Gaseous pollutants and particle emissions of a 2.5 DCI engine fuelled with biodiesel from waste cooking oil and diacetyl glycol

Carmen C. Barrios[1], Aida Domínguez-Saéz[1], Paloma Álvarez[2]

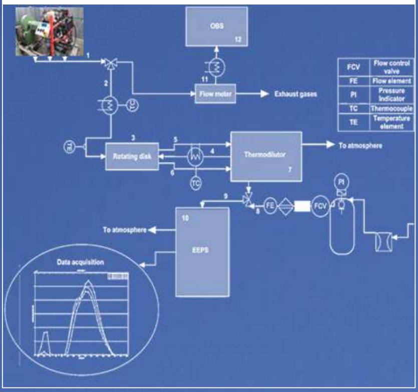
[1]Environmental Department, CIEMAT, Avda. Complutense, 40, 28040, Madrid, Spain

[2]Department of Chemical Engineering, US, C. Profesor García Gonzalez, s/n, 41012, Sevilla, Spain

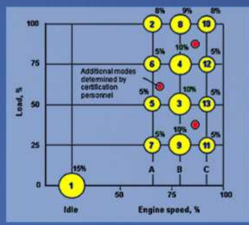
INTRODUCTION AND BACKGROUND

- **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. 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 CIEMAT has spent years trying different types of fuels in different engines. Currently, among their projects, they are working on the LIFE Bioseville project, which aims to recover fried oils for the production of high quality biodiesel (García-Martín et al, 2018) and oxygenated additives from waste glycerin from biodiesel manufacturing.**
- **The aim of this work is to compare the gaseous emissions (CO2, NOx) and nanoparticle emission in number and size distribution of a 2.5 dci diesel engine (Euro 5) with conventional diesel and different proportion of waste cooking oil and oxygenated additives from glycerin (diacetyl glycol) over the European Steady-State Cycle.**

SETUP AND METHODOLOGY

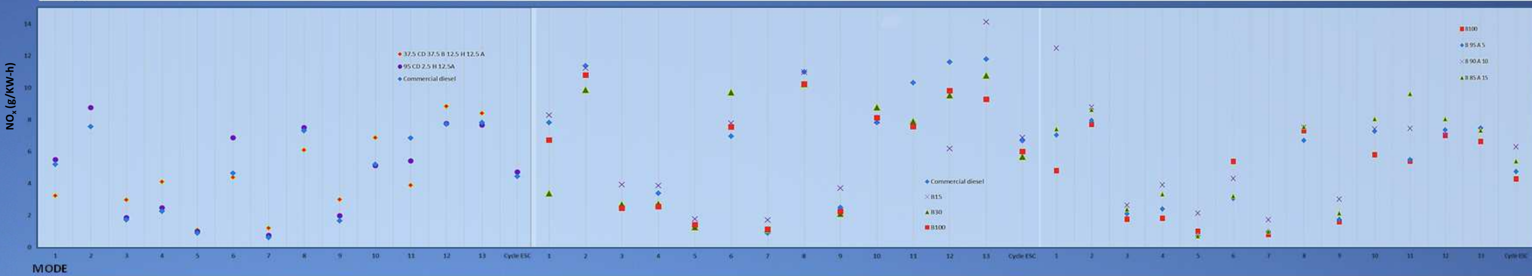


- **The engine test bench used was composed of a diesel engine and dynamometer (SCHENK W150) controlled by a HORIBA's SPARC system. Particle size distribution data were measured using an Engine Exhaust Particle Sizer 3090 (EEPS, commercially available from TSI Inc.) and a Rotating Disc Raw Gas Diluter MD19-2E, a first hot dilution (150 C and dilution factor of 1:1695) and a second cold dilution (1:2 dilution factor) (Barrios CC. et al, 2014).**
- **The fuels used were conventional diesel and 3 blends of diesel/biodiesel (75/15, 70/30 and 0/100), biodiesel with 3 proportions of oxygenated additives (5, 10 and 15%) and conventional diesel with 15% of oxygenated additive (Barrios CC. et al, 2014). Regulated emissions and particle emissions in number and size distribution were measured in the European Steady-State Cycle.**

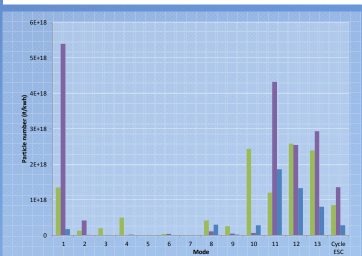


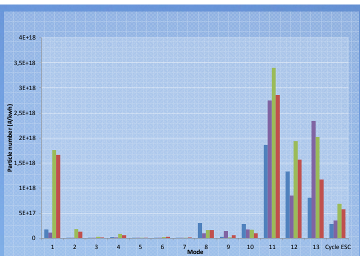
Mode	speed	% Load	%	t (min)
1	Idle	0	15	4
2	A (2200 rpm)	100	8	2
3	B (2900 rpm)	50	10	2
4	B (2900 rpm)	75	10	2
5	A (2200 rpm)	50	5	2
6	A (2200 rpm)	75	5	2
7	A (2200 rpm)	25	5	2
8	B (2900 rpm)	100	9	2
9	B (2900 rpm)	25	10	2
10	C (3600 rpm)	100	8	2
11	C (3600 rpm)	25	5	2
12	C (3600 rpm)	75	5	2
13	C (3600 rpm)	50	5	2

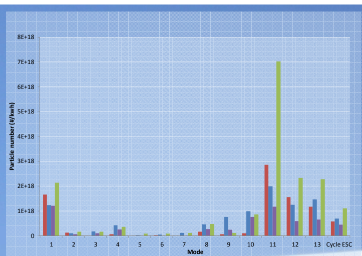
NO_X EMISSIONS RESULTS



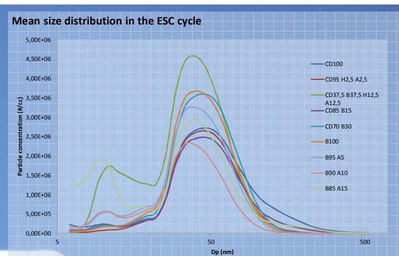
NANOPARTICLE EMISSION IN NUMBER AND SIZE DISTRIBUTION RESULTS







Mean size distribution in the ESC cycle



CONCLUSIONS

From the experiments carried out, it was concluded that:

- As expected, NOx and CO2 emissions increase.
- In the case of NOx, due to the increase in O2 content both with the use of Biodiesel and the use of oxygenated additives and in the case of CO2 due to an improvement in the combustion process.
- The total number of particles decreased for the B90A10 mixture with respect to the rest of the mixtures tested.
- On the other hand, the size distribution showed important changes. The use of acetylglycol promoted the appearance of a greater number of particles in nucleation mode (dp <30nm), with an average number of 5.72E6 # / cc.
- While the number of particles in the nucleation mode of experiments performed with conventional diesel was 2.10E6 # / cc.

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BIOSEVILLE

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