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Informed and in-depth editorial on the world mining industry

A fluid interaction

Robert Pell examines how mining operations are improving in efficiency, reducing downtime and cutting costs through advances in fuels and lubrication technology

A diesel fuel tanker delivery by freight group TOLL in Australia's Pilbara iron ore mining region

Fuel economy is critical to all mine operations and diesel fuel is always at or near the top of the list in mine costs along with power. Fluids, particularly oils and greases, are critical to the achievement of top performance in today's engines and powertains. Therefore the effective management of fuel and fluids in mining operations is important for a financially successful operation, especially in these challenging times when mine managers are constantly looking for ways to improve efficiency.

Fuels are transported in bulk to mine sites by tankers and much less commonly by pipeline, but in both cases stored in tank farms on site. Oils and fluids such as lubricants tend to be delivered in barrels and stored on-site with large operations having oil tank storage. Fuels tend to be provided by wholesalers/importers and large petroleum groups as well as national petroleum groups; with oils, lubricants and greases often also provided by arms of these groups but also smaller local dealers and representatives due to smaller values and volumes to bulk fuel. Delivery of fuels onsite is normally by machines coming directly to the tank farm as part of regular movements, with fluids and oils dealt with during scheduled maintenance work. In some cases in large mines there are mobile fuel and fluid trucks to service trucks in the pit but this is less common.

Using specific and dedicated fuels (such as those better suited to climate extremes), as well as customised lubricants, oils and greases for particular applications helps to increase machine performance. Areas such as filtration to ensure quality of supply are also important.

Tin alloy as a catalyst

A recent field trial in Malaysia, carried out by ITRI, indicated that the use of tin alloy pellets added to fuel can have positive results on fuel saving and exhaust emissions. The emission reduction and fuel saving was identified using eleven different engines. Stringent targets are in place worldwide to cut pollution from engines and improve fuel economy as governments urgently try to reduce harmful emissions as well as our dependence on fossil fuels. At the same time a surprisingly simple technology based on adding tin alloys into fuel tanks or fuel lines has for many years claimed to reduce fuel consumption and exhaust emissions in engines.

However, this has been met with widespread scepticism. Recently, tin producer and smelter Malaysia Smelting Corporation (MSC) has carried out field trials using the tin fuel catalysts, supplied by Broquet International, UK, on several engines and vehicles at its Rahman Hydraulic Tin Mine (RHT), in Malaysia.

The specially formulated tin alloy pellets are either added into a fuel tank or placed inside a fuel line cartridge. They are not significantly used up and can last for the lifetime of the engine. Fuel consumption was measured over a six month baseline and then over six months with the catalysts fitted. Exhaust emissions were measured by Acumen Scientific Sdn Bhd, of Penang, Malaysia.

The tests included pick-up trucks, a cargo truck, tipper truck, electrical generator, large static diesel engine, a Jeep and a Volvo Sedan car. Results in all eleven vehicles were positive. Fuel savings in diesel engines were 4-7% and in petrol 6-7%. Emissions of CO, NOx and SO_2 were all reduced by 30-60%.

Dr Jeremy Pearce, ITRI's Technology Team Leader stated that "These latest results confirm that it is time for tin fuel catalyst technology to be taken more seriously by engine manufacturers, governments and the scientific community. Tin alloys clearly have beneficial effects when they are contacted with fuels and we need to seize this opportunity to make the use of fossil fuels in engines cleaner and less polluting for us all."

ITRI is proposing two complementary theories for the improvement of efficiency, both based on the known properties of the metal. Firstly, tin may react with trace metals present in fuel that cause engine gums and deposits, resulting in cleaner engines. Secondly, tin is already used commercially as a reforming catalyst, for example to convert organic matter into biodiesel, and similar reactions with fuel molecules are theoretically possible. A paper that was published by the University of Connecticut in 2014 confirmed molecular changes in both petrol and diesel and measured enhanced useful energy yield. Their Department of Energy project identified tin alloys as 'next generation fuel reforming catalysts for efficient energy usage'.

These are the latest in a series of recent trials coordinated by ITRI, with other work in Peru and in China. They confirm positive data ITRI has collated from more than 70 other tests on the technology carried out by suppliers over several decades.