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P&O

Results of Test Using PD5 on the Tugmasters Operated by P&O at

Larne Port

Introduction

Tests using PD5 fuel conditioner were ran on the fleet of Tugmasters operating in Larne Port. The testing period was from 10 February 2002 until 6 March 2002. On the 10 February emission readings were carried out on Tugmasters B1, D65, S14 and GT9. The emission test was a smoke reading taken directly from the exhaust of each vehicle using a “Dieseltune DX.210 Smokemeter”. The results from these tests were recorded to be used as a reference to the amount of smoke each of the Tugmasters produced prior to treatment of their fuel with PD5. Once the results had been recorded PD5 was added to the fuel bunker that is used to fuel the Tugmasters. The volume of PD5 added was in the ratio of 1 part PD5 to 4000 parts fuel bunkered.

From the period 10 February until 6 March all the fuel used by the Tugmasters had been treated with the PD5 fuel conditioner. On the 6 March each of the vehicles listed above was again tested for their emissions using the same recording device that had been used in the previous test. The results from the test showed an average reduction of **80.8%** on the amount of smoke produced by the Tugmasters. During the period of the test P&O personnel performed visual tests that concluded that there had been a significant reduction in the amount of smoke emitted from the exhausts of the Tugmasters. The drivers of the Tugmasters also noticed an improvement in the overall operation of the vehicles citing that they appeared to be running smoother and that there appeared to be an increase in power in the vehicles.

Results

The test was performed on the four Tugmasters listed in the introduction. The test that was carried out was simplistic in nature to avoid as many potential sources of error as possible.

The test involved testing the vehicles for smoke emissions once the vehicles at obtained normal operating temperatures (i.e. not on cold start). The accelerator of the vehicles was depressed by half in order to achieve a value of approximately 2500rpm and the emissions measured. This test was repeated 10 times so that as average value for the emissions at this load could be calculated.

Figure 1 below demonstrates graphically the reduction in smoke emissions generated due to the addition of PD5 fuel conditioner.

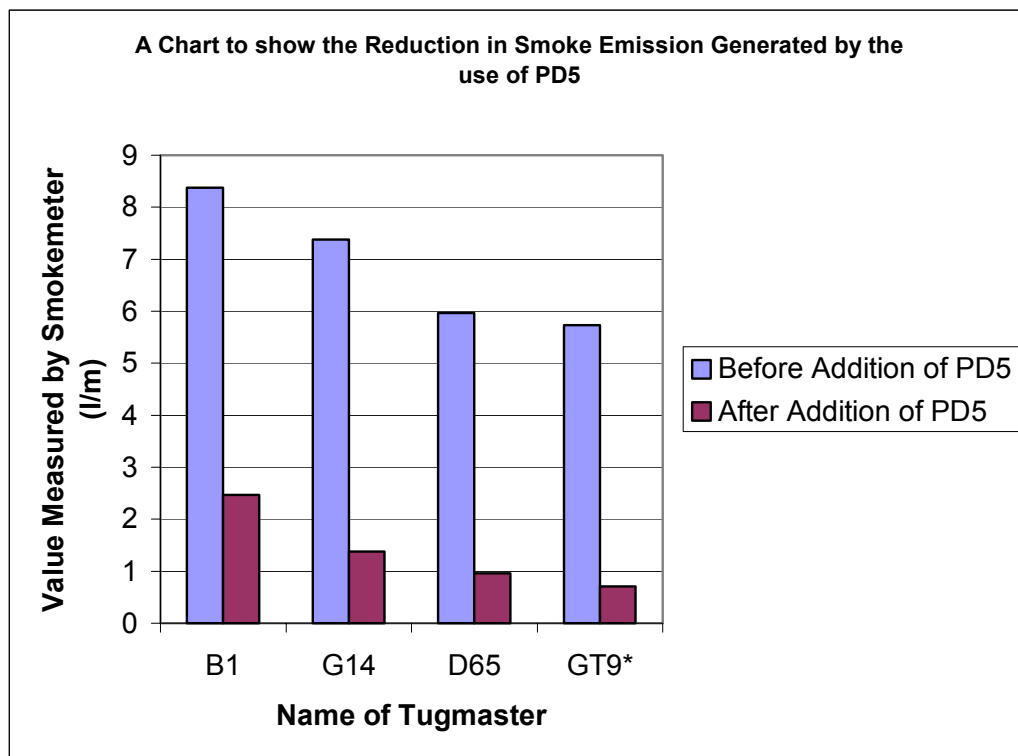


Figure 1: A chart to show the reduction in emissions experienced due to the use of PD5 in a ratio of 1 part PD5 to 4000 parts fuel.

Discussion of Results

It can be clearly seen from Figure 1 that there has been a significant reduction in emissions due to the use of PD5 fuel conditioner.

Table 1 below shows the percentage reduction in emissions for each of the vehicles tested.

Vehicle Tested	<i>% Reduction in Smoke Emission</i>
B1	70.5
G14	81.3
D65	83.9
GT9*	87.6

Table 1: Percentage reduction in emissions due to the use of PD5

An average value in the reduction in emissions due to the use of PD5 calculated from Table 1 is **80.8%**. Needless to say this is clearly a very favourable outcome to the test and proves that PD5 has had an effect on the combustion process with the Tugmasters.

As smoke is essentially unburnt hydrocarbons it would be fair to surmise that the use of PD5 will also increase the fuel efficiency of the vehicles using fuel treated with PD5. It could also be said that operational costs could be reduced due to the result of less coking of the engines (piston heads etc.) due to the more complete combustion of the fuel in the piston chamber.

