Nanoparticle from light duty vehicles using various fuels for FTP-75 and WLTC

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Background &Objective

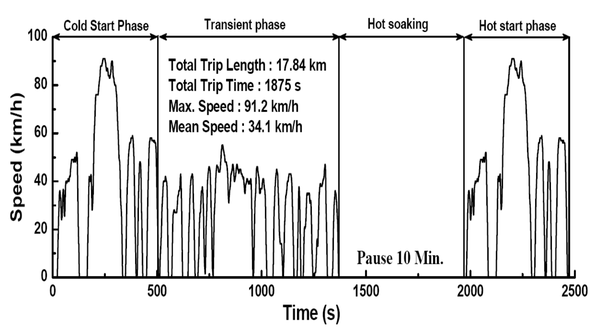
- ◆ In the light duty vehicles, PM and PN are hot issues; especially diesel and GDI vehicles.
- ◆ In the case of sub 23 nm PM, MPI gasoline, LPG and CNG also have PN problem.
- ◆ The authors want to compare PN from CNG, LPLi, GDI and diesel vehicles
- ◆ And also, Comparing the test mode because WLTC has more severe test condition.

Test apparatus

<Test Vehicle & Spec>

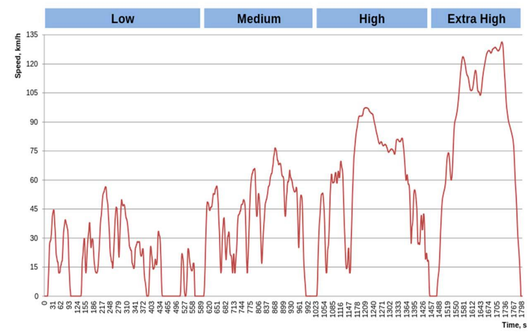
	K5 (KIA)	K5 (KIA)	SM5 (Samsung)		Veloster (HMC)	I30 (HMC)	Sorento (KIA)
Fuel	LPG	Gasoline	LPG	LPG-CNG	Gasoline	Diesel	
Boost	N/A				Turbo/Intercooler		
Engine type	LPLi	MPI	LPG	LPG-CNG Bi-fuel	GDI	CRDI	
Volume (l)	2.0				1.6		2.0
Engine oil grade	5W-20				5W-30		
Model year	2013	2014	2013		2014	2012	2009
Odormeter	44,230 km	31,037 km	57,565 km	57,565 km	22,808 km	105,843 km	115,384 km
Aftertreatment	TWC					DOC+DPF	DOC
Transmission	Automatic 6		CVT		Automatic 6		

<FTP-75 cycle>



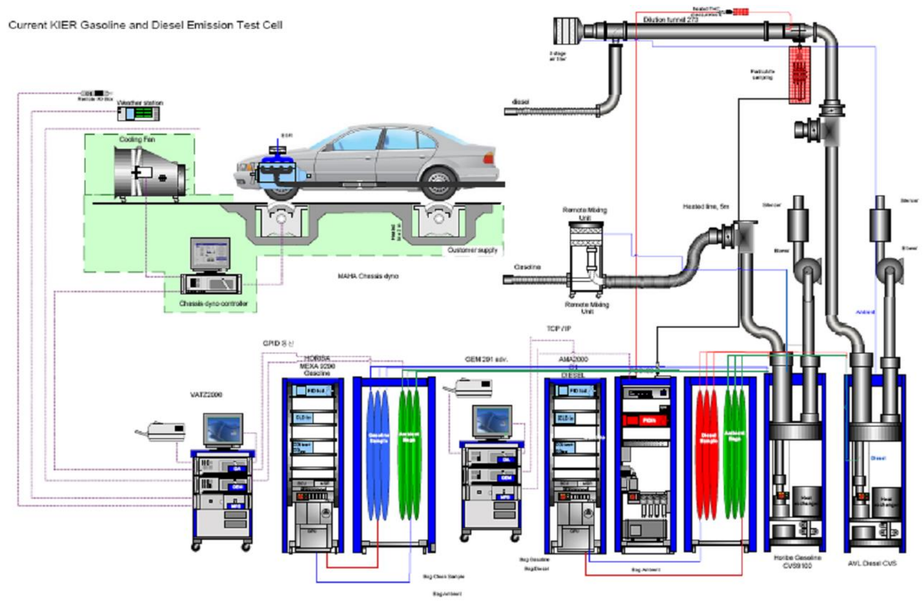
Phase	Time (s)	Distance (km)
Cold start transient phase	505	5.78
Stabilized phase	865	6.29
Hot soak	Min 540, max 660	-
Hot start transient phase	505	5.78
Total	2,475	17.85

