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# Reduction of Carbondioxide and other Emissions from Road and Water Transport by enzymes in an additive named XMILE

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Abstract

Addition of XMILE to a fuel improves fuel quality. For road and water transport fuels it appears that the combustion properties are improved. Results are presented that demonstrate energy saving and a reduction in emissions of CO2, CO, particulate matter, soot and NOx. In many applications it has been shown that XMILE contributes to improved stability of the fuel and has positive effects on the durability of the engines.

## 1. INTRODUCTION

The active ingredient in XMILE is a mixture of enzymes. The different enzymes are obtained by extraction from green leaves. For the use in liquid fuels they are dissolved in octanol and dispersed in kerosene. In this way the enzymes can be mixed efficiently with the fuel. The enzymes added to the fuel will improve fuel stability and combustibility, modify deposits and limit biological degradation. On the other hand it has been shown repeatedly, that after addition of XMILE, the fuel will unaffectedly meet the specifications. A typical value for the dosage is 1 : 10,000. Caleb Brett Laboratory reported that a sample of diesel oil enriched with XMILE was compared with the original diesel oil. They concluded that the analytical resuls for both samples were well within the ranges of EN590, but that the cetane number and lubricity of the XMILE enriched samples were significantly better.

Since then, various XMILE formulations have been shown to have appreciable benefits in terms of improved combustion from spark ignition engines, road diesel engines, heavy marine diesels and commercial and power station boilers. XMILE can be summarized as an advanced enzyme – based solution for increasing fuel efficiency, emission reduction and sustainability of the combustion system.

## 2. Road Transport

### 2.1 XMILE makes a combustion engine perform optimally

XMILE treated fuel has better combustion properties. It reveals itself in a shorter combustion delay, increased rate of heat release and smoothly running of the engine. Incomplete combustion leads to increased formation of particulates and gaseous pollutant species and to surface carbonisation. Carbonation in diesel engines directly affects turbocharger and injector performance. It involves higher energy consumption. The use of XMILE treated fuels reduces carbon buildup in clean engines and in dirty engines it it decokes the engine. Consequently the efficiency, power output and fuel consumption are restored to the values as before the

contamination. In all combustion processes the ratio of fuel to air is critical. Especially the fuel filters and the injector spray pattern are critical. Problems of this kind can be overcome by driving on XMILE treated diesel fuel. Spectacular results have been obtained, like visual improvement of smoke formation.

2.2 XMILE reduces Emissions

As a consequence of better combustion properties of XMILE treated fuels, the fuel consumption is reduced and the emission of CO2 decreases. Carbonmonoxide ( CO ), hydrocarbons and aldehydes are generated in the combustion process. They are indicators of incomplete combustion. When using XMILE treated fuel, the combustion will be more complete and the emissions of these compounds will be reduced. Spectacular is the improvement with respect soot formation. When driving slowly, as in tailback and in urban traffic, the engine is very inefficient and easily soot is generated. With XMILE improved combustion, soot formation is prevented, even when driving slowly. Also the emission of nitrogenoxides ( NOx ) will be reduced as a result of better combustion.

2.3 Experiences with XMILE in Road Transport

XMILE has been applied successfully in many countries.
It was introduced in Europe primarily in Ulster under the name Soltron.
The Queens University of Belfast tested Soltron in in its labortories and concluded:
”Soltron has been tested and found to increase power output and economy of a single cylinder Ricardo E6 diesel engine. No other additive produced such positive results.” See Fig.1.
It is well known that the emission of fine particles and soot of buses in city transport is considerable because of frequent stopping and accelerating.
On Soltron addition the soot emission of the Ulster bus was reduced by 50%.

With a view to air pollution during the Olympic Games in Athens 2004 the consequences of the use of Soltron in dieseltrucks was investigated by order of the Greek Government.
The project consisted of a number of soot measurements. One before the application, one test on the first day of application and one after 6 days of application.
A continued effect of Soltron was established. It appeared that after 6 days an average soot reduction of 70% was obtained.

Truck drivers establish power increase, less soot emission, less deposits at the outlet and a more quiet engine when they apply XMILE.
In The Netherlands fuel savings of a transport company was investigated. Trucks with comparable tasks were selected.
Six of these trucks were assigned to one group ( blue ) and five other trucks to another group ( red ).It appeared that the fuel efficiency of both groups was comparable. During the application of XMILE in the red group the fuel efficiency of the red group was on average 5.4% better. The results are presented in Fig.2.
Some service stations consider it an interesting opportunity ta add XMILE to the bunker tank and to sell the XMILE enriched fuel as a premium fuel. In The Netherlands it is applied in 23 service stations.
Many clients are enthusiastic when they discover that they can drive much more kilometers for the same amount of money. For the service station owner it offers interesting marketing perspectives; moreover contented clients tend to return to the station frequently.

