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Spent oil management and its recycling potential in India – inventory and issues

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Abstract

In India, there are 36,165 industries, generating 62,32,507 Metric Tonnes of Hazardous Waste (HW) every year. However, Generation of recyclable HW is the highest in the country. Recyclable waste attributes to the dominant HW treatment option 49.55% followed by land disposable (43.78 %) and incineration (6.67 %) respectively. Under the Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2008 the processes generating HW were finalized, yet the differentiation of quantum of HW generation based on types of HW i.e used / waste oil, lead waste , zinc waste etc. has been highlighted first of its kind as an inventory in the present study. There are about 257 Spent oil (Used/Waste Oil) registered recycling facilities distributed across 124 districts spread over 19 states in India with the total spent oil recycling capacity as 1.39 MMT. Thus India has a huge recycling potential with a greater yield while considering the generation of used oil and waste oil from automotive sector and manufacturing industries. The major constraint faced in recycling waste / used oil is cost of the collection, storage & subsequent transportation of the waste to the recycling unit.

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Keywords: Hazardous Waste; Recycling; Spent Oil; Hazardous Waste (Management, Handling & Transboundary Movements) Rules, 2008; India

1. Introduction

As per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 (HW Rules), 'hazardous waste' is defined as '*any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances'*. As

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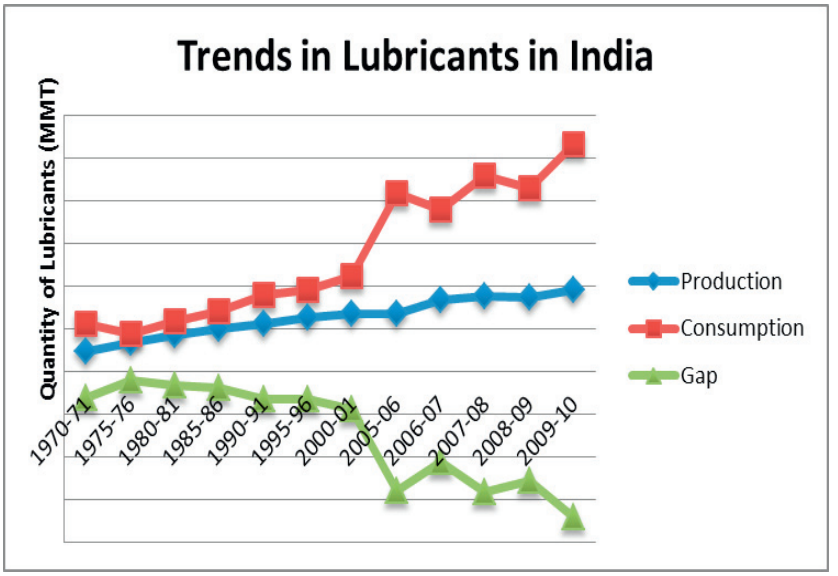
per Schedule IV of the Hazardous Waste Rules, 2008, both used oil & waste oil have been categorized as 'hazardous wastes' and also listed in Schedule I under the rules [1]. Spent Oil (used & waste oil) has been classified as 'RED' category (highly polluting) therefore recyclers require registration for 'recycling' or 'reprocessing' of these wastes.

Used lubricant oil constitutes a major feedstock into the recycling spent oil sector (Used/Waste Oil). Lubricating oils are used in all core industrial sectors including defence, railways, marine and transport with the lube oil growth potential for 2005-10 was reported as 4.6%. According to the study by Bhatnagar et al., lube oil demand in India is of the order of 10 lakh tonnes per year, out of this, almost 60% accounts for automotive and the rest of 40% for industrial lubricants [2,3].



Source: Ministry of Petroleum & Natural Gas

Fig. 1. Yearwise trend in quantity of Lubricants in India.

Current gap between demand and supply of lube oils as shown in figure 1 as well as the projected widening of the gap due to rapid growth in demand arising from the automobiles sector etc. serve as added incentives for recycling.

Organization for Economic Co-operation and Development (OECD) defines *cleaner technology* as 'Technologies that extract and use natural resources as efficiently as possible and that produce durable products which can be **recovered or recycled** as far as possible'. **United Nations Conference on Environment and Development (UNCED)** (1992), Agenda 21, Chapter 34 introduces the term *environmentally sound technologies* (ESTs) as 'protect the environment, are less polluting, use all resources in a more sustainable manner, **recycle more of their wastes and products** [4]. Thus Cleaner Technology and Environmentally Sound Technologies inherently include recovery and recycle as the sustainable options in the definitions provided above.

Reprocessing involves the recovery of used oil and its re-conversion into top quality oil that can be used in production processes. Three objectives are achieved with this type of action:

- There is a considerable reduction in the quantity of used oil that is considered waste.
- In business terms, important savings are made in the purchase of new oils.

