LANDFILL GAS UPGRADING

IMPROVED WATER SCRUBBER DESIGN

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Overview

- SORPA bs. in Iceland has operated a landfill gas upgrading station in Iceland since the year 2000
- Landfill gas upgrading with a water scrubber
- Increased demand for methane called for new upgrading plant
- New plant in year 2005

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Overview contd.

- First upgrading plant
  - Delivered as a complete plant on skid
  - Tellerettes – a random packing – used as packing material in water scrubber
- New plant erected in year 2005 – Plant designed by VGK-Honnun
  - Structured packing used as packing material in water scrubber

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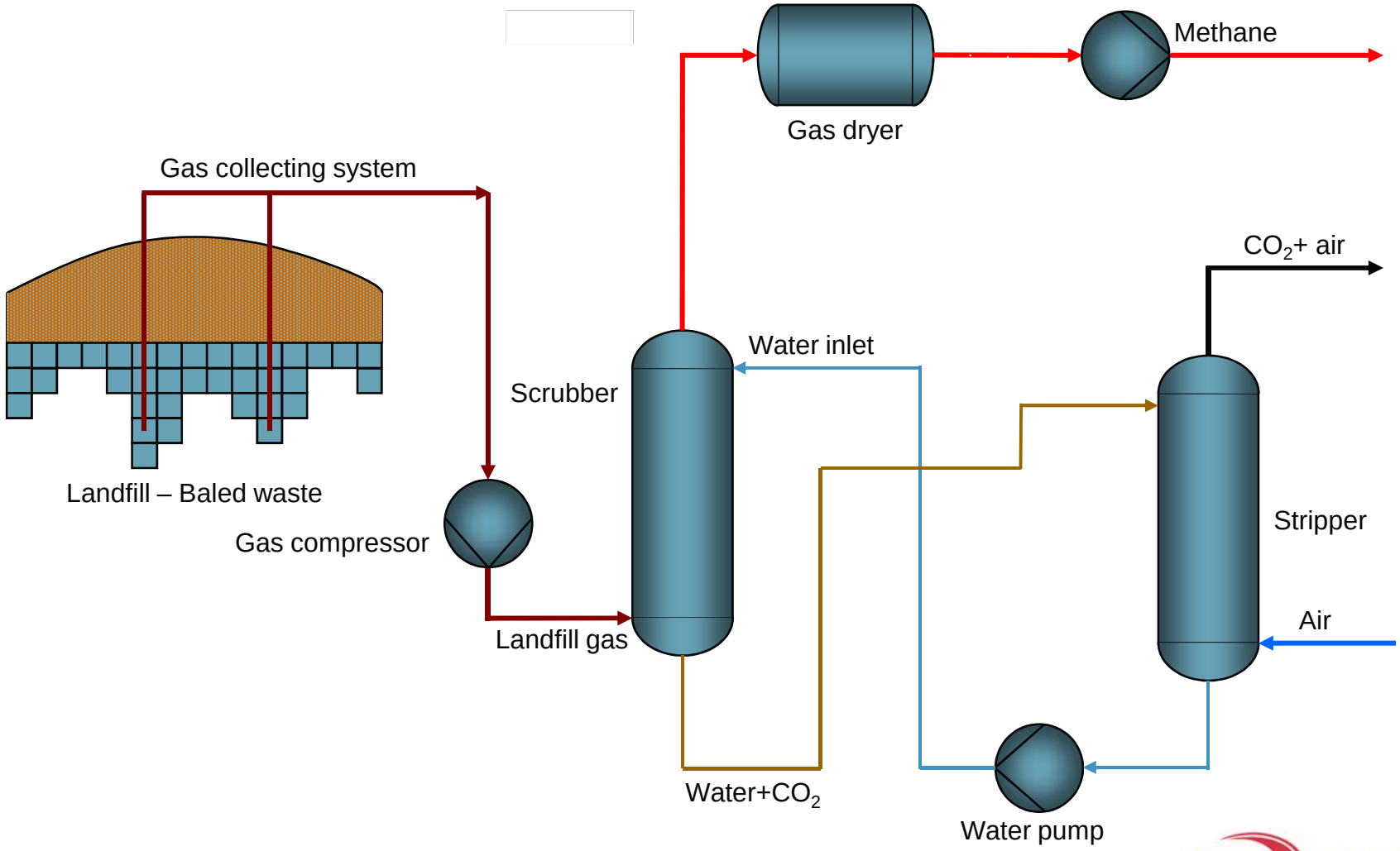
Simplified process overview



