

# Analysis of DMBs produced

## Scientific Objectives

Quality of the DMBs produced. Their miscibility with diesel and biodiesel, their compliance to EN590 requirements and, if non-compliant, suggest means to achieve compliance.

The tests were performed in the Technology Center of YPF, the largest oil company in Argentina.



Figure 1. YPF Technology Center. Buenos Aires Argentina

IDENTIFICATION	Especificación EN 590	GO			
		Grade 3	GO + 5%EL	GO + 7% FAME	GO + 7% FAME + 5% EL
Density @ 15°C ASTM D 4052-02, kg/m <sup>3</sup>	820,0 – 845,0	832,9	840,7	836,2	844,3
Distillation ASTM D 86-09, °C					
95 % vol. Recovered	≤360	345,6	342,3		
Máx.					
% Vol. recovered @250°C	≤65	40,2	43,5		
% Vol. recovered @350°C	≥85	96,1	96,7		
Cetane Index ASTM D 4737-08	≥46,0	52,3	48,6		
Cetane number ASTM D 613-10a	≥51,0	54,2	52,6	53,9	51
Aromatic hydrocarbons IR / EN 12916, % p/p					
Polycyclic aromatic	<11				
Viscosity @ 40°C ASTM D445-09	2,00-4,50	2,567	2,386	2,643	2,463
Carbon Residue s/10% residue (Micro Método) ASTM D 4530-07, %p/p	≤0,30				
Water, mg/Kg	<200	57	70	63	93
Copper strip corrosion 3hs@50°C, ASTM D 130-04	Máx. 1				
Total contamination EN12662-08, mg/Kg	≤24				
Lubricity HFRR, CEC F-06-A-96, µm					
WSD (corrected wear scar diameter)	≤460	489	442	408	339
Rancimat modified EN15751-08, hs	≥20			38,79	36,41

Table 1. DMB Tests EN590 compliance

Notes:

GO Grade 3: Diesel Grade 3

GO + 5%EL: Diesel Grade 3 + 5% Ethyl Levulinate

GO + 7% FAME: Diesel Grade 3 + 7% FAME

GO + 7% FAME + 5% EL: Diesel Grade 3 + 7% FAME + 5% Ethyl Levulinate

## EXPERIMENTAL PART

### RESULTS

Not miscibility problems of the DMB with the diesel fuel was detected to the percentage assessed in this work. The literature reports problems of miscibility at content of around 20 % of DMB.

To compensate for the reduction in the number of cetane number (ASTM D613) due to the use of DMB it is necessary to add additives cetane number improvers. It is necessary to add approximately 500 ppm of that product. (Figure 2)

The samples of diesel fuel and biodiesel prepared with 5% DMB met most of the requirements of the specification EN 590.

We notice a good anti-wear performance in the diesel fuels formulations while using DMB.

## EXPERIMENTAL PART

At this stage of the work we received a new sample of the product developed at the University of Rio de Janeiro (UFRJ). The evaluated sample in the previous period had a high content of water that does not meet the European standard EN590 specification.

New sample was subjected to a drying process at the UFRJ which had a positive result which is evident in the low water content determined. (Table 2)

Test	Method	SAMPLES		
		EL (Commercial)	EL (UFRJ) 2011	EL (UFRJ) 2012
density (g/ml) at 15°C	ASTM D-4928	1,0173	1,0178	1,0173
water content (%)	ASTM D 4052	0,07	0,73	0,01

Table 2. Water contents commercial Ethyl Levulinate (EL) and DIBANET samples

At this stage of the project were prepared samples of diesel and biodiesel containing 5% of DMB and assessed according to standard EN590.

The results were similar and confirm those obtained with the sample produced by the University last year (M30). The reduction of two points in cetane number in diesel and biodiesel was confirmed. To compensate for the reduction in the number of cetane number (ASTM D613) due to the use of DMB were used 300ppm and 500 ppm of additives cetane number improvers, (figure 2).

The good performance regarding the anti-wear protection, is also evidenced evaluating lubricity by High Frequency Reciprocating Rig (HFRR) in standard method EN ISO 12156 from the EN590 specification.

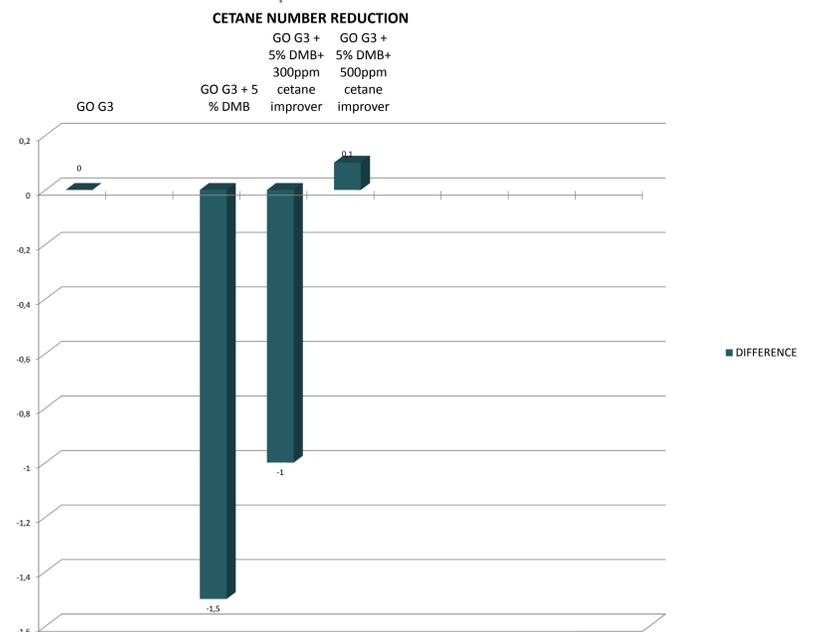


Figure 2. Experimental results of adding 300ppm and 500 ppm to Diesel Grade3 + 5% DMB sample.

## CONCLUSIONS

- The addition of a final stage of drying to the DMB process should be assessed in order to ensure compliance with the EN 590 specification in this aspect.

- The samples of diesel fuel and biodiesel (B7) prepared with 5% DMB met most of the requirements of the specification EN 590.

- We noticed a good performance against the wear when of the DMB is used in the formulations.

- It's necessary to add 500 ppm approximately of cetane number improver additive to compensate for the reduction of this parameter when 5% of DMB is mixed with diesel fuel or biodiesel.

- In addition to these determinations, it would be interesting to test the DMB blends in an engine bench test in the future. Properties such as consumption, performance and emissions could be evaluated.