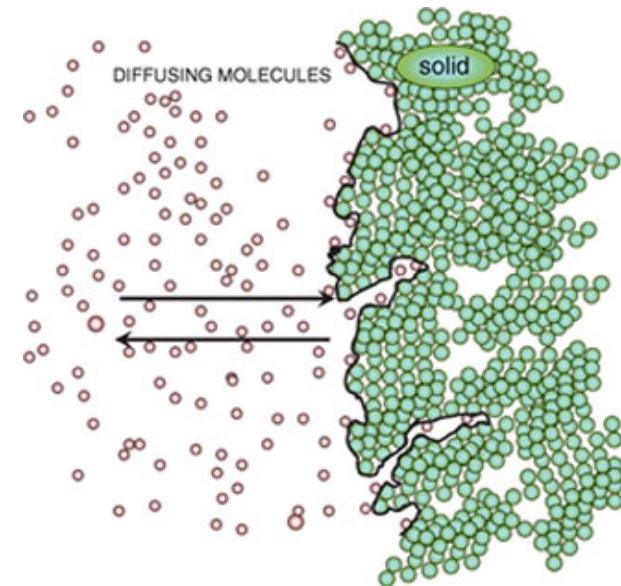
What is A.C.?

- **Pore distribution of activated carbon**



What is A.C.?

- **Phases of adsorption**
 - Transport / Diffusion / Fixation
 - Equilibrium
- **Chemi- \leftrightarrow Physisorption**
 - Irreversible \leftrightarrow reversible



What is A.C.?



- **Parameters for adsorption**
 - **Type of A.C.**
 - **Type of molecule**
 - **pH, temperature, pressure, contact time, ...**

What is A.C.?



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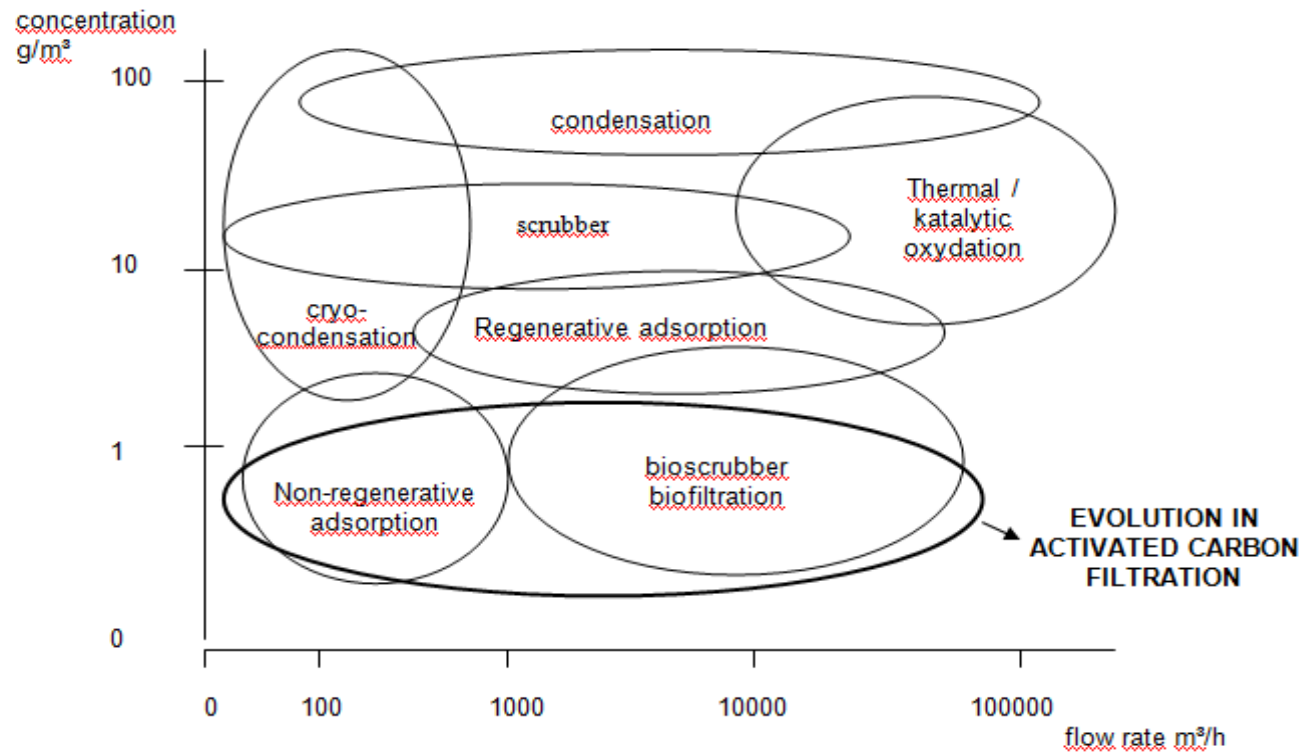
▪ Liquids

