

XIII. DIESEL FUEL ADDITIVES

A. Product Overview and Description

Fuel additives are chemicals added to fuel in very small amounts to improve one or more properties of the base fuel. Detergents, corrosion inhibitors and storage stability improvers are examples of commonly used fuel additives. More recently, additive manufacturers have developed products that improve the engine combustion process and reduce emissions, without compromising or negatively impacting the properties of the base fuel. Some emission-reducing fuel additives employ fuel-borne catalyst (FBC) materials that use catalytic processes to reduce emissions during engine combustion.

A variety of different materials have been employed as FBCs including copper, cerium, cerium/platinum, iron/strontium, manganese and sodium. In the U.S. and Europe, the use of FBCs has been as part of a system with DPFs or DOCs. FBCs can also be used to facilitate regeneration of DPFs. As a general rule, the higher the level of FBC in the fuel, the more effective (i.e., the lower the exhaust temperature required to combust the soot) the catalyst's performance. However, the higher the FBC level, the shorter the time interval before the DPF must be cleaned. One application required an FBC level of 30 ppm to 60 ppm for effective operation. Other applications require levels in the range of 8 ppm to 10 ppm.



Courtesy of Clean Diesel Technologies, Inc.

B. Emission Reduction

There are numerous manufacturers offering diesel fuel additives that are claimed to improve exhaust emissions, fuel economy, or both. In general, these improvements are claimed to be accomplished by improving combustion efficiency (by one means or another), resulting in reduced emissions. Additive manufacturers have developed proprietary formulations or fuel treatment processes, and license the process techniques/equipment and operating technology to small independent refiners that process the fuel into the finished product and sell it to users. In general, no engine modifications or changes to any other piece of fuel storage/dispensing or operating equipment are required to use these types of additives.

Cetane number improvers are a major class of diesel fuel additives that promote emission reductions (primarily NO_x). In a recent report, EPA presented the results of an analysis of the

impact of cetane improvers on NO_x emissions. A statistical regression analysis found that if cetane improvers are added to a national average base fuel which would increase the cetane number by 5, NO_x emissions would be lowered by a couple of percentage points.

C. Status & Availability

FBCs have been verified by EPA as part of both an FBC/DOC system and an FBC/FTF system for use in retrofit applications (www.epa.gov/otaq/retrofit/retroverifiedlist.htm). Several retrofit projects in the U.S. are using FBC additives, at least one of which is in conjunction with a DPF. Approximately 1,600 delivery trucks operated by Coca-Cola have used an FBC additive.

D. Selection & Use Criteria

FBCs have also been sold as stand-alone products to be added to the fuel, even where exhaust aftertreatment emission control technology is not utilized. In one study, more than 94% of the additive was found to be retained in the engine and exhaust system. This retention level increased to 99% when a DPF was used.

E. Costs

Available data suggest that the cost of the verified FBC additive is about \$0.05 per gallon of finished fuel product, for total fuel volume usage of about one million gallons per year. A general range of cost for non-FBC additives is between \$0.04 to \$0.10 per gallon of finished fuel product, depending specific product type and volume used.

F. Product Quality, Delivery, Storage and Fueling

Progress is being made in developing precise on-board dosing FBC systems. However, in retrofit applications, particularly where a DPF system is involved, the more prudent course to avoid potential problems with imprecise on-board FBC delivery may be to use premixed fuel (e.g., the FBC is added to the fuel storage tank or a dispensing pump is used that adds the appropriate amount of the FBC when vehicle fueling occurs).