CADDET energy efficiency IEA OECD

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Improved process for reclaiming used engine oil

On-site system for reclaiming engine oil

Summary

Zimmark Inc. has developed a technology that reconditions used lubricating oil on-site, at the point of generation. The process uses precipitation to remove the contaminants that build up in diesel lubricating oil after prolonged use. Cost savings for the Canadian National Railway, for whom Zimmark operates six units, are approx. CAD 0.50/litre or CAD 500,000 annually for 1 million litres of recovered oil. When compared to virgin oil, total energy savings are approx. 4.0 MJ per litre of recovered oil. Zimmark operates 11 reconditioning facilities in Canada, recovering over 1.25 million litres of oil annually. Other installations are located in the United States, Mexico, and Asia.

Highlights

- **Energy savings of 4.0 MJ per litre of recovered oil**
- **Savings of CAD 0.50 per litre of recovered oil**
- **No threat of oil spills**

The containerised lubricating oil recovery site.

Aim of the Project

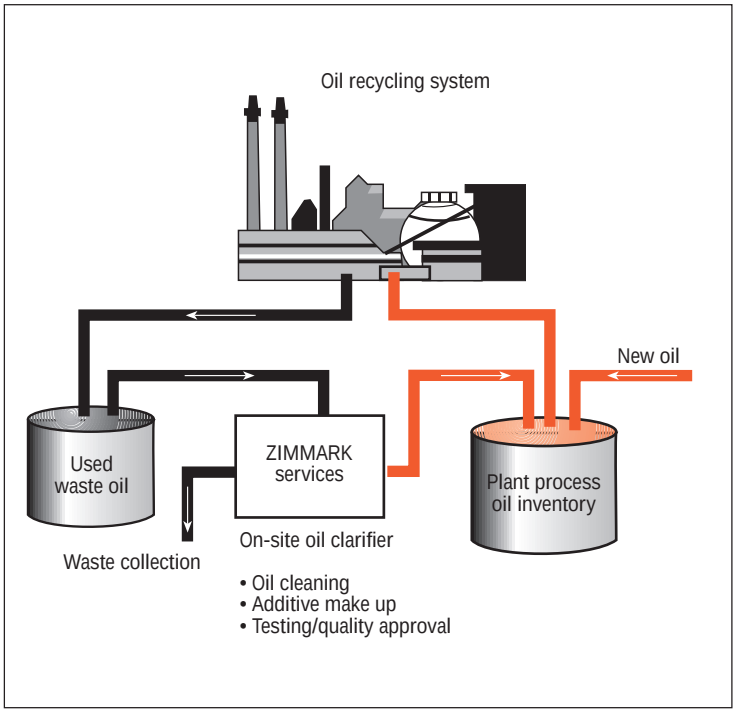
Canadians use 900 million litres of lubricating oil each year, about half of which is consumed in first-time use. Because oil does not wear out (it just gets dirty with use), the remainder, about 42% of the oil, could theoretically be recovered. Yet only 22% of that amount is actually recycled. The rest, approx. 380 million litres annually, is either burned, sprayed on gravel roads, ploughed into landfills, or flushed down sewers illegally. Zimmark Inc., a Canadian based company, has developed a technology for recovering used oil that produces a higher quality recycled oil and reduces batch processing time.

The Principle

Although the technology for removing the impurities that accumulate in lubricating oil has been known for years, its use has been limited by the high cost of collecting and re-refining the oil. Now, with financial support from CANMET's Industry Energy Research and Development (IERD) programme, Zimmark Inc. has found a way to solve both problems simultaneously.

The technology developed by Zimmark Inc. uses precipitation to remove the contaminants that build up in lubricating oil after prolonged use, relying on a chemical coagulant, heat, and time. The technology is being applied to crankcase oil from diesel locomotive engines. Currently installed systems are returning 1.26 million litres of oil annually to Canadian railroads, at a level of quality that meets the clients' stringent technical specifications. Figure 1 shows a schematic representation of the oil recycling process.

Figure 1: Schematic of the lubricating oil recycling process.