- Waste water
- Groundwater
- Drinking water
- Process water
- Purification raw material
- Catalyst

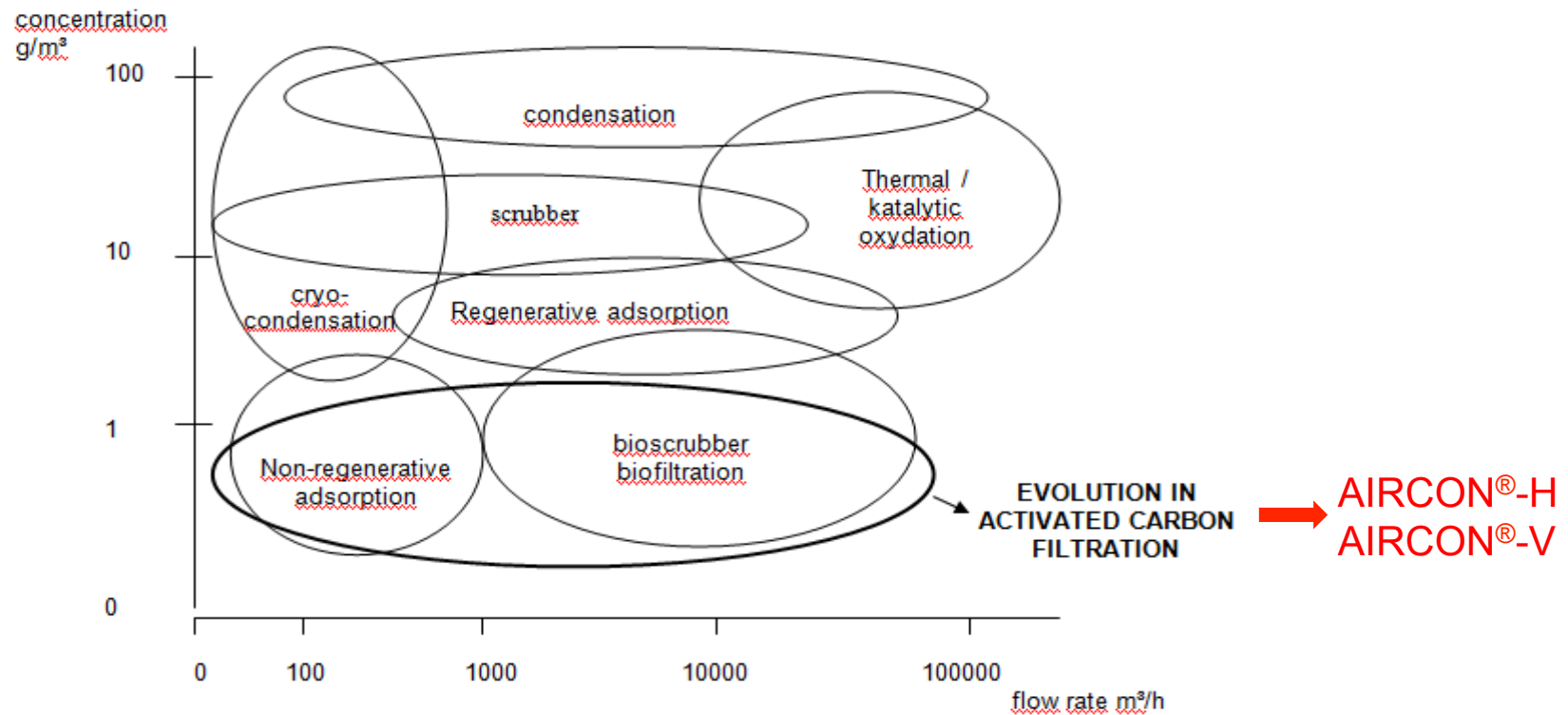
▪ Gas

- Air VOC
