



POLYTECHNIQUE
MONTREAL

LE GÉNIE
EN PREMIÈRE CLASSE

Hydrophobic Polymer Exclusion Nets

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2nd Canadian Organic Science Conference

Difficulty growing organic apples

Apple Scab



www.nature.com

Codling moths



utahpests.usu.edu



web2.irda.qc.ca

Weevils

- Up to 95 % damaged fruit without any control

Institut de recherche et de développement agroenvironnement

- Organic apple protection : HDPE exclusion net

irda

Dubois
Agrinovation

 Agriculture and
Agri-Food Canada



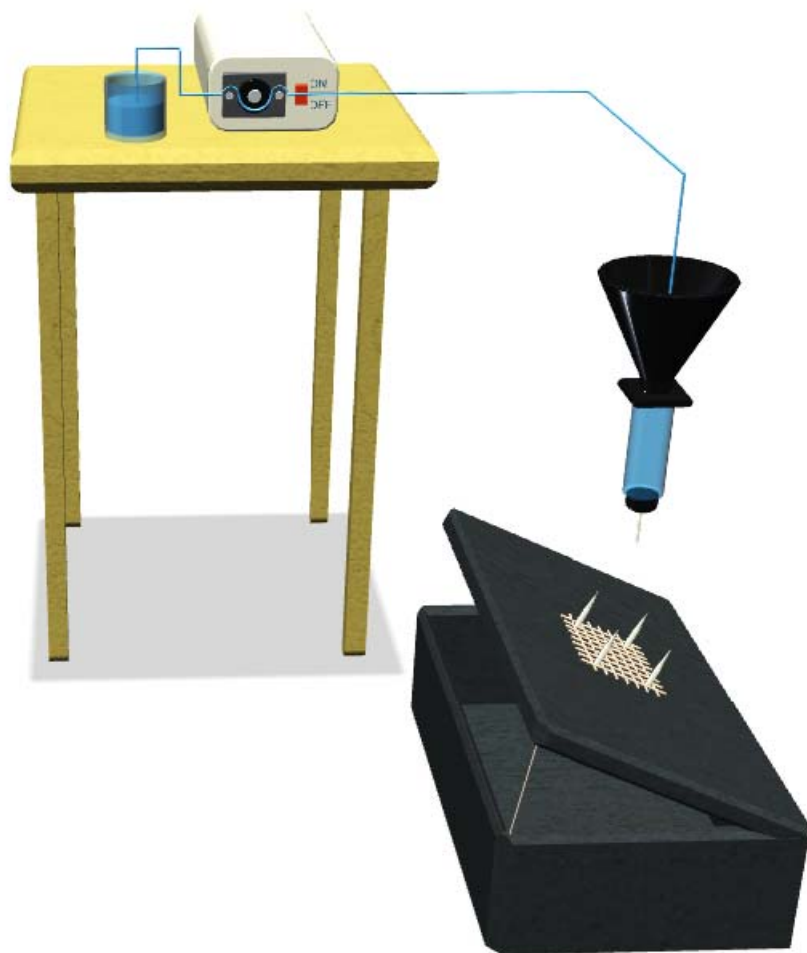
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www.alt-carpo.com

