Influence of the use of oxygenated additives on the particle emissions of a Euro 3 urban bus from the current fleet in the city of Seville

BIOSEVILLE
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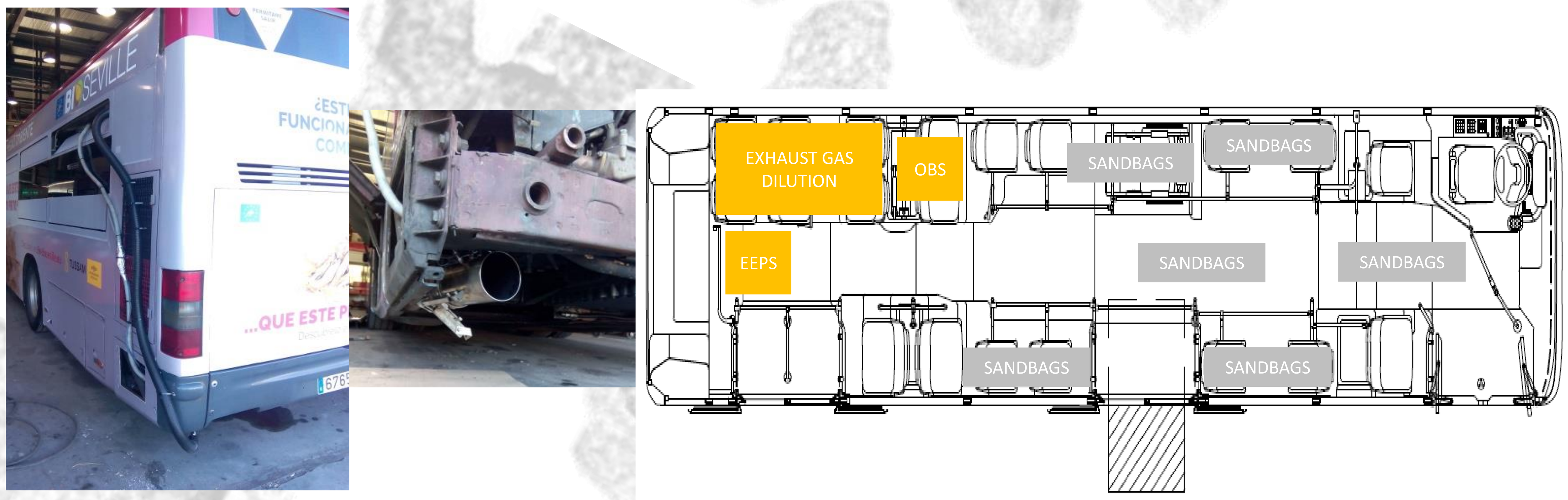
INTRODUCTION AND BACKGROUND

- The transport sector is one of the main contributors to pollutant emissions into the atmosphere. Emissions from vehicles damage urban air quality and cause serious health problems for people. Both public administrations and research organizations are making big efforts to reduce pollutant emissions and a possible alternative to solve it is the use of unconventional fuels that reduce dependence on fossil fuels and also can reduce emissions. The vehicle emission group (GEV) of the Center for Energy, Environmental and Technological Research (CIEMAT) has been testing different types of fuels in different engines for years, including biofuels of vegetable origin and those from waste oils. Currently, among their projects, they are working on the LIFE + Bioseville project, which aims to recover fried oils to produce high-quality biodiesel and oxygenated additives from waste glycerin from biodiesel manufacturing.
- The aim of this work is to make a comparative analysis of gaseous emissions (CO2, NOx and HC) and nanoparticle emission in number and size distribution of a bus engine (Euro 3) with different proportion of conventional diesel, biodiesel, waste cooking oil and oxygenated additives from glycerin (diacetyl glycol) (47.5% Conventional Diesel, 47.5% Biodiesel, 2.5% additives and 2.5% heptane). The bus used is part (43%) of the fleet of buses that circulate daily in the city of Seville as part of the service provided by the Urban Transport Company of Seville (TUSSAM) and has been driven through the city of Seville during the month of January fulfilling the busiest urban and extra-urban bus lines in the city.

