JOINT FINAL EVENT

PaREGEn + PEMs 4Nano

Improving solid particle penetration of catalytic stripper for PEMS system

Objectives

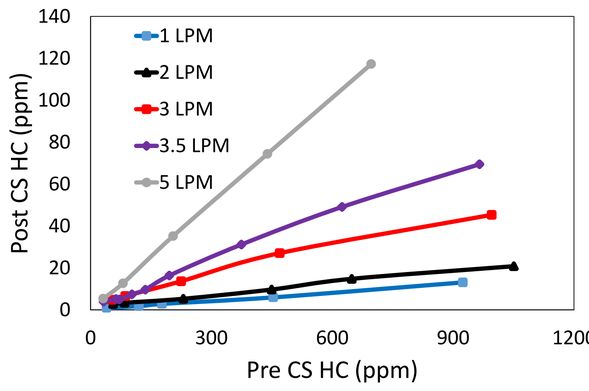
Improvement of catalytic stripper for higher solid particle penetration with adequate volatile and semi-volatile particle removal, and HC removal.

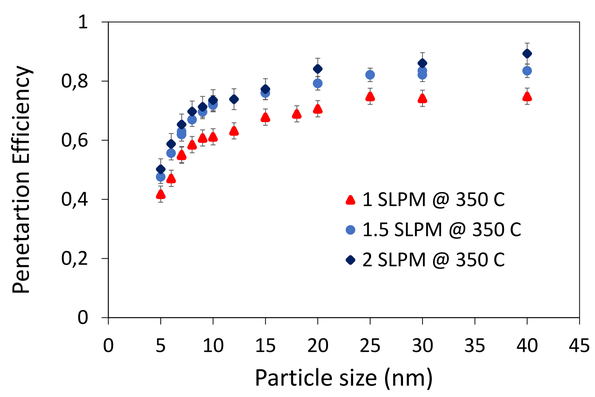
Methodology

Catalytic Stripper (CS) is improved for solid particle penetration (especially at 10-20 nm particle size) with adequate semi-volatile particles and HC removal. Improved CS is designed with optimum catalyst bed length based upon the test results of existing CS (S/N 010CX16-20130021).

Experimental Results

HC removal and Solid particle penetration of CS (S/N 010CX16-20130021)