From a Health and Safety point of view the use of PD5 fuel conditioner will lead to a great reduction in the amount of smoke that drivers of the Tugmasters and Ship's crew are exposed to.

Conclusion

The results from the test on the Tugmasters clearly state that there has been a reduction in smoke emissions produced by the Tugmasters due to the addition of PD5 to their fuel.

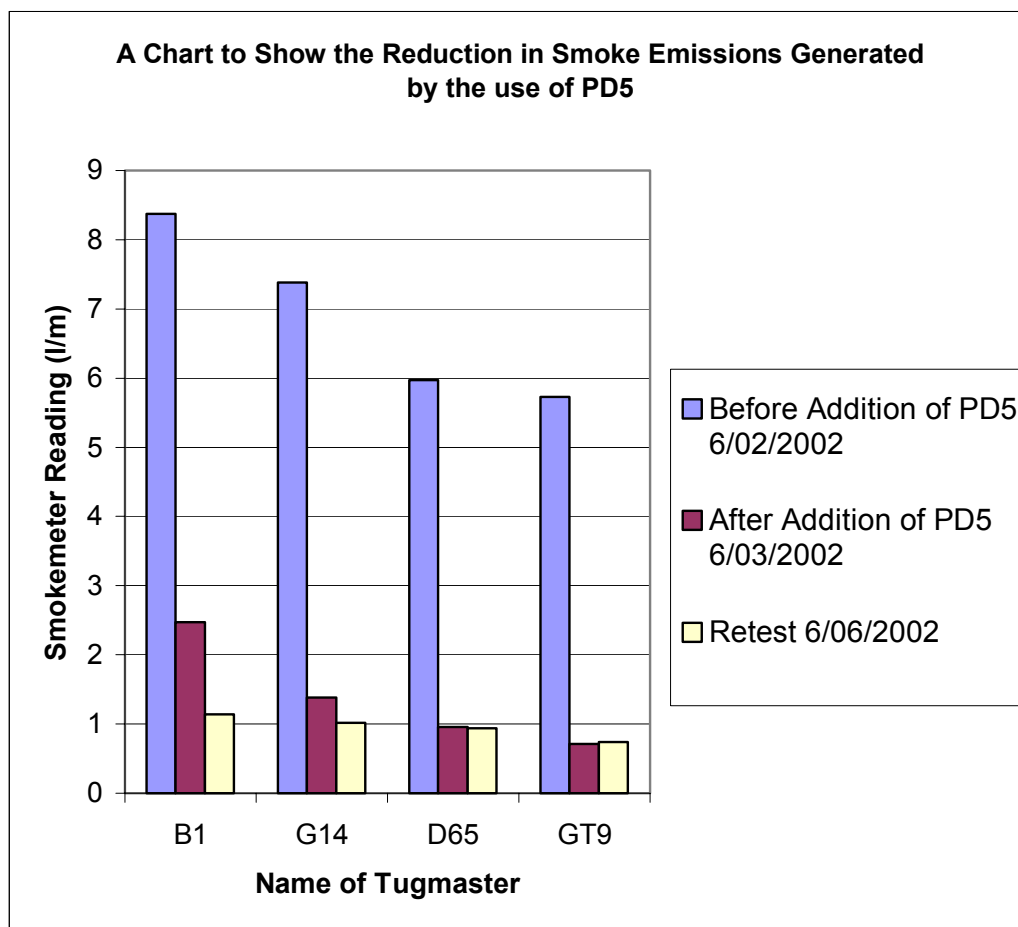
The following points summarize the test:

- There was an average reduction of **80.8%** in smoke emissions;
- There will be a significant reduction in the amount of fuel burnt by the Tugmasters due to the more complete combustion of fuel (estimated at between 15-20%, calculated using a carbon balance);
- A reduced maintenance cost will be incurred due to less coking of the vehicles engines;
- The Health & Safety of employees will be improved as they are forced to breathe in less smoke.

*Tugmaster GT9 was replaced by S20 because of operational reasons.

Appendix A

In order to quantify the continued benefit of PD5 on the smoke emissions of the Tugmasters a further test was carried out on the Tugmasters four months after the original test and three months after the first test using PD5. The results from the retest are shown in the graph below along with the results from the previous two tests. It can be easily seen from the graph that PD5 has continued to show its effectiveness at reducing the amount of smoke (and hence their fuel consumption) generated by the Tugmasters.



Vehicle Tested	Smoke Emissions prior to the use of PD5 06/02/2002	Smoke emissions on the 06/03/2002 after introduction of PD5	Smoke emissions on the 06/06/2002 after continued use of PD5	Total Percentage smoke emission reduction due to the use of PD5
B1	8.37	2.47	1.14	86.4%
G14	7.38	1.38	1.02	86.2%
D65	5.97	0.96	0.94	84.25%
GT9	5.73	0.71	0.74	87.1%
Average Reduction in smoke Emission				86.0%

Table: To show the continued benefit of using PD5 over a four month period.

It can be seen from the graph and the table that there has been a very significant reduction in smoke (particulates) emitted by the vehicles tested. The reduction in smoke is extremely consistent in every vehicle tested with an average value of **86%** recorded. This means 86% less environmental pollution, 86% less unburnt fuel and hence a dramatic improvement in fuel consumption and 86% less smoke for the employees of P&O to breathe, hence an improved working environment.