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Plant layout

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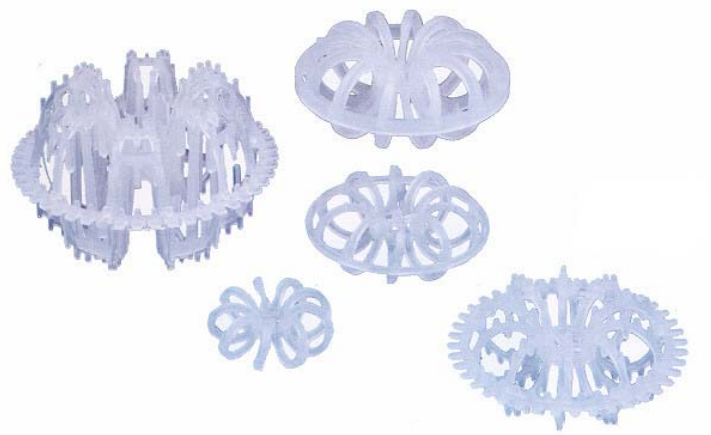
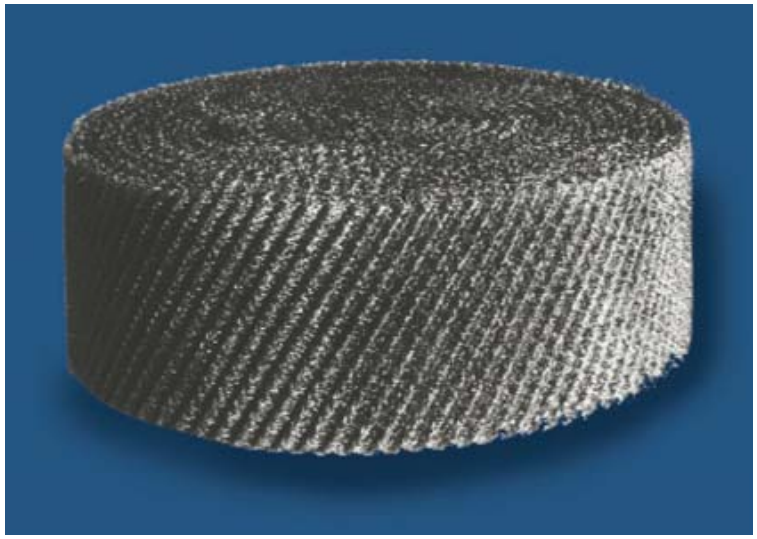
Packing material





	Tellerettes, 1”	S200
Surface area m^2/ m^3	180	1390
% Voids	87	96
Material	PP	316 SS
Cost per unit volume	1	20

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Performance of old plant

- Nameplate capacity: 50 Nm^3/h
- Efficiency of water absorption in the range of 40-50%
- Residual CO2 content 5-6%

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Design objectives of new plant

- Design capacity of plant: 2x400 Nm^3/h
  - Design capacity of scrubbers: 2x200 Nm^3/h
  - Packed height is 6m in a DN500 scrubber
  - Residual CO_2 less than 1%
- Flexibility
  - Sole supplier of methane in a growing market
  - Plant utilization at commissioning:
    2 x 100 Nm^3/h
- Future capacity
  - Icreased packing height
  - Increased water circulating capacity