- The life cycle of the oil is extended with reprocessed oil being reintroduced into the same production cycle.

It is also worth mentioning that almost entire recycling of HW 'wastes' is done by mainly the SMALL & MEDIUM enterprises (SMEs) in India.

The Hazardous Wastes (Management, Handling & Trans-boundary) Rules, 2008 was notified after the first Hazardous Waste inventory, hence the assessment of quantum of HW generated based on individual types of HW i.e lead waste, zinc waste, copper wastes, used/waste oil, etc. was not highlighted. Yet the differentiation of quantum of HW generation based on types of HW i.e used / waste oil, lead waste, zinc waste etc. has been highlighted first of its kind as an inventory in the study based on the field survey conducted by Central Pollution Control Board (CPCB) between 2009-12.

2. Inventory of Spent Oil Recycling Sector in India

2.1. Sources of Spent Oil

As per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 the sources of used / waste oil are given below at Table 1.

Table 1. Sources of Used/Waste Oil.

Oil type	Sources
Used oil	Oil derived from crude oil or mixtures containing synthetic oil including used engine oil, gear oil, hydraulic oil, turbine oil, compressor oil, industrial gear oil, heat transfer oil, transformer oil, spent oil and their tank bottom sludge
Waste oil	Oil which includes spills of crude oil, emulsions, tank bottom sludge and slop oil generated from petroleum refineries installations or ships

2.2 Field Study of Used/Waste Oil Reprocessing Sector with reference to Hazardous Wastes in India

2.2.1. Status of Hazardous Waste in India

CPCB prepared the first National Inventory of Hazardous Waste Generating Industries & Hazardous Waste Management in India in February 2009. The salient findings of the inventory are presented below:

- In India, there are 36,165 hazardous waste recycling industries, generating 62,32,507 metric tons of HW every year.
- Generation of recyclable HW was the highest in the country accounting for 49.55% of the total HW generated followed by land disposable (43.78 %) and incinerable (6.67 %) respectively.
- The state-wise profile of HW generation vs HW disposal options is given at table 2.

As quantum of recyclable waste generated was significant, there is enormous potential in utilizing such wastes thereby conserving rapidly depleting virgin/natural resources and reducing environmental degradation.

Table 2. Profile of Statewise HW generation vs treatment options.

State	% country's HW generation	% HW disposal options		
		Land-fillable	Incinerable	Recyclable
Gujarat	28.76	61.25	6.06	32.19
Maharashtra	25.16	36.22	9.74	54.03
A.P.	8.93	38.00	0.06	61.94
Other states	37.15	69.16	37.13	43.74
Remarks : %age HW generation of major eight states	Gujarat, Maharashtra, A.P., WB, TN, Rajasthan & Chhattisgarh= 80.29%	Gujarat, Maharashtra, A.P., TN, WB, Rajasthan Orissa & Kerala= 90%	Gujarat, Maharashtra, A.P., WB, TN, Rajasthan, UP, Punjab= 89.08%	Gujarat, Maharashtra, A.P., WB, UP, MP, Chhattisgarh, Jharkhand = 84.08%

2.2.2. Status of Spent Oil Reprocessing Sector

The national inventory on hazardous wastes indicated that 49.55 percent was 'recyclable'. Most of these HW have characteristics suited to their utilization as resource material either for recovery of energy or materials like metals or their utility in construction works, manufacture of low-grade articles or recovery of the product itself, which after processing can be utilized as a resource material. Salient features of the highlights of the inventory of used oil & waste oil based on registration of recycling units until 2010 are given below:

- The total spent oil (used and waste oil) recycling capacity / potential registered = 1674139 KLA i.e. 1.39 MMT as provided below at Table 3.

Table 3. Recyling Potential of Used, Waste and Spent Oil with reference to Hazardous Waste

Type	Recycling Capacity / Potential (KLA)	Percentage
Recyclable HW	**-**	**49.55 (Out of total HW Qty)**
Spent oil	1674139	45 (Out of Recyclable HW Qty)
Used oil	781279	46.67 (Out of total Spent Oil)
Waste oil	892860	53.33 (Out of total Spent Oil)

- In India there are about 257spent oil registered recycling facilities distributed across 124 districts spread over 19 states. The statewise percentage share of recyclers and recycling capacities are well depicted in figure 2a & 2b.
- Among all the states Maharashtra has the largest number of registered used/waste oil recyclers approximately16 % followed by Gujarat accounting for approximately 14%.
- The states were ranked based on the number of recycling units & their recycling capacity/potential in the following Table 4.
- With respect to highest total registered recycling capacity, Maharashtra leads with approximately 22 % followed by Gujarat approximately 19%.
- Maharashtra, Gujarat, Rajasthan , UP and AP rank high both in terms of number of recycling units approximately 57% and collective recycling capacities approximately 65%.