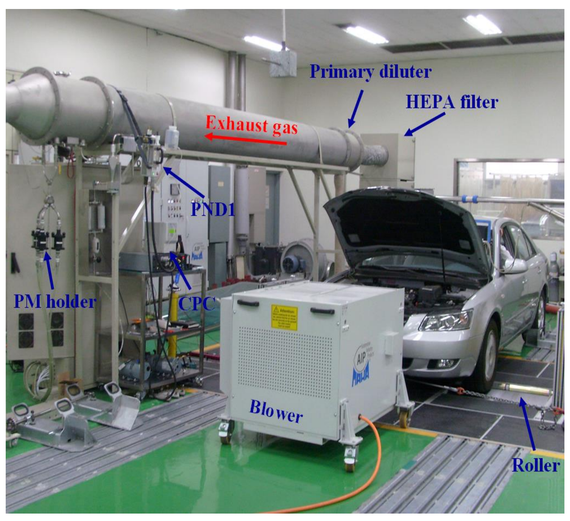
<WLTC>

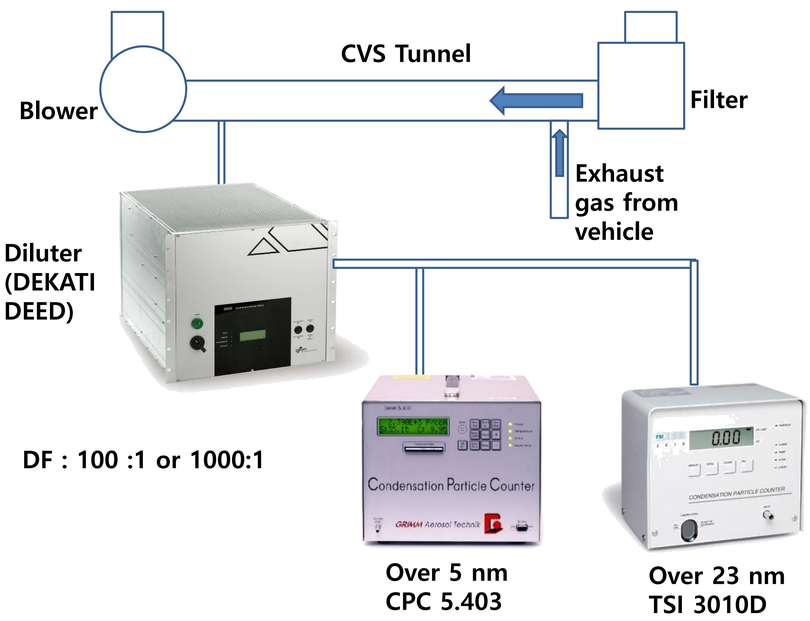


	Low	Medium	High	Extra High	Total
Duration, s	589	433	455	323	1800
Stop duration, s	156	48	31	7	242
Distance, m	3095	4756	7158	8254	23262
Maximum speed, km/h	56.5	76.6	97.4	131.3	
Average speed without stops, km/h	25.7	44.5	60.8	94.0	53.8
Average speed with stops, km/h	18.9	39.5	56.6	92.0	46.5