The Situation

Initial efforts focused on improving the performance of the coagulant chemical. To shorten processing time, Zimmark decided to heat the oil. With viscosity reduced, settling proceeded more readily. To accomplish this on a larger scale, the company developed a special heating vessel that allowed the oil to be heated uniformly, inhibiting the creation of thermal currents that disperse the sediment. The results were significant. The performance of the coagulant chemical was notably improved, cutting the process time of the precipitation process in half, from 15 days to 8. Moreover, the recon-ditioned oil met the high technical specifications set by Canadian railroads. The process achieves a 90% recovery rate. As an added bonus, the company found that, unlike re-refining, the process removed negligible amounts of expensive oil additives. Figure 2 shows samples of used oil before and after processing.

Zimmark has installed and operates oil reconditioning facilities at five regional Canadian National Railroad (CNR) maintenance centres and at the eastern maintenance centre of the Canadian Pacific Railway (CPR). Additional

Figure 2: Samples of used lubricating oil before and after processing.

units are under consideration for CPR's western maintenance shops. The Zimmark process consumes 0.224 MJ (0.0623 kWh) of energy per litre of oil recovered. Virgin oil and re-refined oil require 4.25 MJ (1.18 kWh) of energy per litre of product, almost 20 times as much. At current recovery rates (1.26 million litres per annum), that represents annual energy savings of 5.07 TJ (1.40 GWh or 828 barrels of oil equivalent (BOE)).

But the energy saved during processing is just part of the return. The quantity of virgin oil that is displaced by recycled oil (48.3 TJ, 13.4 GWh, or 7,900 BOE) must also be added. Thus, the total energy savings supplied by the Zimmark system is approx. 53.3 TJ (14.8 GWh or 8,700 BOE) annually.

The Zimmark system makes it possible for railroads to recycle 1.26 million litres of lubricating oil each year. The company expects to double this figure in the near future as additional facilities are commissioned and installed at railroads and industrial oil users' facilities. Recycling the oil eliminates the harmful impacts associated with disposal and every litre of recycled oil displaces an equivalent litre of virgin oil, which can be left in the ground. Because the system can be located on-site (Figure 3), the threat of spills while used oil is collected and transported to a central facility is eliminated.

Another variation on the theme which is proving successful, is the use of recycled washing water to clean used parts at remanufacturing and repair companies. Initial trials have shown that the process significantly reduces the amount of cleaning water requiring disposal. In addition, the recycled water needs very little make-up detergent.

The Company

Zimmark, a small firm located in Burlington, Ontario, acquired the rights to the process developed by British Rail and applied to Natural Resources Canada for support in upgrading it. Research was conducted at the company's facilities in Burlington, and a commercial prototype was tested at CNR's maintenance facilities near Toronto, Ontario.

Figure 3: On-site oil recovery at a CPR maintenance centre.

Economics

Zimmark does not sell its equipment to clients outright. Instead, it installs and operates it on a site provided by the client, charging only for the reconditioned oil produced. Cost savings for the Canadian National Railway, for whom Zimmark operates six units, are approximately CAD 0.50/ litre, or CAD 500,000 annually for 1 million litres of recovered oil.

Zimmark is committed to developing its colloidal chemistry technology with the aim of applying it to the highly contaminated oils produced by four-stroke diesel engines. The potential market for such a technology is very large since most surface carriers, including lorries, buses, military vehicles and ships, are powered by four-stroke engines. In North America alone, 30 railroad systems and hundreds of bus and lorry fleets stand to benefit from the process.

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* IEA: International Energy Agency
OECD: Organisation for Economic Co-operation and Development

IEA

The IEA was established in 1974 within the framework of the OECD to implement an International Energy Programme. A basic aim of the IEA is to foster co-operation among the 24 IEA Participating Countries to increase energy security through energy conservation, development of alternative energy sources, new energy technology, and research and development (R&D).

This is achieved, in part, through a programme of energy technology and R&D collaboration currently within the frame-work of 40 Implementing Agreements, containing a total of over 70 separate collaboration projects.

The Scheme

CADDET functions as the IEA Centre for Analysis and Dissemination of Demonstrated Energy Technologies. Currently, the Energy Efficiency programme is active in 15 member countries.

This project can now be repeated in CADDET Energy Efficiency member countries. Parties interested in adopting this process can contact their National Team or CADDET Energy Efficiency.

Demonstrations are a vital link between R&D or pilot studies and the end-use market. Projects are published as a CADDET Energy Efficiency 'Demo' or 'Result' respectively, for ongoing and finalised projects.

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