METHODOLOGY

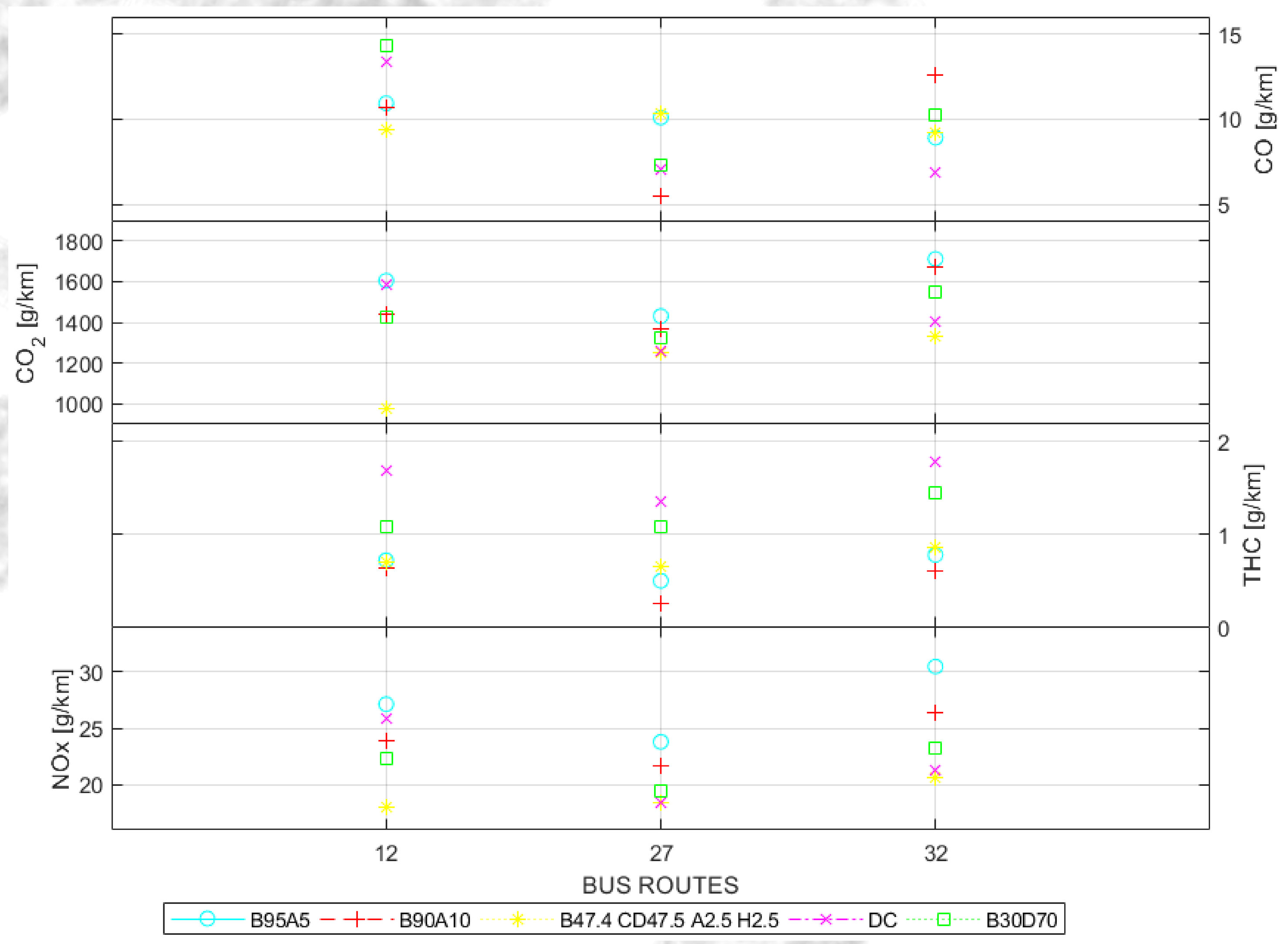
The measures of polluting emissions from the bus were made in an urban bus of the real urban bus fleet, an IVECO City-Class Euro 3 bus. 3 lines were covered. The three lines have been selected among those with the highest number of register users. To ensure the validity of the data, 3 repetitions of each line have been made. The measuring equipments installed in the bus were: an OBS2200 system from HORIBA, an EEPS from TSI and a rotatory disk dilutor from Matters Engineering. The bus circulated without passengers, reason why the weight of the passage was simulated with sandbags that added 1000 kg. In addition, in order to avoid the influence of the driver on emissions, the same driver was always used.