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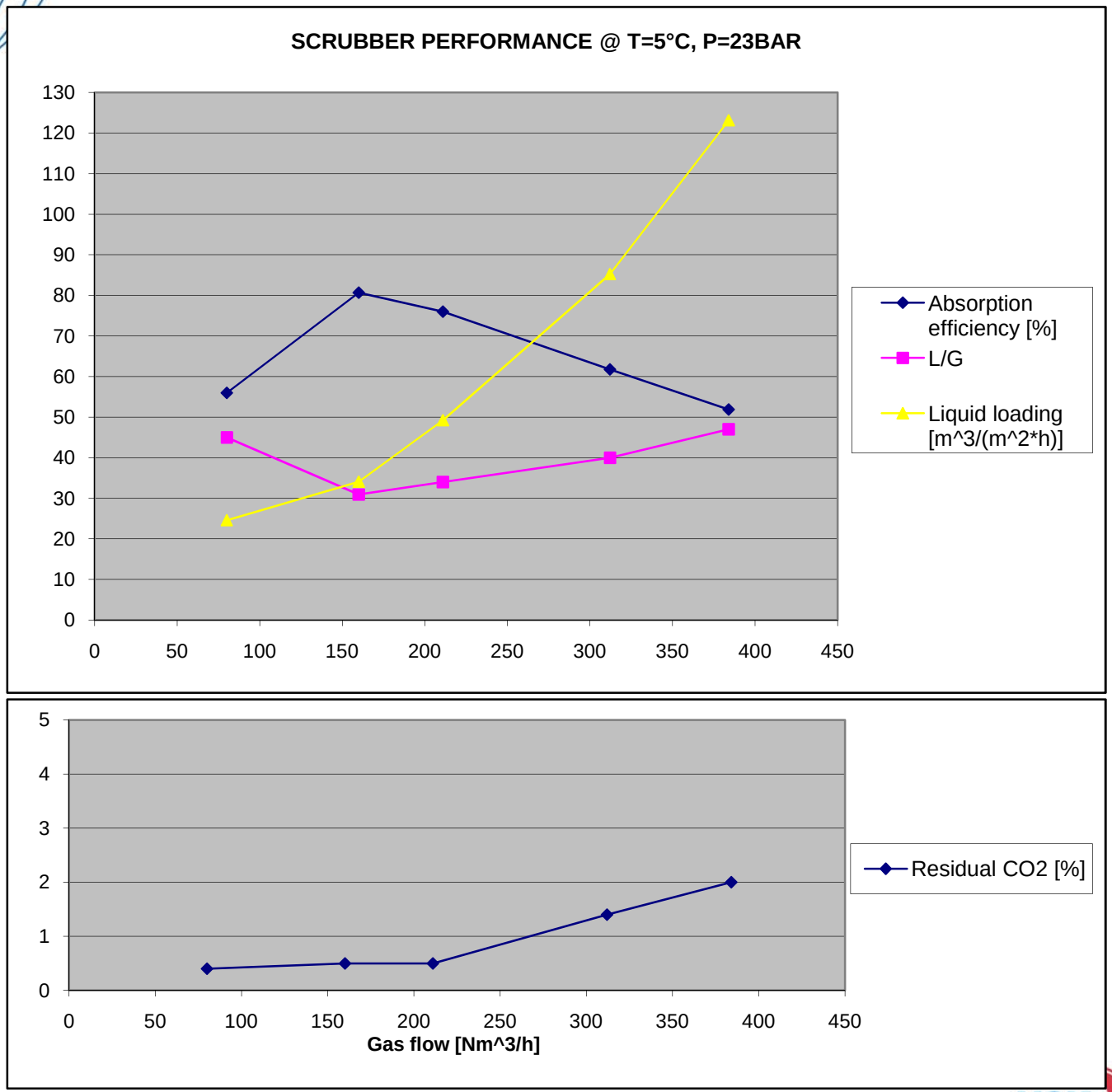
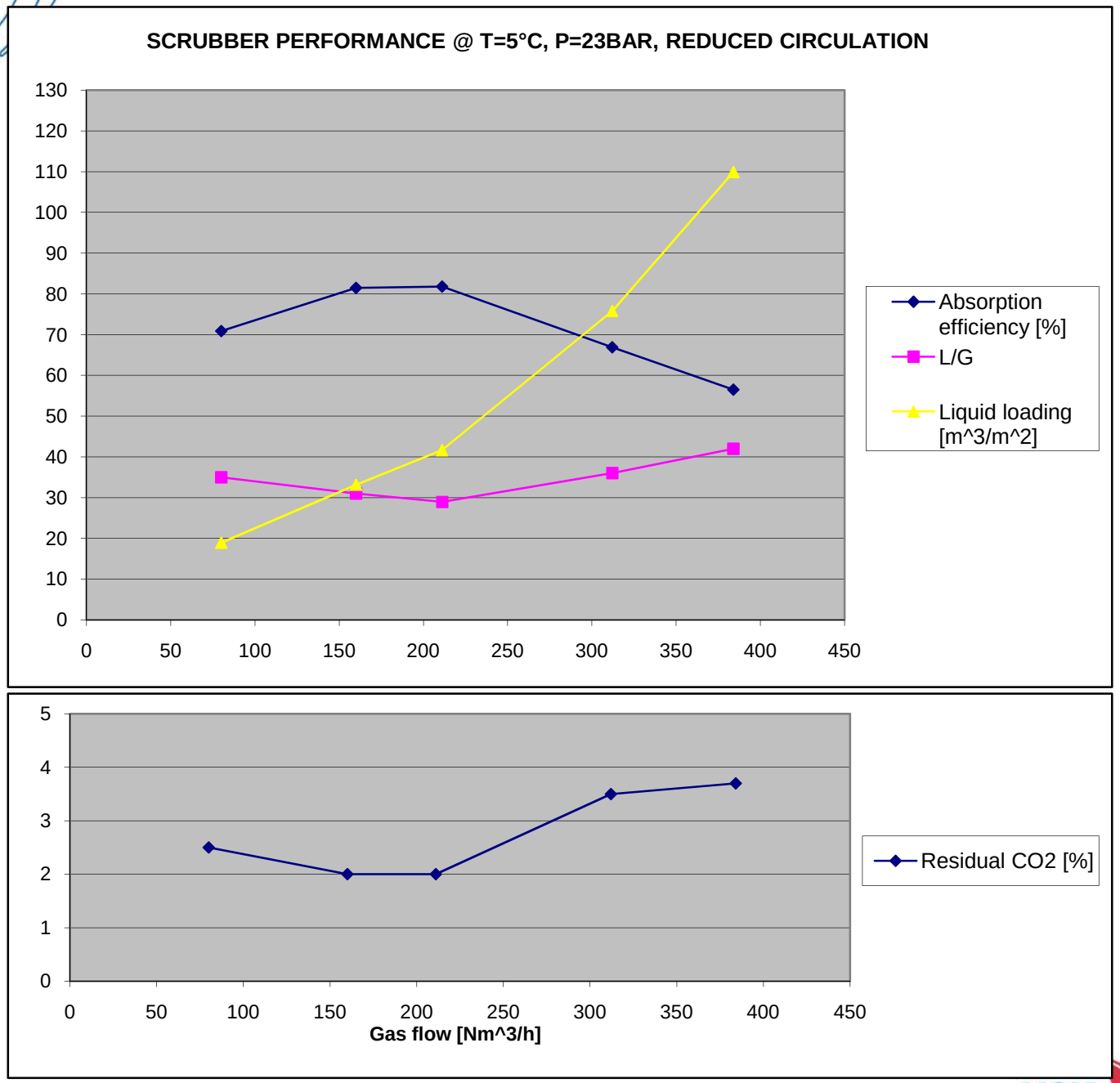
