Performance of PMP PN System with Catalytic Stripper VPR using > 1mg/m3 Tetracontane

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Imad Khalek, SwRI

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Objectives

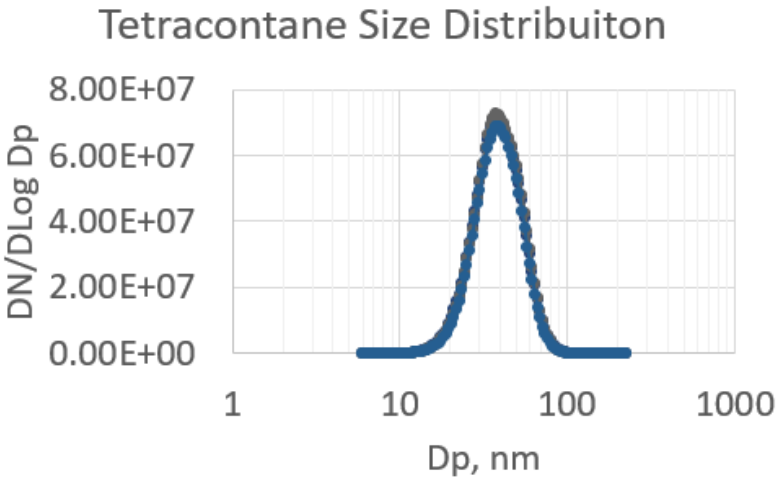
- Research the feasibility of using the new VPR removal efficiency criteria that includes:
  - Material: Tetracontane
  - Size distribution: GMD> 50 nm using SMPS
  - Mass Concentration: > 1 mg/m3 using SMPS
  - PN System: PN Compliant System for > 23 nm using TSI CPC 3790 wit 50% efficiency at 23 nm
  - Using TSI CPC 3750 with 50% efficiency at 7 nm & 65% efficiency at 10 nm

Equipment Use

- Tetracontane Particle Generator
- SMPS
- PMP Compliant System with Catalytic Stripper VPR using:
  - CPC 3790 with 50% efficiency @ 23 nm
  - CPC 3750 with 50% efficiency @ 7nm or ~65% @10 nm

Tetracontane Size Distribution

- Tetracontane Particle Geometric Mean of 40 nm
  - We should be able to go up to > 50 nm
  - Time did not permit
- Total Mass Concentration ~1 mg/m³



Mean(nm)	40.0	40.2	39.8
Geo. Mean(nm)	38.0	38.2	38.0
Mode(nm)	37.2	37.2	37.2
Geo. Std. Dev.	1.38	1.37	1.36
Total Concentration(#/cm³)	2.54E+07	2.55E+07	2.37E+07

Mean(nm)	52.2	52.0	51.2
Geo. Mean(nm)	50.1	50.0	49.3
Mode(nm)	53.3	53.3	51.4
Geo. Std. Dev.	1.3	1.3	1.3
Total Concentration(µg/m³)	1121.4	1135.0	1021.9

Catalytic Stripper (CS) VPR Performance (Catalyst Gas Temperature: 300°C)

Tetracontane Particle Removal Using PMP with Catalytic Stripper									
PMP Concentration Using 23 nm CPC				7 nm	SMPS	SMPS	VPR	VPR	VPR
	PRF Corrected			PRF Corrected	Number	Mass	Removal	Removal	Removal
PRF	Concentation	Stdev	COV	Concentration	Conc	Conc	Efficiency	Efficiency	Efficiency
	Part./scm3	Part./scm3	%	Part./scm3	Part.cm3	mg/m3	%	**%, 3*stdev**	%
							> 50%@23nm	> 50%@23nm	> 50%@7nm
286	153	286	187%	543	2.54E+07	1.13	99.9994%	99.9966%	99.9979%
664	112	664	594%	234	2.55E+07	1.13	99.9996%	99.9922%	99.9991%
547	132	547	413%	284	2.37E+07	1.03	99.9994%	99.9931%	99.9988%

Preliminary results showed that CS VPR removal efficiency was over 99.99% using either a CPC 3790 with 50% efficiency @23 nm or CPC 3750 with 50% efficiency at 7 nm

Next Step/Comment

- Our Next step is to redo these experiments using tetracontane size distribution with a geometric mean diameter > 50 nm instead the ~40 nm used in this work
- This approach to VPR characterization seems to be feasible and not difficult to do if having the right equipment.
- The penetration requirement should be much higher than just 99%