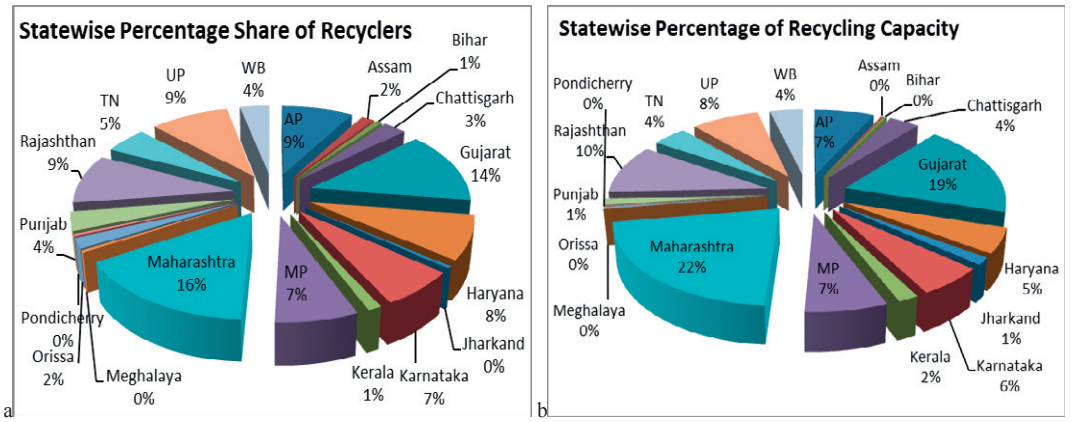


Fig. 2a. Statewise Percentage share of number of recyclers b. Statewise Percentage share of Recycling capacities of the Recyclers

Table 4. Statewise ranking states based on total number of recycling units.

Sl.	States	Districts	Units	Rank : Based on of Recycling Units	Rank: Based on Recycling Potential		
				Spent	Used	Waste	Spent
1.	Andhra Pradesh	11	22	5	5	6	5
2.	Assam	3	4	13	18	15	16
3.	Bihar	3	2	16	16	14	14
4.	Chhattisgarh	4	7	11	14	7	10
5.	Gujarat	11	35	2	2	2	2
6.	Haryana	10	21	6	3	13	7
7.	Jharkhand	1	1	17	13	12	12
8.	Karnataka	8	17	8	7	9	6
9.	Kerala	2	3	15	12	11	11
10.	M.P.	11	18	7	9	4	5
11.	Maharashtra	**16**	**41**	**1**	**1**	**1**	**1**
12.	Meghalaya	1	1	17	19	--	18
13.	Orissa	4	5	12	15	--	15
14.	Pondicherry	1	1	17	17	--	17
15.	Punjab	3	9	10	11	--	13
16.	Rajasthan	8	24	3	4	3	3
17.	Tamil Nadu	10	13	9	8	10	8
18.	Uttar Pradesh	10	24	4	6	5	4
19.	West Bengal	7	9	14	10	8	9
TOTAL		**124**	**257**	19			

- The bar chart as shown below in figure 3a represents number of districts and total number of recycling units spread across all the states and figure 3b presents the percentage of total registered recycling capacity of the country with respect to used oil, waste oil and spent oil.

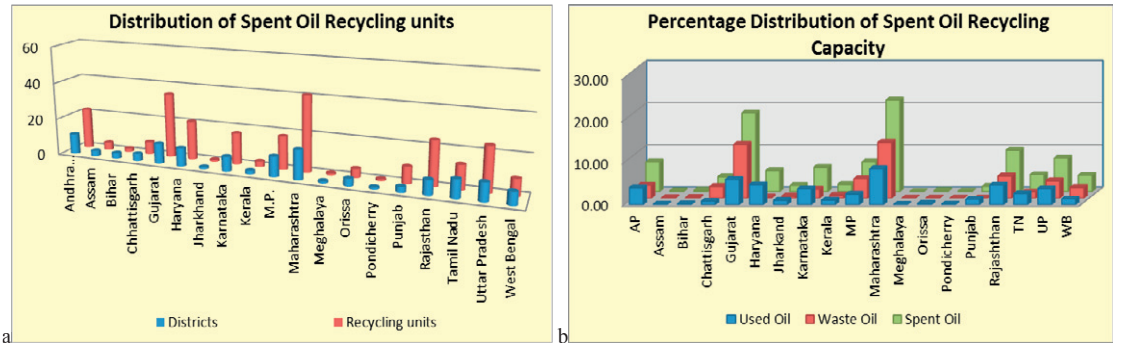


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Fig. 3a. Number of districts and Recycling units b. Distribution of Spent Oil Recycling Capacities.