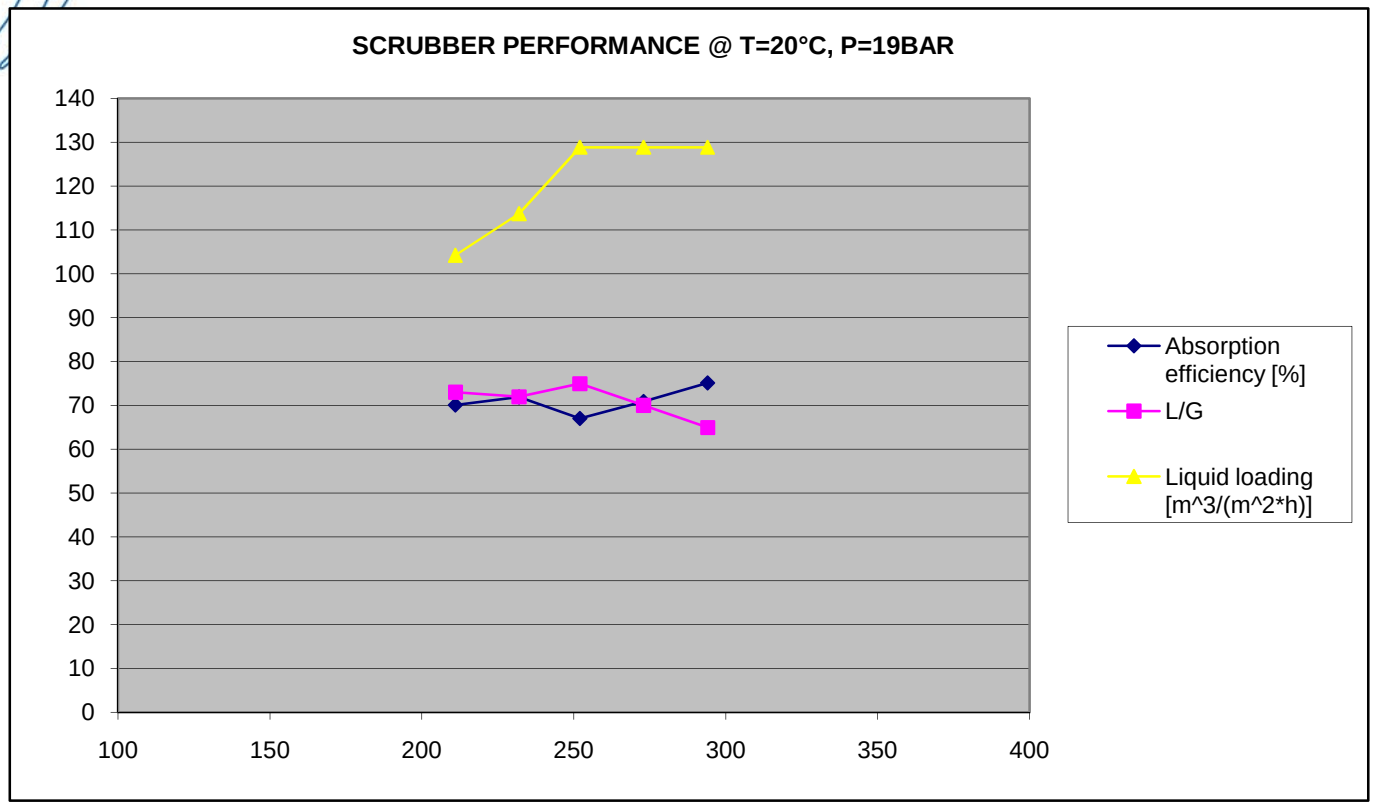
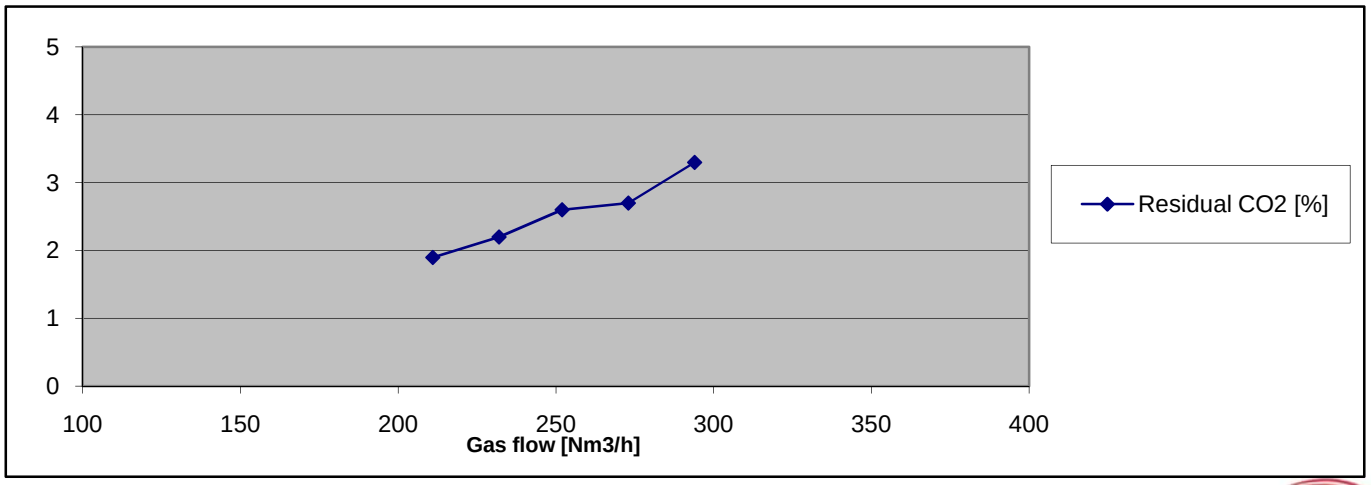

