

Technology Brief

SOLVENT EXTRACTION TECHNOLOGY FOR USED OIL TREATMENT

Solvent extraction, an innovative adaptation of existing crude oil refining technology, is being studied for its potential to upgrade used oils produced by small-scale oil treatment facilities. Low temperature distillation, the current technology used in most small-scale facilities, cannot significantly reduce the ash and other residues present in used oil, which limits product marketability. Other technologies, such as hydrotreating, high temperature/pressure distillation, and cracking are very technically sophisticated and generally not economical or safe for small-scale operations.

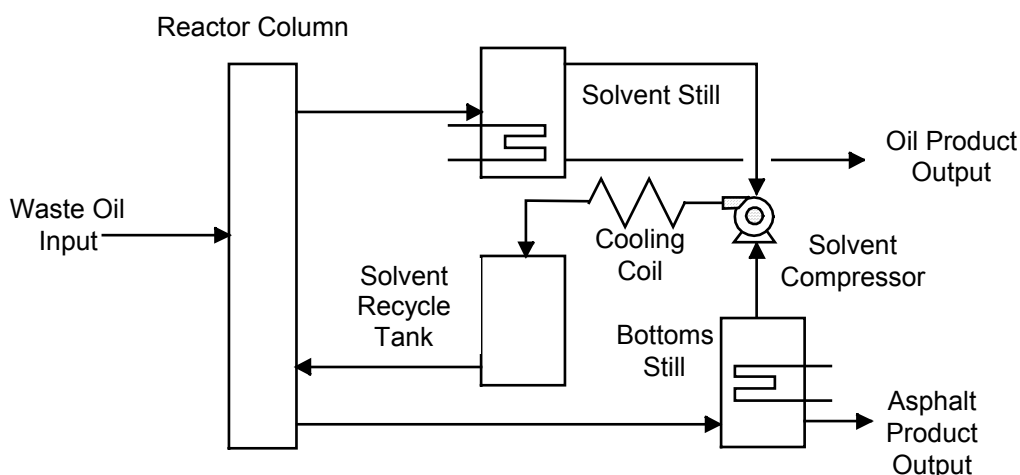
The solvent extraction process described here is used in some large-scale virgin crude oil refineries for refining of vacuum gas oils. If applied to used oils, solvent extraction has the potential to produce oil products that are superior to those being produced by simple distillation. These products might be successfully blended into more valuable lighter diesel or heating fuel oils, or into lubricating oil stocks.

Key Words	
Materials:	Used Oil.
Technologies:	Solvent Extraction.
Applications:	Heating fuel; lubricating oil.
Market Goals:	Small-scale production of higher value used oil products.
Abstract:	Describes a preliminary design of a technology for upgrading used oils.

This fact sheet describes a design for using solvent extraction to produce an improved oil product, at a scale and simplicity of operation consistent with the used oil recycling industry.

Process Description

The figure at left presents a simplified, conceptual process flow diagram for the solvent extraction technology. Used oil is mixed in the Reactor Column with an aliphatic solvent such as liquefied propane. The solvent acts selectively, dissolving the oil fraction and leaving the impurities. The oil-laden solvent is transported from the top of the column to the Solvent Still, where the solvent fraction is separated from the oil for recycling within the process. The impurities



(bottoms) slowly settle by gravity to the bottom of the Reactor vessel where they are pumped to the Bottoms Still. Residual solvent is also separated there. The recovered solvent is liquefied through a compressor and cooling system and reinjected into the Reactor Column through the Solvent Recycle Tank to repeat the cycle.

The oil product output, drawn from the Solvent Still, looks to be suitable for blending with higher value fuel oils and with lubricating stock. The bottoms output resembles light asphalt and may be a marketable product.

Process Parameters

The project to date has met the following objectives:

- Determination of key process parameters to guide the design of a pilot plant; and
- Design of a pilot-scale plant that would produce sufficient quantities of used oil for product testing.

An extensive literature search conducted during the project helped to define many of the process parameters used in the pilot plant design. The operating parameters for the primary reactor vessel were derived primarily from the IFP process (a solvent treatment technology developed in France.)

The design employs a continuous process flow scheme at a target used oil feed rate of 2,000 gallons per day (approximately 730,000 gallons per year). The range quoted for the IFP process allowed the

selection of an operating temperature of 120° Fahrenheit and an operating pressure of 230 pounds per square inch. Finally, the design targeted a solvent to oil ratio in the range of 3:1 to 5:1.

Recommendations

Construction of a pilot scale solvent treatment plant by interested parties is recommended to allow refinement of the design. Further validation of the solvent extraction technology will entail the following steps:

- Testing of the pilot plant under varying operating parameters;
- Testing the physical and chemical characteristics of the oil product output;
- Determining market acceptance of the products by providing interested customers with test quantities; and
- Designing a full-scale facility.

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For More Information

For a copy of the report, *Solvent Extraction Technology for Used Oil Treatment (O-95-1)*, use the CWC Publication Order Form. For more information call CWC at (206) 443-7746, email info@cw.org, or visit the CWC Internet Website at www.cwc.org.

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CWC is a division of the Pacific NorthWest Economic Region, 2200 Alaskan Way, Suite 460, Seattle, Washington, 98121.