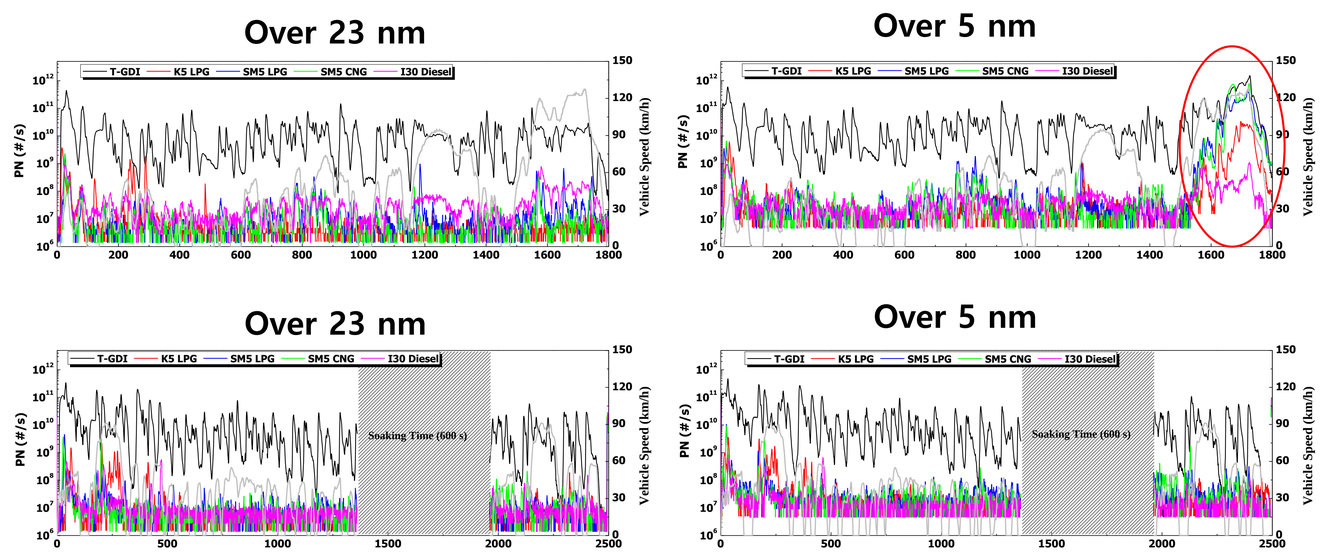
<Schematic Diagram of Test Equipment>



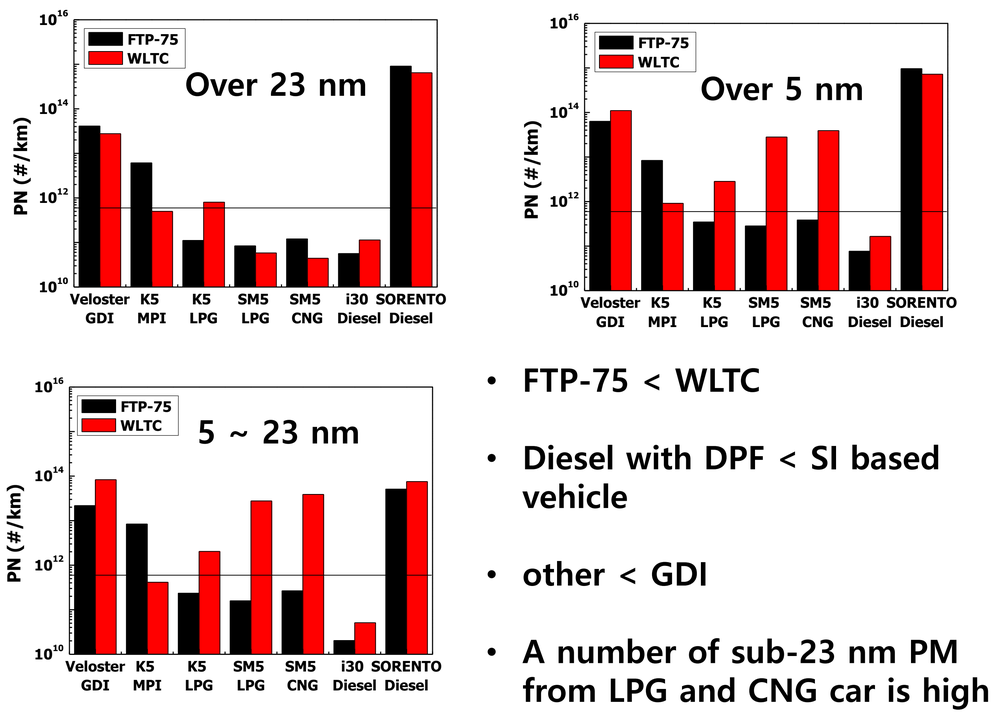




RESULTS



- PN depends on acceleration and deceleration of vehicle.
- other < GDI
- PN of CNG and LPG was similar to PN of GDI when vehicle speed was over 100 km under WLTC.



- FTP-75 < WLTC
- Diesel with DPF < SI based vehicle
- other < GDI
- A number of sub-23 nm PM from LPG and CNG car is high

SUMMARY

1) In this study, gasoline, LPG, CNG and diesel vehicles were investigated to comparing emissions.
2) Emission level; FTP75 is higher than WLTC; CO and HC from GDI is higher than other SI based vehicles; NOx from diesel vehicle is higher than SI based vehicle and diesel without DPF vehicle is the highest.
3) PN level : WLTC his higher than FTP-75 due to higher speed; diesel with DPF vehicle is lower than other vehicles; GDI is higher than other SI based vehicles; PN for Sub 23 nm in LPG and CNG is higher.

Acknowledgments This research was financially supported by KAMA.