Used oil recycling (re-refining)

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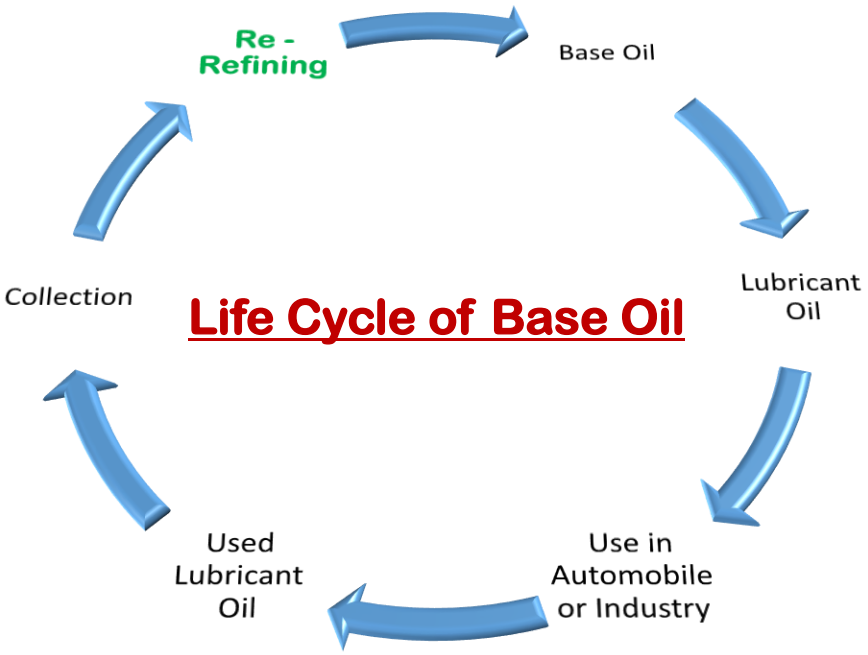
Lifecycle of Base Oil

- ✓ Base oil is petroleum product obtained by fractional distillation of crude oil, it is the main raw material to produce lube oils like engine oil, gear oil, hydraulic oil etc.
- ✓ Lube oils are used for specific interval, during their usage it get contaminated by many impurities such as worn metallic particles of engine cylinders, degradation of additives, unburnt fuel, gases generated from combustion process, dirt etc. and loose their property to lubricate properly.
- ✓ This used oil then goes through the Re-Refining process where all impurities are removed and we obtain fresh base oil again.
- ✓ This re-refined base oil can be used again for making lube oil by adding required additives.



Benefits of Used Oil Re-Refining/Recycling

- ✓ We have limited stock of crude oil, by recycling the used oil, we can save non-renewable energy resource for future generation.
- ✓ Used oil is toxic by nature. A small amount of used oil can pollute large amount of water on earth and can harm many lives, by recycling use oil, we can save environment.
- ✓ Used oil recycling business has attractive, also by this business recycled base oil can be made available to people at cheaper price than virgin base oil.

Process for Used Oil Recycling

Used oil recycling process is done in 3 stage:

1. Dehydration

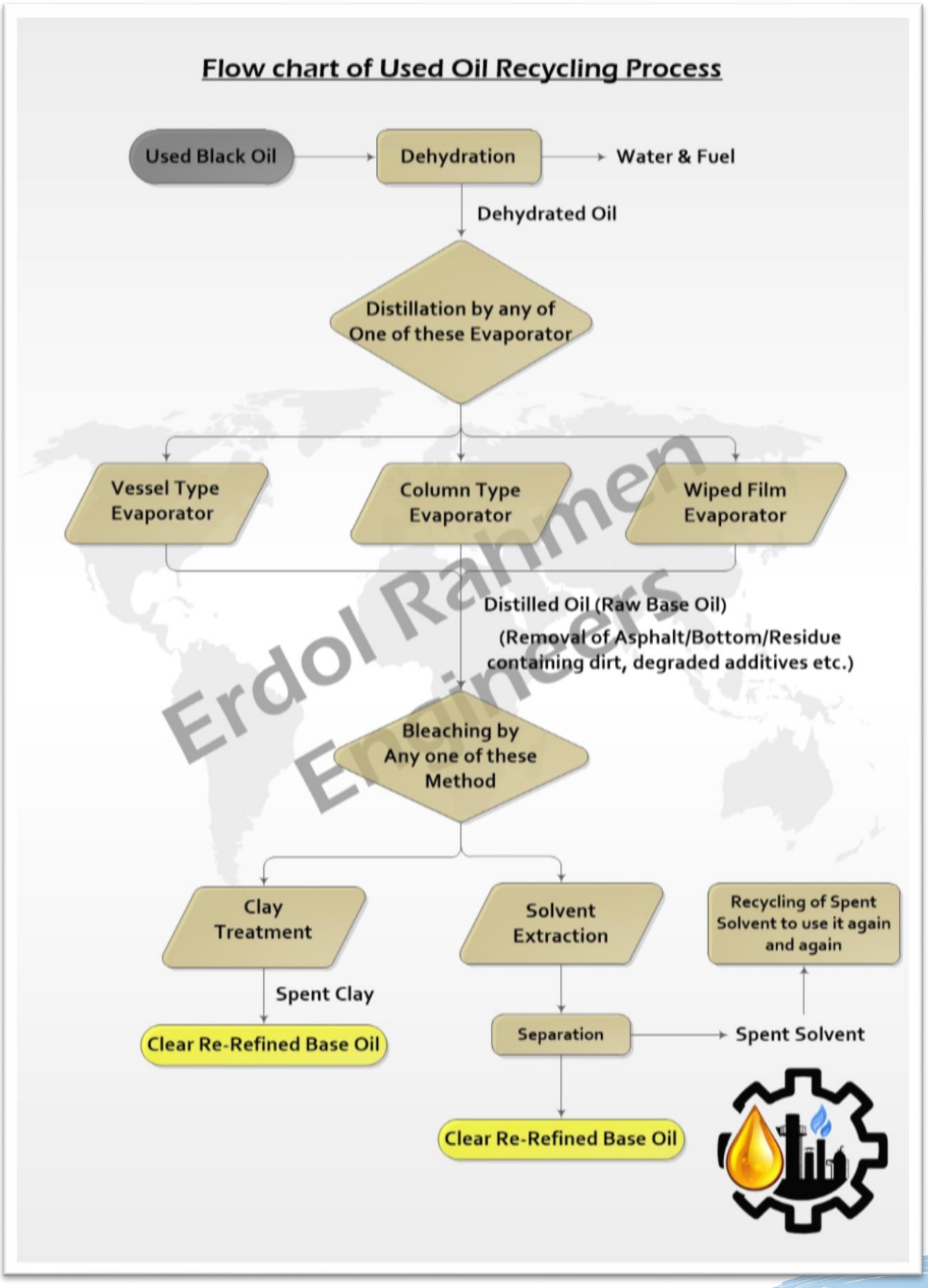
Process of used oil recycling begins with dehydration. From storage tank, used oil is transferred to reactor for dehydration where it is heated up to certain temperature to remove water & fuel (Which is also known as light ends). The process is done under 600-700 mmHg vacuum to decrease surface tension. As temperature raises, first water & then fuel evaporates and passes through condenser, so they come to liquid form again and are collected in receivers.