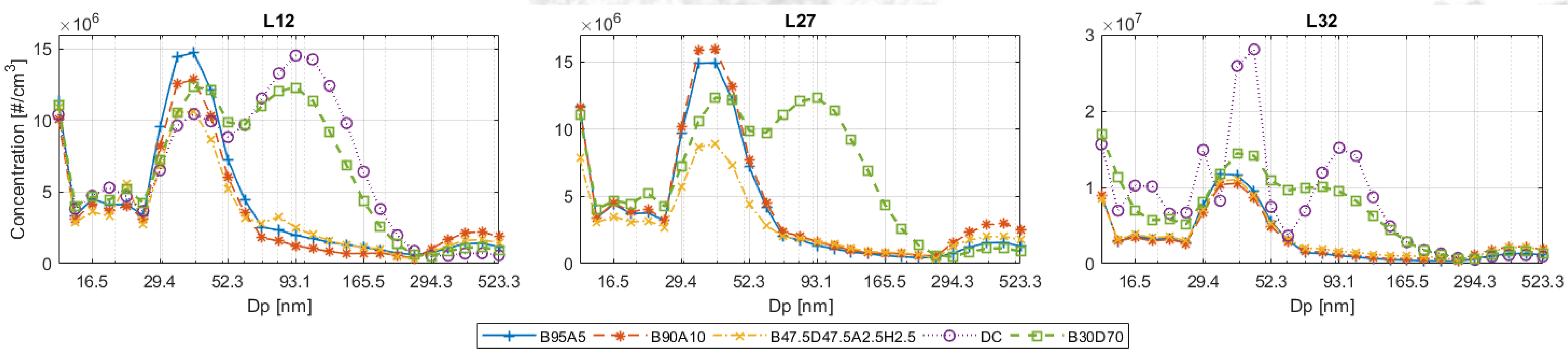
ASSEMBLY OF EQUIPMENTS

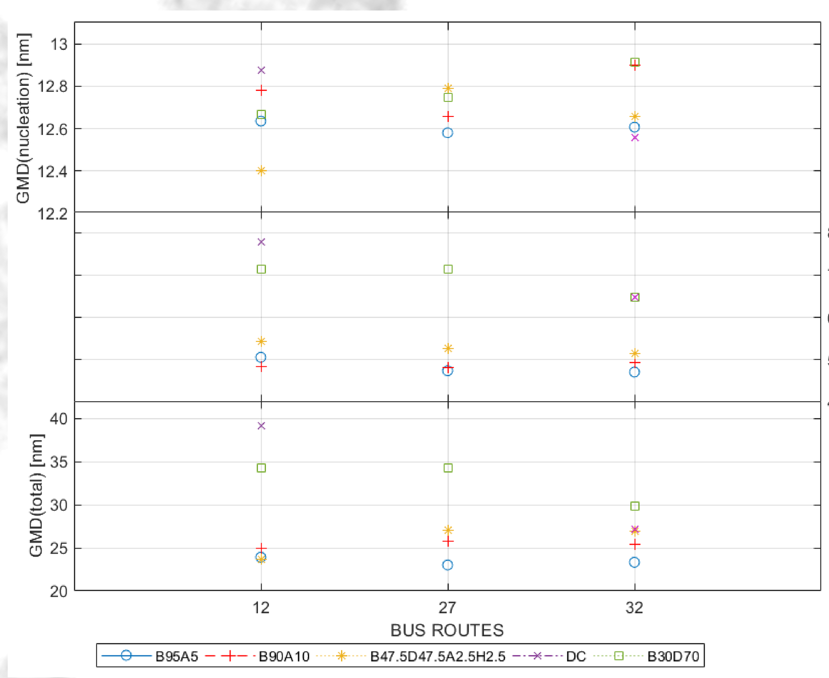


EMISSIONS RESULTS

Comb	L	Vel (km/h)	CO (g/km)	CO_2 (g/km)	THC (g/km)	NOx (g/km)	Fc (g/km)	PN_{nucl} (#/km)	PN_{acum} (#/km)
DC	12	11,43	13,36	1587,63	1,68	25,90	504,31	2,77E+15	2,66E+15
DC	27	13,93	7,07	1261,56	1,36	18,35	400,26		
DC	32	11,17	6,91	1405,40	1,78	21,29	446,02	1,16E+16	2,68E+15
B30 D70	12	12,87	14,33	1426,95	1,09	22,30	452,64	3,08E+15	1,97E+15
B30 D70	27	15,21	7,36	1325,18	1,08	19,45	420,14	2,76E+15	1,65E+15
B30 D70	32	11,81	10,25	1552,07	1,44	23,21	492,86	4,80E+15	2,18E+15
B90 A10	12	13,73	10,94	1604,43	0,72	27,12	507,80	3,67E+15	1,64E+15
B90 A10	27	16,01	10,11	1430,44	0,50	23,79	452,42	3,41E+15	1,34E+15
B90 A10	32	12,30	8,92	1711,20	0,78	30,45	541,11	3,33E+15	1,19E+15
B95 A5	12	13,74	10,67	1442,58	0,64	23,94	455,71	4,24E+15	1,22E+15
B95 A5	27	20,09	5,48	1368,23	0,26	21,64	432,61	4,09E+15	1,28E+15
B95 A5	32	13,77	12,57	1672,79	0,61	26,43	529,05	3,82E+15	1,16E+15
B47.5 DC47.5	12	14,11	9,38	975,90	0,70	18,02	306,52	2,59E+15	7,75E+14