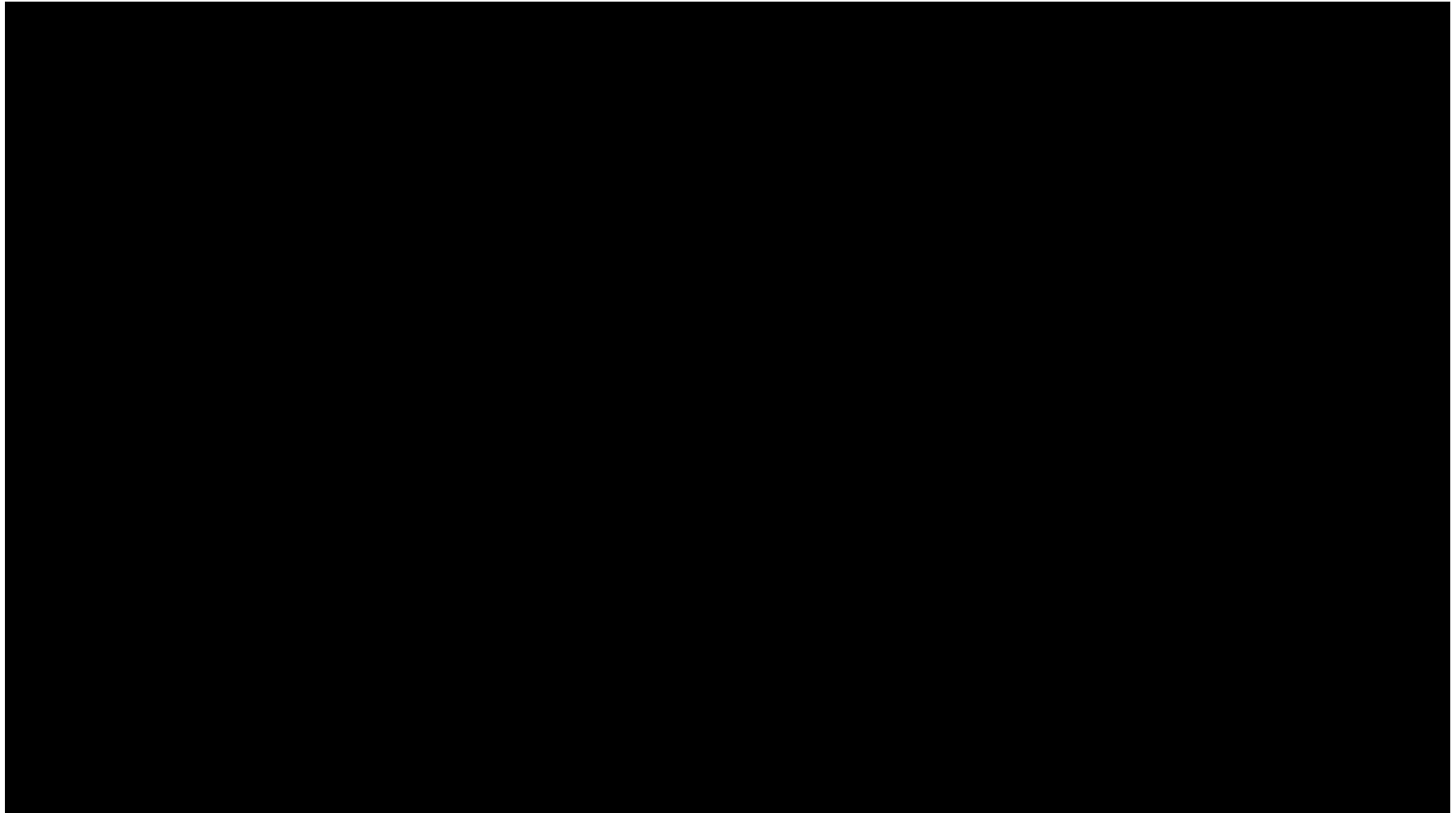
Proof of concept



www.sportsmansguide.com

Proof of concept
Commercial rainproofing treatment
Two-step solvent approach
(Silicon Chemistry)

Rain Test



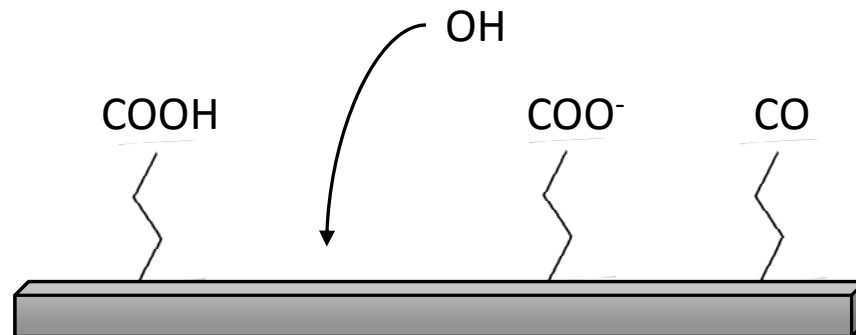
Commercial treatment limitations

- Hydrophobicity largely lost after a short period (~ 2 hours)
- Potential leaching on the apples
- Loss of elasticity