2. Distillation

After dehydration process, used oil is shifted to evaporator for distillation where it is heated to 320 °C - 350 °C under >759.5 mmHg vacuum, with raise in temperature, base starts evaporating from used oil and passes through condensers, so they come to liquid form again and is collected in receivers. After all base oil evaporates, Asphalt (which is also known as Bottom, Residue, Bitumen etc.) remains at bottom of evaporator which is also collected in receiver.

3. Bleaching

Base oil received after distillation process is known as 'Raw Base Oil' because it still contains impurities (mostly aromatics & ash contains), so it is taken further to bleaching process where it gets reacted with bleaching clay (clay-treatment process) or NMP solvent (solvent-extraction process). After bleaching process, we get final Recycled Base Oil.


Flow chart of Used Oil Recycling Process
Used Black Oil
Dehydration
Water & Fuel
Dehydrated Oil
Distillation by any of One of these Evaporator
Vessel Type Evaporator
Column Type Evaporator
Wiped Film Evaporator
Distilled Oil (Raw Base Oil)
(Removal of Asphalt/Bottom/Residue containing dirt, degraded additives etc.)
Bleaching by Any one of these Method
Clay Treatment
Solvent Extraction
Recycling of Spent Solvent to use it again and again
Spent Clay
Clear Re-Refined Base Oil
Separation
Spent Solvent
Clear Re-Refined Base Oil
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Available technologies for Distillation process

There are 3 types of evaporator available for distillation process. Their comparison is as below:

	Vessel type evaporator	Wiped Film Evaporator (WFE)	Column type evaporator
Operation	Batch wise	Continuous	Continuous
Output color after distillation process	4 - 6	3 - 5	3 - 5
Recovery*	High	Low	High
Maintenance	Medium	High	Low
Life span	5-8 years	10-15 years	10-20 years
Available Heating method	1. By Burner 2. By Re-boiler	1. By Thermic Fluid Heater	1. By Re-Boiler 2. By Thermic Fluid Heater
Level of Automation	Semi-Automatic	Automatic	Automatic
Cleaning interval	Once after 45 batches	2-3 times in year	2-3 times in year
Initial cost	Low	High	Medium

Available technologies for Bleaching process

There are 2 types of bleaching method available. Their comparison is as below:

	Clay-Treatment	Solvent-extraction
Operation	Batch wise	Continuous
Output color after bleaching process	Can be set between 1.5 - 3 as per customer's requirement	Can be set between 1 - 3 as per customer's requirement
Bleaching media	Bleaching earth / Bleaching clay	NMP solvent
Is media Re-generative?	NO	YES
Media usage	10 % of batch capacity clay will be required per batch	1-2.5 % solvent will be lost per cycle depending upon its quality
Price of media	200 - 500 USD / ton	2500 - 2900 USD / ton
Smell of base oil after process	No smell	No smell / very low smell of NMP solvent may be there
Process loss of base oil	1-2 %	<1 %
Maintenance	Medium	High
Life span	8-10 years	8-10 years
Available Heating method	1. By Thermic Fluid Heater	1. By Thermic Fluid Heater 2. By Re-boiler
Level of Automation	Semi-Automatic	Semi-Automatic
Cleaning interval	Once after 45 batches	2-3 times in year
Initial cost	Low	High

Final re-refined base oil

Used Oil > Distilled Oil > Recycled Base Oil (With Solvent Extraction method)

Used Oil > Distilled Oil > Recycled Base Oil (With Clay Treatment method)