- Air odor
- Solvent recovery
- Purification
- Respiration protection
- Catalyst
- Molecular sieves

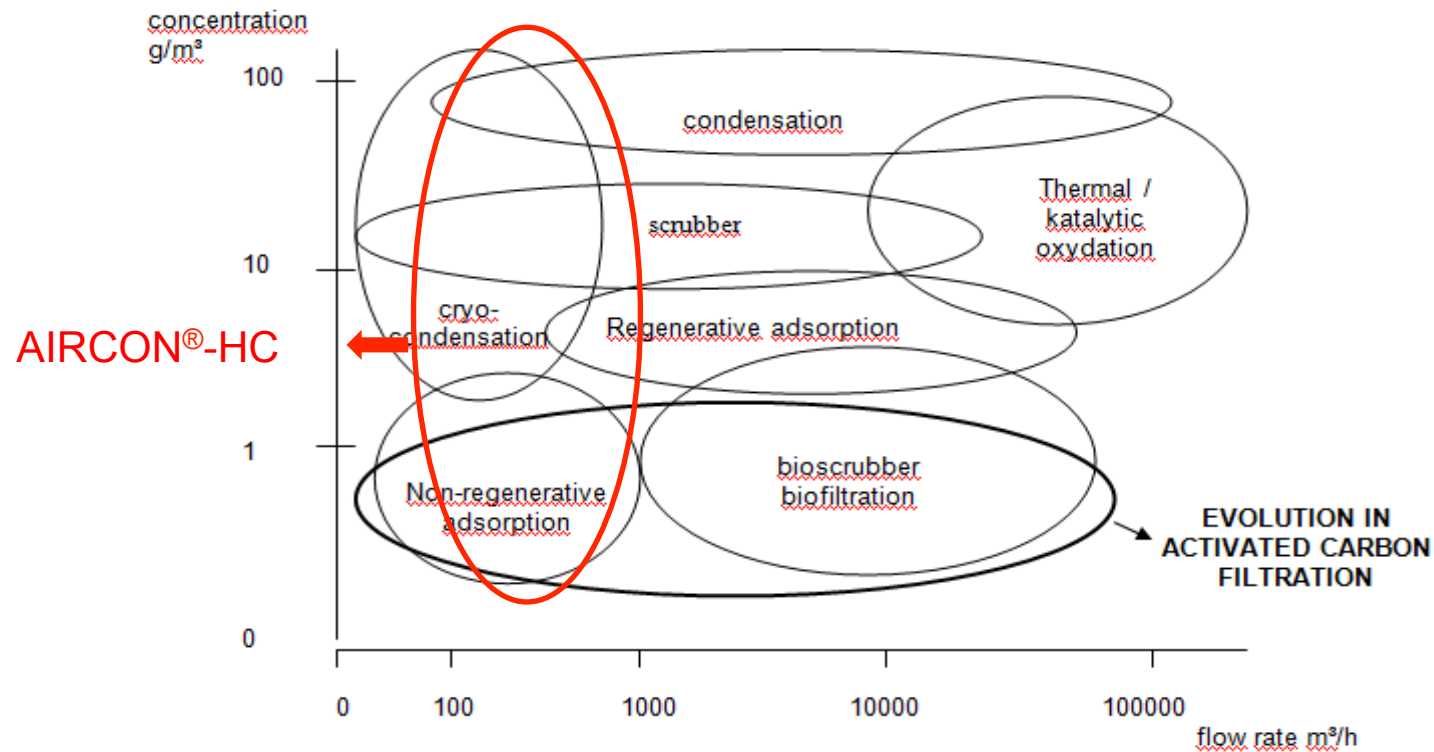
Applications.