B47.5 DC47.5	27	19,37	10,35	1254,85	0,66	18,46	396,78	2,19E+15	7,94E+14
B47.5 DC47.5	32	15,97	9,25	1334,70	0,86	20,58	421,52	2,83E+15	1,00E+15

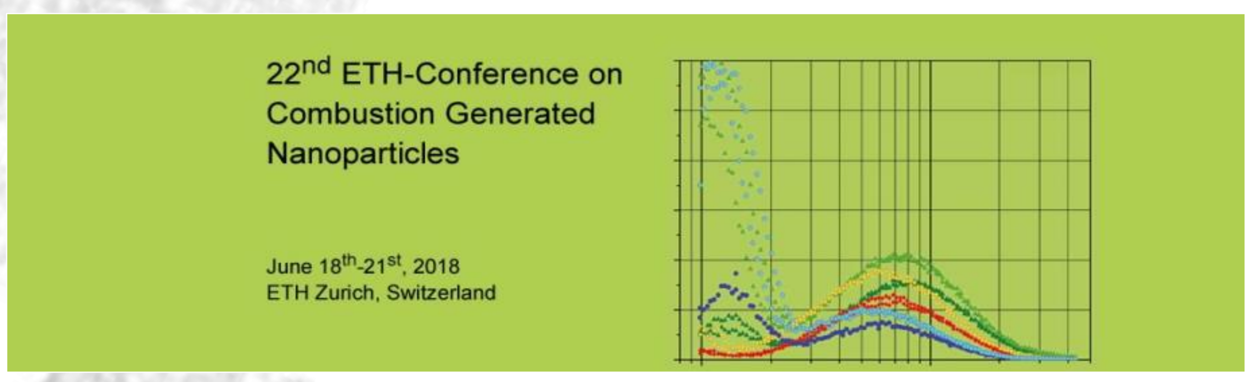






CONCLUSIONS

Among the most relevant results obtained with this study in an urban bus (Euro 3) is the influence of the addition of 2.5% acetyl glycol and 2.5% heptane to the mixture of 47.5% conventional diesel (DC) and 47.5% biodiesel (B) has on the emission of nanometric particles. It was concluded that on average the total number of nanometric particles emitted by the engine was reduced when using this blend a 60.19% (1.58E8 #/cc) when compared with those emitted with conventional diesel (DC) as fuel (3.96E8). On the other hand, the size distribution showed important changes. The use of oxygenated additive promoted the appearance of a smaller number of particles in the accumulation mode (dp>24 nm), with an average number of 4.92E7 #/cc, while the number of particles in the accumulation mode of experiments carried out with diesel was 1.37E8 #/cc.



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