A remanufacturing cleaning solution: reduced costs, emissions and landfill

DPF Expert & Abertay University

A Remanufacturing Case Study

Summary

Identifying the chemical breakdown of a cleaning solution used to remanufacture diesel particulate filters (DPFs) will enable DPF Expert to reduce their cleaning costs by 60% and have a significant impact on their carbon footprint.

Diesel Particulate Filters (DPFs)

A diesel particulate filter (or DPF) is a device designed to remove diesel particulate matter or soot from the exhaust gas of a diesel engine. This cuts the amount of harmful smoke being released into the atmosphere. After continued use the DPF can become clogged with the residue it traps which causes warning lights to appear on the vehicle's dashboard.

When this happens, the filter needs to be replaced. This can be a costly process and as the replacement DPF is expensive and there may be downtime for vehicles as the parts are not always in stock at local garages.

DPF Expert was established in 2015 to provide DPF (diesel particulate filter) services to the motor trade by remanufacturing existing DPFs to an "as new" standard including testing and warranty.

Cleaning a DPF costs approximately £200 compared to buying a new DPF at a cost of £800 - £1200 in a car and several thousand pounds in buses and trucks.

Remanufacturing DPFs

DPF Expert purchased a machine to clean the DPFs, removing the soot and ash residue and remanufacturing them to an as new standard.

DPF Flashcleaner Machine

The machine uses water, air pressure and a cleaning solution to return the DPF to 98-99% clean so it can be reused.

The contents of the cleaning solution were unknown due to limited packaging information and had to be purchased from the machine manufacturer overseas resulting in high transportation costs.

Funding from the Scottish Institute for Remanufacture enabled DPF Expert to work with experts from Abertay University. The aim of the project was to determine the components of the solution to facilitate process optimisation and open the possibility of both sourcing alternative suppliers and/or development of an improved formulation.

Identifying the solution components

Researchers from Abertay University undertook analysis of the cleaning solution for any chemical components and the presence of enzyme (s) by sampling an unopened batch and storing the samples in a sterile environment at an ambient temperature to prevent any uncontrolled variables.

Chemical components in the solution were analysed using 1H NMR spectroscopy – a type of testing used to determine the structure of the molecules in the solution. The data collected suggested the sample contained two surfactants, also known as surface active agent. When added to a liquid, the surfactants reduce its surface tension, thereby increasing its spreading and wetting properties. There were also minor traces of a defoaming agent and finally, acetic acid, which was identified as a possible contaminant.

In order to analyse the protein components of the solution, it was necessary to concentrate the solution 100,000 fold. Even with this level of concentration, SDS-PAGE and mass spectrometry did not detect the presence of an enzyme in the solution.

The analysis concluded that the solution consists of biodegradeable surfactants that can easily be independently sourced by the company to allow them to produce their own solution.

Results & Next Steps

The identification of the chemical make-up of the cleaning solution used by the Turbo Guys in their DPF cleaning opens up opportunities for the company to source their own solution, potentially using powdered components which would save 60% of the costs of both the cost of the solution and the cost of transportation.

The company can now also investigate the potential of manipulating the solution to improve or extend the number of uses of the biological cleaning agent and therefore potentially reduce the use of the industrial grade detergent and in turn the cost of disposal.

Through manipulating the solution to improve the efficiency of their remanufacturing process the company will be able to increase volume and reduce the unit price. Increasing the volume could also lead to the company expanding capacity with the purchase of a second machine allowing a greater number of DPFs to be remanufactured. Every DPF remanufactured diverts an average of 10kg of silicon carbide and steel from landfill.

Reducing the transportation of the solution will directly reduce the company's carbon footprint and if a manipulated solution can reduce the amount of industrial grade detergent used for each cleaning cycle this will have an positive environmental impact too.

Understanding the solution composition will allow DPF Expert to market their unique cleaning process with greater confidence and allow them to accurately market the environmental credentials.

Summary

Accessing matched funding from the Scottish Institute for Remanufacture enabled the DPF Expert to access the expertise and specialist equipment and techniques required to analyse the solution. The results have allowed the company to review their process and identify opportunities for cost saving and increased efficiency. As a result of this project, future collaborations are planned between Abertay University and DPF Expert potentially as a Knowledge Transfer Partnership.