www.123rf.com

Chemical modification



- Surface functionalization

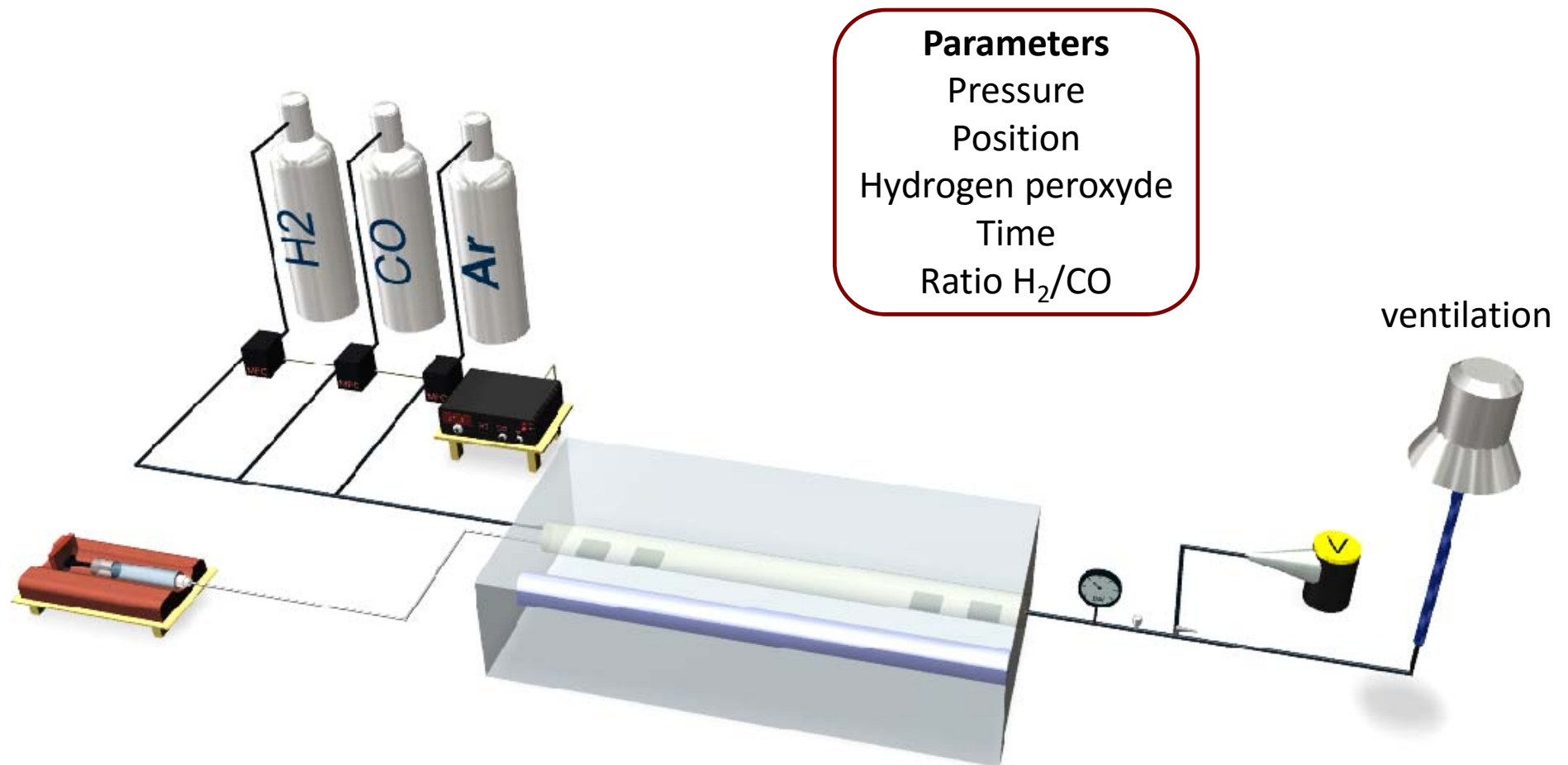
Advantages

- Durability of the treatment
- Without physical modification of the substrate

Disadvantage

- Complex process

Photo-Initiated Chemical Vapour Deposition

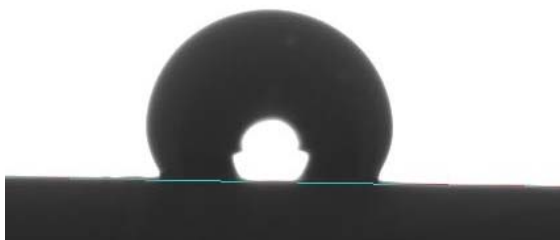


Hydrophobic Result

HDPE



Initial contact angle = 99 °



Contact angle = 124 °

Conditions

Pressure = 10 kPag

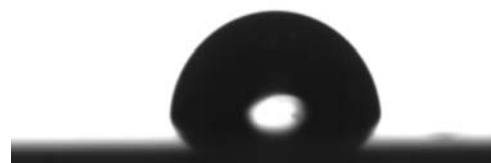
Position = 20 cm

Without peroxyde

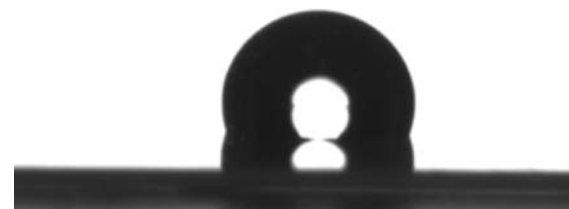
Time = 30 min.