## 3. WATER TRANSPORT

In The Netherlands much attention has been paid to the use of XMILE in water transport. Fishery was the first sector for a comprehensive study. Subsequently a test programme was started with StenaLine on board of several ferryboats. The programme aimed at the use of XMILE in combination with MGO ( marine gas oil ). A programme is still running in which the use of XMILE in combination with HFO ( heavy fuel oil ) is tested.In collaboration with the shipowner Wijnne & Barends tests are done on board of a coaster. Programmes with individual companies, inland shipping and the Royal Dutch Navy are in preparation.

### 3.1 Dutch fishing Vessels

The XMILE Marine programme started in January 2006 with 2 boats GY 287 and SC 31 followed by UK 284 in March and UK 243, NG 19 and UK 287 in April. The ships operate from Den Helder, Harlingen and other ports. During the year more ships started to participate, operating from Texel and Zeeland.
Finally the results of eight ships, that participated for more than half a year in the programme, were taken into account. In all cases the condititon of the engine was established as starting point of the endurance test. In particular the fuel consumption under normal operating conditions was recorded before XMILE was added to the fuel ( MGO, marine gas oil ).
The experiences of most fishermen are consistent. The most important results are:
better fuel quality, energy saving, smooth running of the engine, more power, less smoke and less engine oil consumption.
Eight ships that participated in the programme determined a collective fuel saving of 23,300 litres per week. The saving is different for each ship, but the average value is 8.3%, with a variation between 5 and 18%. As there are seasonal effects and differences in operational management the fuel saving is set at 5% or more. As an energy saving of 1.2% is needed to compensate for the the costs of XMILE, the balance is positive for all ships. This applies even more when the reduction in operating costs ( maintenance, reduction in the use of lubricant and filters ) is taken into account.

### 3.2 StenaLine

XMILE was tested on board of several ferryboats of StenaLine on auxiliary engines using MGO. The projects were executed by StenaLine in collaboration with XMILE Europe. The main target was energy saving by at least 5%, while maintaining the sustainability of the engine at high level.
With the help of a combustion analyzer, the concentration of CO2, CO and NOx was measured in the flue gases.
Subsequently the specific fuel consumption ( SFC, g/kWh ) was calculated and the emissions of CO2, CO and NOx ( g/ kWh ) were assessed.
The project was started with daily measurement of the exhaust gases. In this way the baseline of the engine performance was established. Subsequently XMILE was dosed to the bunker tanks in a ratio of 1 : 10,000. The first indication of a XMILE effect was a temporary increase of the CO emission; in the fuel system and the combustion chamber deposits are removed. After this fuel system cleaning up stage the combustion efficiency improves and the emission of CO2 decreases. Moreover the emissions of CO and NOx are reduced. In Fig. 3 to 5 this is shown for the StenaLine Trader.
After successfull tests StenaLine North Sea decided to apply XMILE to all MGO applications as the target energy saving was reached and it appeared that XMILE contributes to improved durability of the engines. XMILE contributes also to meeting environmental targets and a

reduction in the use of consumables. Moreover the decision was made to apply exhaust analysis on all ships and to extend the tests with XMILE in combination with HFO to more ships.

### 3.3 Endurance Testing with Shipowner Wijnne & Barends

In 2006 Shipowner Wijnne & Barends informed XMILE Europe about their problems.
With respect to the coaster MS Isabel the high fuel costs were a major problem. Moreover the consumption of engine oil was high and it had to be replaced frequently. There were also considerable problems with respect to the engines. The cylinders and combustion chamber were dirty, in such a way that high wear and damage to the engine was expected. The reliability of the engine was under pressure. The engine manufacturer advised that fuel quality was the origin of the problems.
The decision was made to perform an endurance test on MS Isabel with XMILE. After 1000 operating hours an energy saving of 5% was assessed. The combustion chamber and cylinders were clean. The deposits had been removed. The durability of the engine had been improved and the engine manufacturer supported the use of XMILE. Recently the engine oil was replaced after 1 year and 5500 operating hours. This is 30% later than the instructions of the engine manufacturer. The lubricant was in good shape and the engine was extremely clean.
Wijnne & Barends decided in July 2008 to apply XMILE on all ships of the fleet.
Moreover the decision was made to apply exhaust analysis on all ships.