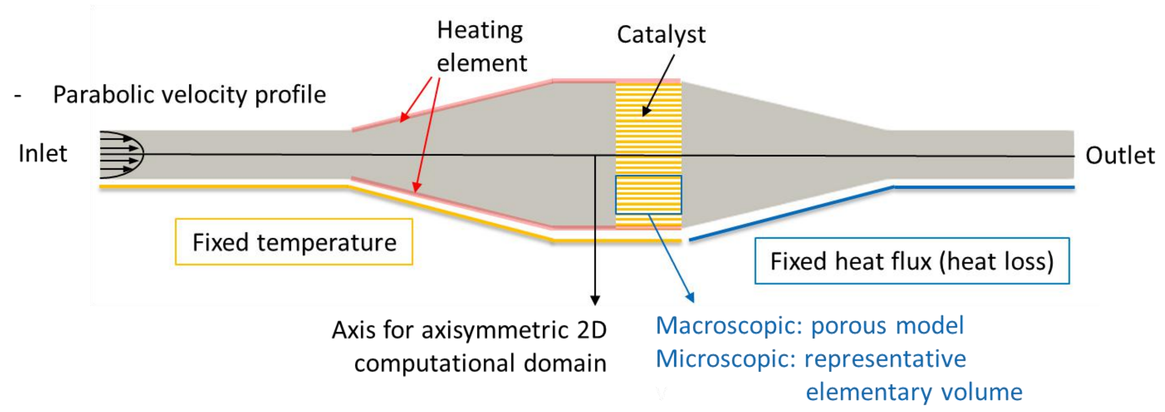


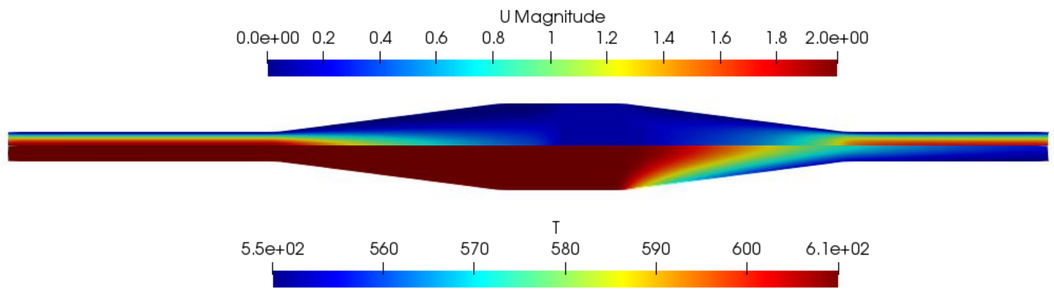


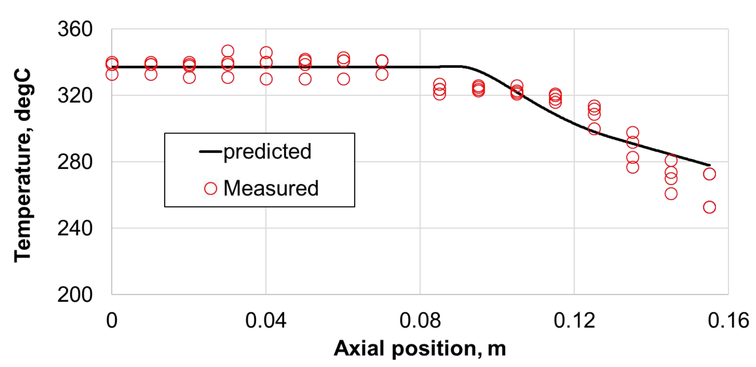
Solid particle penetration and HC removal results of CI CS (S/N 010CX16-20130021) suggests a trade off between them with flow rate. Increase of flow rate from 1.0 SLPM to 2.0 SLPM will increase the solid particle penetration around 10-15% while decrease HC removal 1-2%. We implemented this in the new CS by reducing active catalyst bed length 50% than the previous one.

Numerical modelling

OpenFOAM, an open source CFD-toolkit, is employed to develop macroscopic and microscopic models for particle penetration and species conversion efficiency through the catalytic stripper.



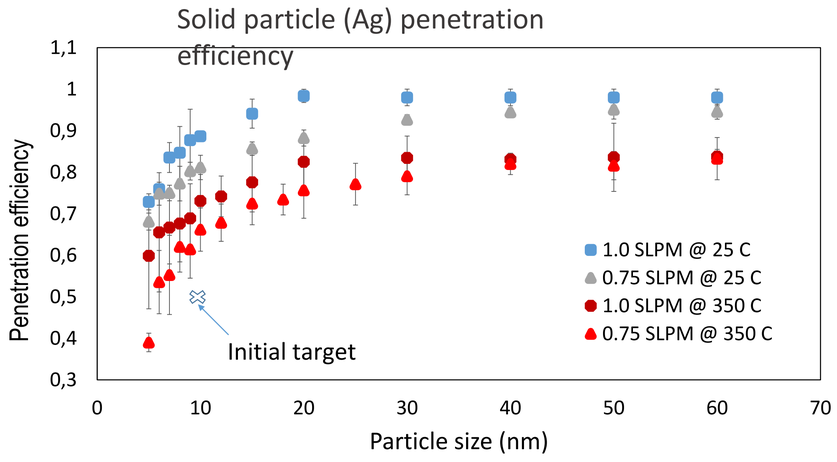




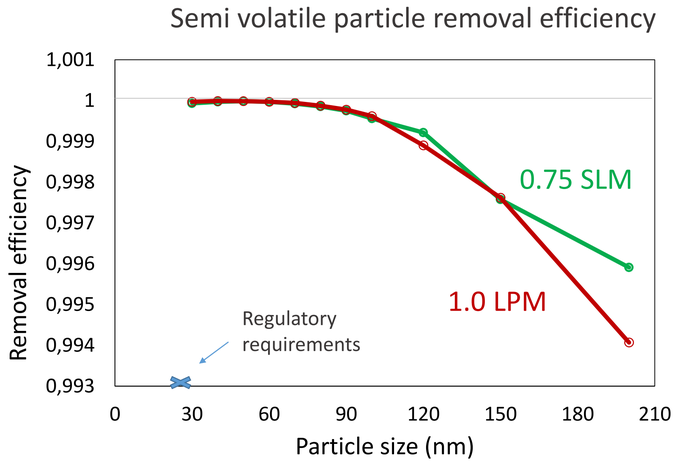
← Measured and predicted temperature profiles at the axis of catalytic stripper.

New improved CS

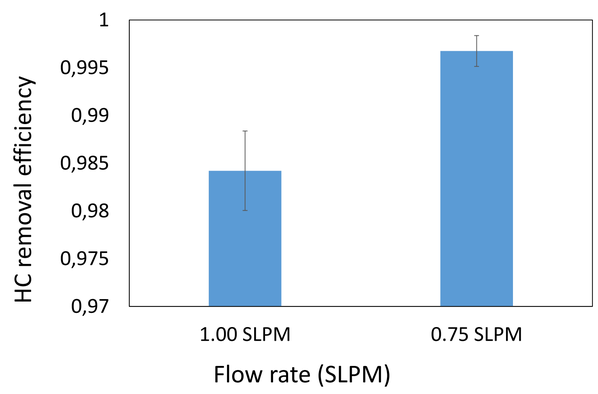
Solid particle (Ag) penetration efficiency



Semi volatile particle removal efficiency



Gas phase HC (toluene) removal efficiency



Conclusions

- We achieved 10-15% improvement in solid particle penetration with new CS, resulting 65-75% penetration at 10 nm size.
- A computational fluid dynamics model for catalytic stripper has been successfully developed and validated with experimental data for HCs removal and solid particle penetration.
- Optimized CS can remove higher concentration of semi-volatile (Tetracontane) particles than the regulatory requirement(>99% removal of 10^3 particles@30 nm). Gas phase HC removal is 98-99% for higher than 1000 ppm toluene concentration.

PEMs 4Nano

HORIBA BOSCH Invented for life CMCL Innovations TSI UNDERSTANDING, ACCELERATED UNIVERSITY OF CAMBRIDGE Université de Lille Applus IDIADA HORIBA Scientific UNIRESEARCH

www.PEMs4Nano.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 724145