Ratio $H_2/CO = 1/2$

PET



Initial contact angle = 85 °



Contact angle = 112 °

Conditions

Pressure = 10 kPag

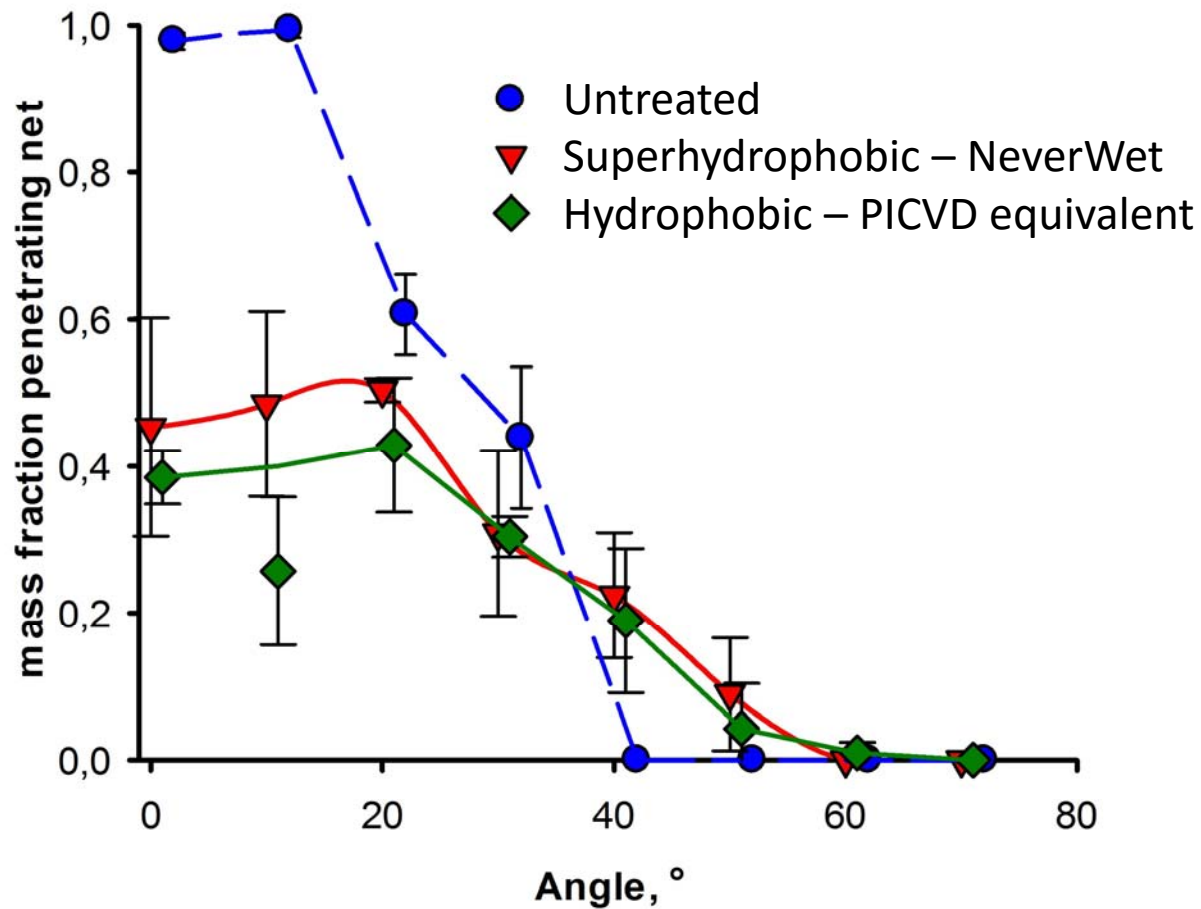
Position = 70 cm

Without peroxyde

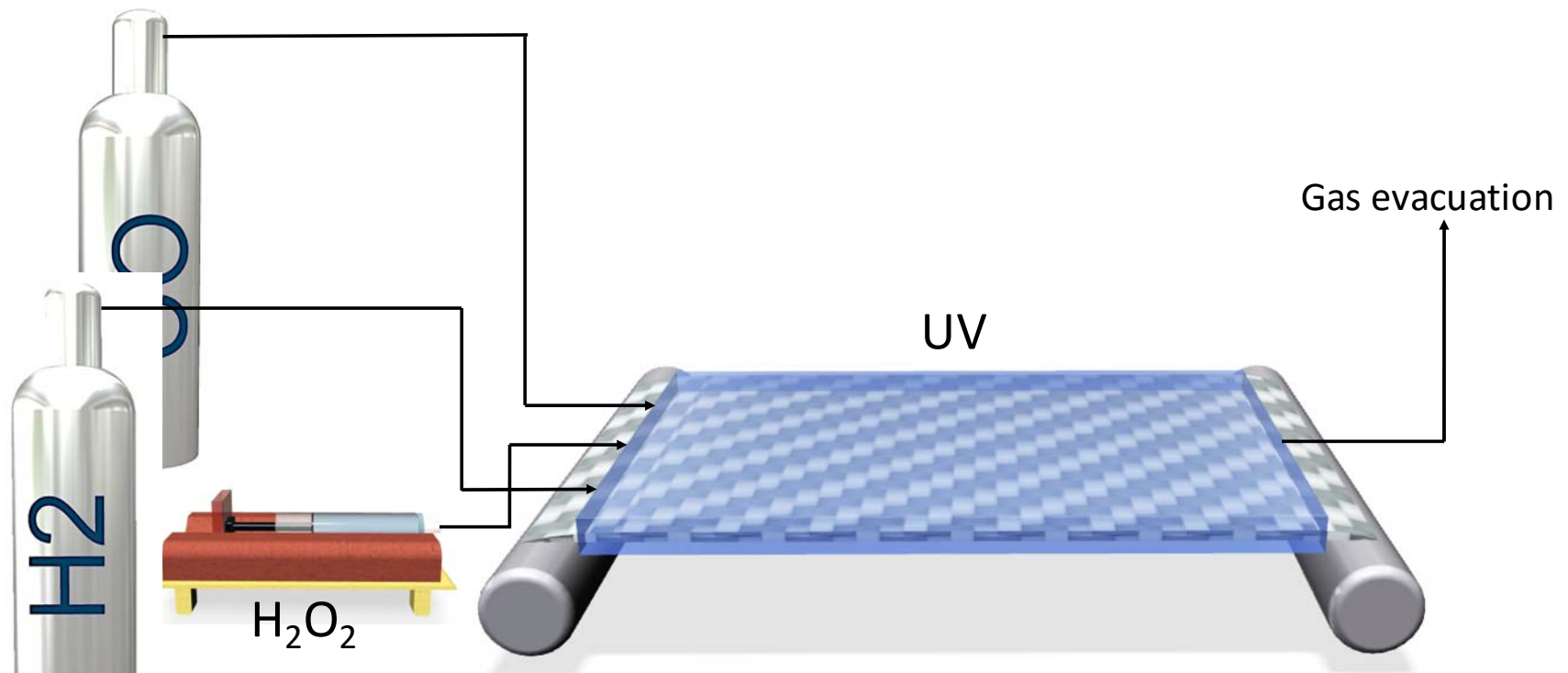
Time = 1h15

Ratio $H_2/CO = 1/8$

Rain Simulator – ProtekNet 80 g



Scale up – Estimate

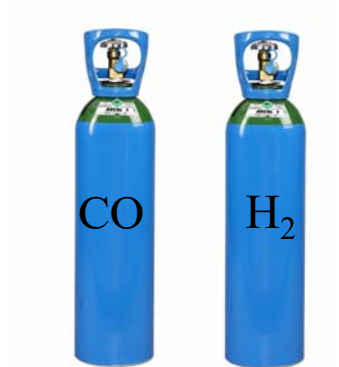


Cost for PICVD layer

1.13 \$ / m²

On going work

- Reaction kinetics investigation



www.laboutiquedusoudeur.com

- Polymer nets



Arkent.fm.alibaba.com

- Testing under real conditions



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Acknowledgments



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Agriculture and
Agri-Food Canada