Technology ?



Technology ?



Technology ?



- **What is Activated Carbon**
- **Applications – Choice of technology**
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- High flow rates – AIRCON[®]-H/V

AIRCON[®]-H



AIRCON[®]-V



Inventions.



- **High flow rates – AIRCON[®]-H/V - advantages**
 - **Up to 40.000 m³/h per filter**
 - **Low pressure drop – 2500 Pa @ max. flow rate**
 - **Mobile / Interchangeable**
 - **Smart internal flow distribution**
 - **No manipulation of spent carbon on site**
 - **Easy connections – plug & play**
 - **Limited space needed (AIRCON[®]-V)**

Inventions.



- **High concentrations – AIRCON[®]-HC**

PETROCHEMISTRY



BIOGAS



Inventions.



- **High concentrations – AIRCON®-HC - advantages**
 - **Very low outlet concentrations possible despite high inlet concentrations**
 - **Mobile / Interchangeable**
 - **No manipulation of spent carbon on site**
 - **Easy dischargeable**
 - **Easy connections – plug & play**
 - **Extensive security measures possible**

Inventions.



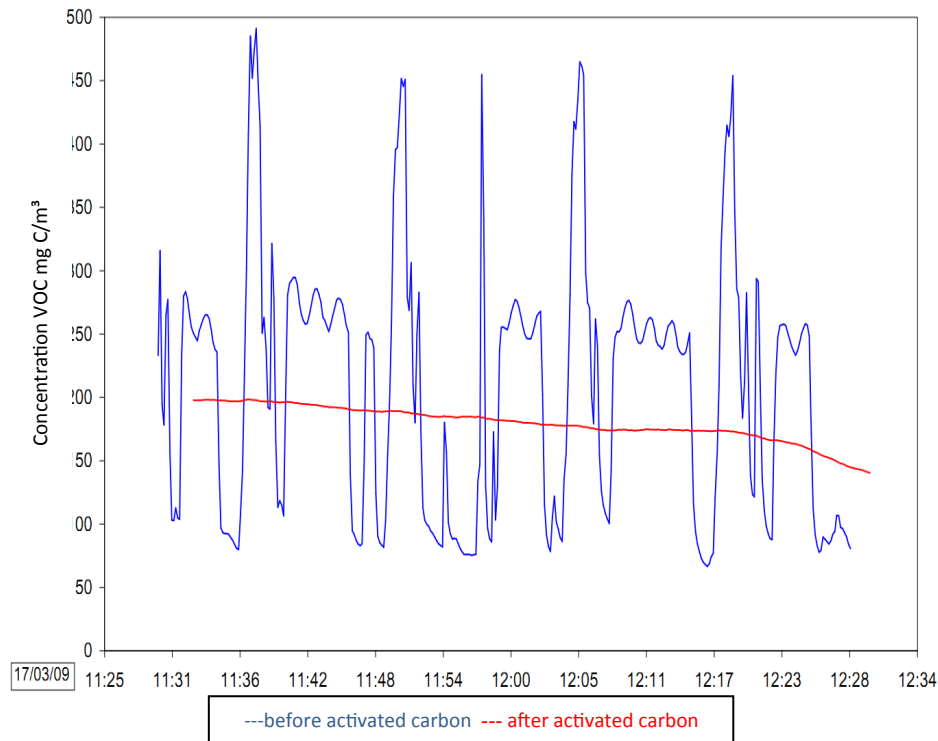
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- **Applications – Choice of technology**
- **Inventions DESOTEC**
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- **Case study 1 : producer plastic components (B)**
 - **Air collected from # painting booths**
 - VOC = 50 - 500 mg C/m³ , very fluctuating
 - Flow rate = 20.000 m³/h
 - Outlet limit = 110 mg C/m³
 - **Selected treatment : biofiltration, but**
 - Temporary high concentrations could be toxic to biofilter
 - Design biofilter based on peak concentrations
 - **Solution : AIRCON[®]-V as buffer**
 - Peak shaving
 - Lower investment costs – smaller biofilters
 - Effective use of biofilter – no toxic shocks
 - Low activated carbon consumption – 1 change every 2-3 years

Case studies.

