HIGHER TECHNICAL INSTITUTE
MECHANICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

INVESTIGATION INTO THE EFFECT OF FUEL ADDITIVES IN BOILER PERFORMANCE

by
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M/78:

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Maratheftis Neophytos

Project Report

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Neophytos Maratheftis

3rd year student in

Mechanical Department.

SUMMARY

Today boilers are widely used in industry for the production of stream for numerous purposes. Boilers are simply one kind of heat exchangers that burn oil to produce the work needed to transform the water into steam. The combustion of oil i.e. the oil being mixed with air and ignited leads to air pollution if for many reasons the boiler doesn't work smoothly. To have smooth operation of the boiler, in one hand all its parts have to work properly and on the other hand the quality of oil has to be good to lead to good combustion with the best air to fuel ratio. Air pollution resulting from the emissions has harmful results on the environment and therefore on humans.

In order to improve combustion and minimize emissions companies have developed a wide range of catalysts which are added to the fuel being burned in the burner. These additives have the function of improving the efficiency of boilers and reducing emissions at the same time, without taking any active part in the reaction.

So the final step that will give a complete view of what these additives do is to test them on a boiler. By examining these additives some conclusions can be drawn concerning the usefulness of these additives.

By Neophytos Maratheftis

INTRODUCTION

As a result of recent air pollution control legislations and regulations owners and operators of fuel oil fired furnace plants are faced with the problem of reducing environmental emissions occurring from the combustion of oil. In the older days boilers weren't as widely used as today and the problem of reducing any emissions wasn't a matter of great importance. In recent years governments and other bodies paid more attention to emission standards from boilers because of the increase in pollution that creates hazardous conditions to people with catastrophic consequences on our environment.

They decided that they had to do something about this situation. So they voted for new and more stricked pollution control legislations in their effort to control emissions. So boilers are more often checked and tested by authorized persons (from the ministry of labour in Cyprus) to see if the regulations are satisfied. If not then the operator is responsible of changing the boiler with a new one and is forced by the state legislations of doing so.

In industry the fuel oil mainly used is heavy grade oil and it is used in hot water boilers for the production of steam. Other grades of fuel such as medium or light fuel oil are also used in industry or in domestic applications where demands aren't so high.

Although overall consumption of fuel oil has more than halved in other European countries in Cyprus fuel oil still remains the only alternative for plant operators due to

the low oil prices. These low prices have also lead European countries that tried to reduce the overall consumption of fuel oil into a half from the decline in fuel oil consumption.

Apart from oxide emissions i.e. emissions of carbon monoxide (CO) and carbon dioxide (CO_2) a further problem is the emission of sulphur dioxide (SO_2) particles, as well as acidic flue gas residues i.e. SO_3 and sulphuric and acid absorbed into flue ash and flue coke.

The SO_2 limits laid down in European regulations can be met by using low sulpur oil with maximum sulphur content up to 1%. In Cyprus such a regulation doesn't exist and the Electricity Authority of Cyprus has imported fuel oil with sulphur content up to 5% to get the lowest prices.

Also the NO_X emissions are another problem that has to be faced in air pollution legislations. In the effort of reducing NO_X emissions primary measures such as selective non catalytic reductions are now widely used.

All emissions mentioned above have all of their own separate consequences on the environment and on humans. So by reducing one of those the problem is not solved completely. All emissions have to be minimized in order to have a clean environment to live in.

So several companies in their effort to find a solution for cutting the emissions of soot and acidic flue gas components have developed special additives for creating the oil with them. Special trials in this field have been carried out and a wide range of additives have been produced for each grade of fuel oil.