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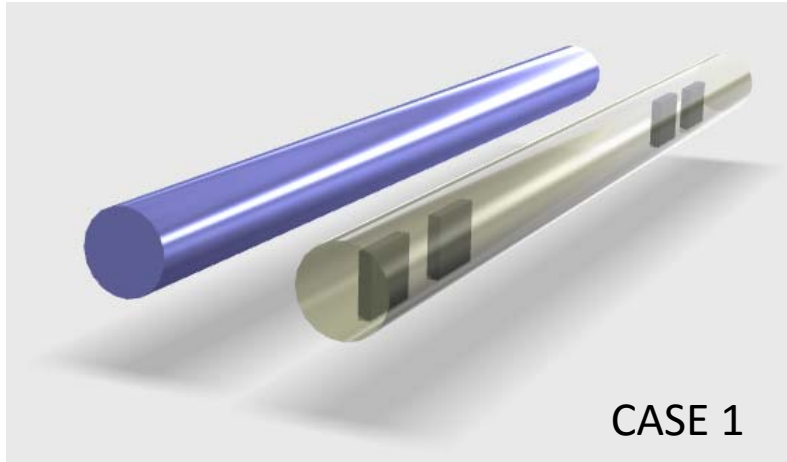
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Fonds de recherche
sur la nature
et les technologies

Québec



Effect of orientation



Conditions

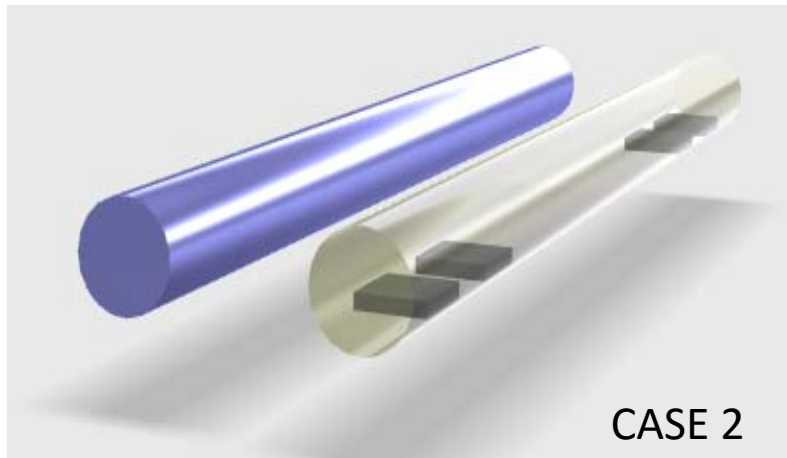
Pressure = 0 kPag (atmospheric)

Position = 45 cm from inlet gas

No peroxyde

Time = 1 h 15

Ratio $H_2/CO = 1/2$



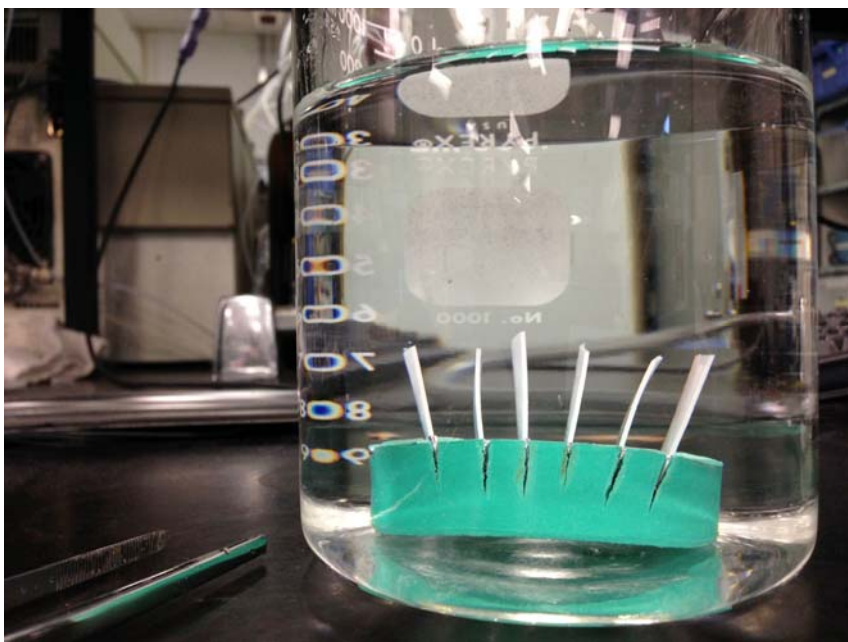
Contact angle

Contact angle	
Case no. 1	$(112 \pm 3)^\circ$
Case no. 2	$(113 \pm 4)^\circ$

Washing Steps

Step 1: Ultrasonic bath

- 15 min Distillated water
- 15 min. Acetone



Step 2: Dessicator

- Minimum : 2 hours
- Maximum : 48 hours

Experimental datas