SCRUBBER PERFORMANCE @ T=5°C, P=23BAR
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
Absorption efficiency [%]
L/G
Liquid loading [m^3/(m^2*h)]
5
4
3
2
1
0
0
50
100
150
200
250
300
350
400
450
Gas flow [Nm^3/h]
Residual CO2 [%]


SCRUBBER PERFORMANCE @ T=5°C, P=23BAR, REDUCED CIRCULATION
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
Absorption efficiency [%]
L/G
Liquid loading [m^3/m^2]
5
4
3
2
1
0
0
50
100
150
200
250
300
350
400
450
Gas flow [Nm^3/h]
Residual CO2 [%]


SCRUBBER PERFORMANCE @ T=20°C, P=19BAR
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
100
150
200
250
300
350
400
Absorption efficiency [%]
L/G
Liquid loading [m^3/(m^2*h)]


5
4
3
2
1
0
100
150
200
250
300
350
400
Gas flow [Nm3/h]
Residual CO2 [%]

Main results

- Test results indicate that the packing volume can be decreased to 1/3 compared with Tellerettes
- Accompanying reduction in scrubber size
  - Weight
  - Wind induced stress
- Efficient use of circulation water
- High turndown ratio for water flow

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Operational challenges

- Owing to the high specific surface area, the packing is very dense
- Sensitivity to packing entrainment
  - Scaling
  - Biogrowth
  - Dirt