■ Case study 1 : producer plastic components (B)



Case studies.

- **Case study 2 : waste methanisation plant (F)**
 - **Foul air of plant collected**
 - Flow rate = 200.000 m³/h
 - Deodorization necessary – NH₃ ; H₂S ; Mercaptans ; Amines ; ...
 - **Selected treatment : scrubbing + biofiltration, but**
 - Implantation very close to city - complaints
 - Via dispersion models - odor limit at stack = 350 UO/m³
 - **Solution : 10 x AIRCON[®]-V as tertiary treatment**
 - Additional pressure drop limited to 1000 Pa - no supplementary fans
 - Very quick and very easy implantation
 - Limited space, high flow rate – no problem
 - Low odor limit reached – avg. 74 UO/m³
 - Long lifetime of the activated carbon – 1 to 2 years

Case studies.

■ Case study 2 : waste methanisation plant (F)

measurement	Before Biofilter (after scrubber)	Before Activated Carbon (after biofilter)	After Activated Carbon (Stack)
1	4598	813	< 50
2	2896	683	< 50
3	3069	1149	< 50
4	8005	2299	114
5	8679	1448	96
6	5161	1933	85
Average	5401	1388	74



Case studies.

- **Case study 3 : vegetable oil producer (B)**
 - **Smelly (sweet smell) air after oil press and dryer**
 - Flow rate = 25.000 m³/h
 - Deodorization necessary – organic N- and S-compounds ; aldehydes
 - **Selected treatment : 2-step oxidative scrubbing**
 - Implantation very close to city - complaints
 - 90 % odor removal wanted
 - **Solution : AIRCON[®]-V as secondary treatment**
 - Especially selected coating to deal with hot (50°C), wet (99%RH) and corrosive gas after the scrubbers
 - Very quick and very easy implantation
 - Limited space, high flow rate – no problem
 - Odor removal efficiency reached – 98 %

Case studies.



■ Case study 3 : vegetable oil producer (B)

	Odor Level (OU/m³)	
	Linseed production	Coleseed production
Before scrubber	134.847	527.959
After scrubber (before activated carbon)	11.552	156.185
After activated carbon (stack)	3190	9.447
Efficiency	98 %	98 %

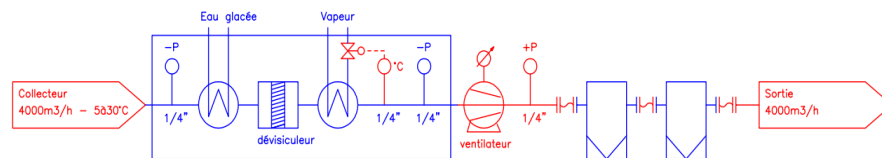


Case studies.

- **Case study 4 : Chemical company (F)**
 - **Highly concentrated VOC process and vent gas**
 - Flow rate = 4.000 m³/h
 - BTEX, phenol, DIPB, cumene – several g/m³
 - RH 100 %
 - Emission limit : 110 mg C/m³ and 2 mg benzene/m³
 - **Solution : pre-condensation + 2 x AIRCON[®]-HC**
 - Cooler – demister – reheating => relative low carbon consumption
 - Ideal conditions before activated carbon - 40% RH - 20 °C
 - 2 AIRCON[®]-HC's in series – high concentrations can be treated
 - Emission limits ensured
 - Efficient use of activated carbon
 - No high investment costs (cry-condensation, ...)
 - High flexibility

Case studies.

- **Case study 4 : Chemical company (F)**



PI&D of VOC treatment



Exemple of similar installation (DCM treatment)

Case studies.



**Regenbeekstraat, 44
B-8800 Roeselare-Rumbeke
Belgium**

T: 00 (0)51 24 60 57

F:00 (0)51 24 59 16

info@desotec.com

www.desotec.com



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