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Biofilm

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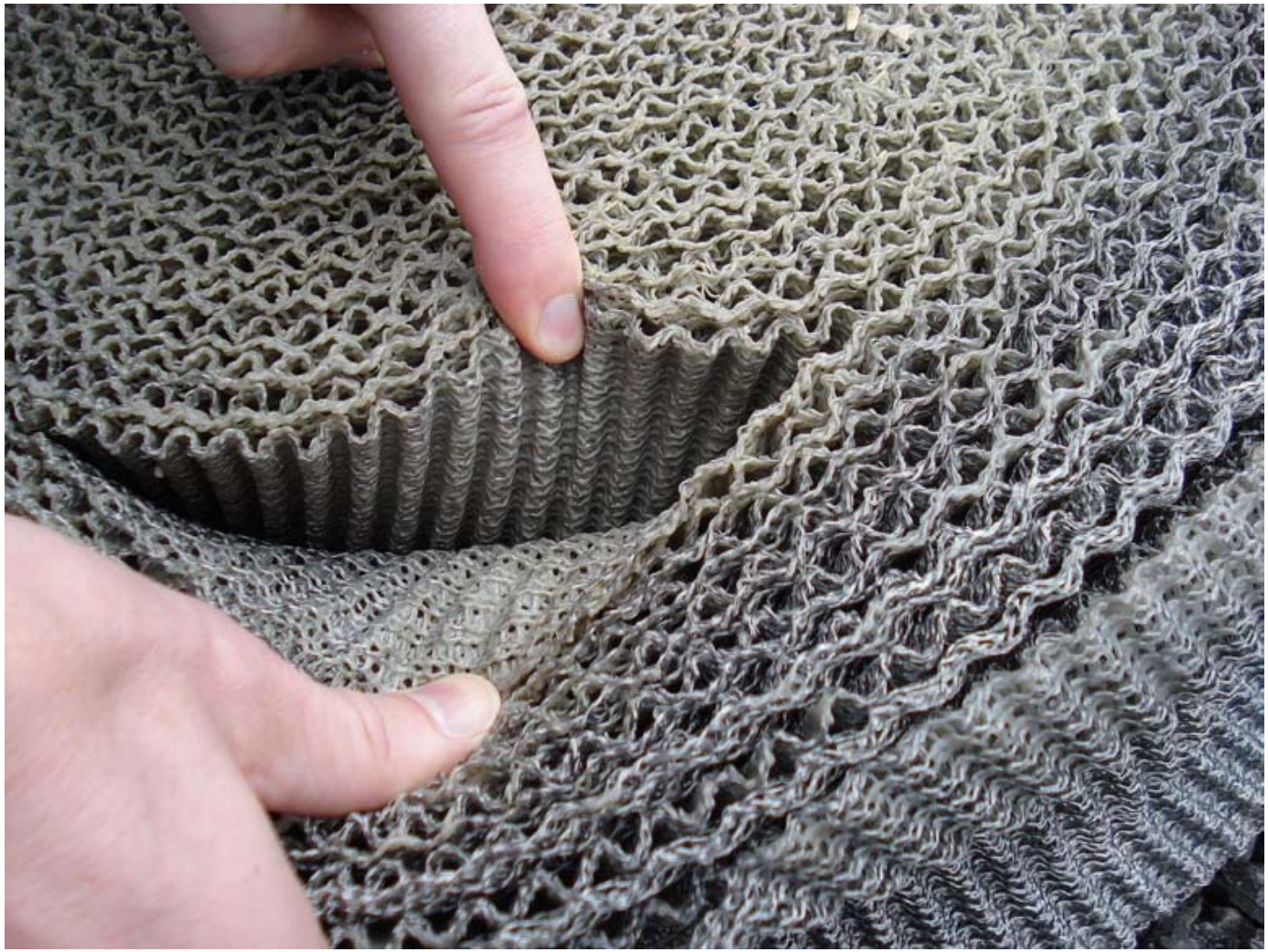
Biofilm



Measures to counter the growth of biofilm

- Continuous
  - Chlorine addition
  - UV
- Periodic cleaning
  - Caustic soda

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Summary

- Efficient CO_2 removal in a compact scrubber
- High efficiency reduces circulation water and hence reduces pumping costs
- Scrubber is more susceptible to clogging due to the high surface density of the packing material
- High turndown ratio of both gas and liquid – Flexible operation

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Thank you for your attention!

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