- District wise inventory on spent recyclers and their recycling potentials are as follows :
  - Maximum number of spent oil recyclers = Ahmedabad in Gujarat 17 recycling units
  - Maximum used oil recycling capacity = Thane (Maharashtra) 57950 KLA
  - Maximum waste oil recycling capacity = Thane (Maharashtra) 115950 KLA
  - Maximum spent (Used & Waste) oil recycling capacity= Thane (Maharashtra) 173900 KLA

Although Maharashtra tops when compared for total number of recyclers and quantum of spent oil recycled, Gujarat has the maximum of number of recyclers at Ahmedabad district out of all the districts having recyclers in India.

2.2.3. Presence of SMEs in Spent Oil Reprocessing Sector

Based on the recycling capacities kilo liters per annum (KLA) it was observed that there is a major presence of SMEs in recycling of spent oil sector. The classification was done as follows:

- Small Recyclers $\geq 360 \leq 10000$ KLA
- Medium Recyclers $\geq 10000 \leq 20000$ KLA
- Mega Recyclers $\geq 20000 \leq 60000$ KLA
- According to the pie charts at Fig. 4 around 81 % of spent oil recycling units are small, 11 % of units are medium and 8 % of units are Mega.
- Regarding used oil it was observed that there is no used oil recycling units belonging to large category i.e. $\geq 20{,}000$KLA and no waste oil units in Meghalaya, Orissa, Pondicherry, and Punjab as provided at Table 5.
- The statewise distribution of small, medium and mega recyclers are presented at figure 5 which shows that Gujarat has the maximum number small, medium and mega spent oil recyclers followed by Maharashtra

It was reported that out of the total volume of lubricating oils consumed in India, about five hundred thousand tons of used oil can be collected and recycled to obtain approximately 3.5 lakh tons of base oil. This shows that the recovery of re-refined oil as 70 % in 2005 which has now increased to 90 % .

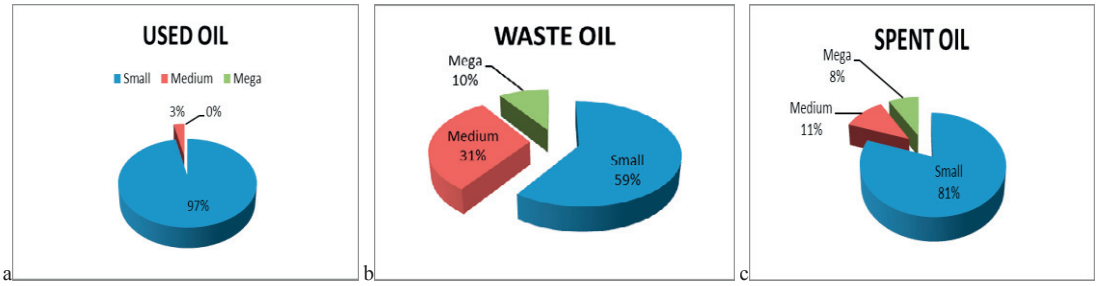

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Fig. 4. Distribution of Small, Medium and Mega units with reference to Used, Waste and Spent Oil Reprocessors.

Table 5. Classification of recycling units based on their Capacities.

Oil type	Range of Used Oil Recycling Capacity			Remarks
	Small ≥ 360 to ≤ 10000 KLA	Medium ≥ 10000 to ≤ 20000 KLA	Mega ≥ 20000 to ≤ 60000 KLA	
Used Oil	216	7	Nil	No used oil recycling units belonging to large category i.e. > 20,000KLA
Waste oil	56	29	9	No Waste Oil Units in Meghalaya, Orissa, Pondicherry, Punjab

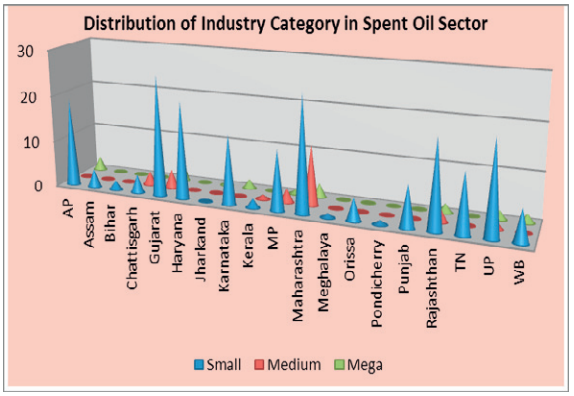


Fig. 5. Statewise distribution of Small, Medium and Mega Recyclers.

3. Environmentally Sound Management of Spent Oil

3.1. Guidelines for Environmentally Sound Recycling of Hazardous Wastes

In view of the 'hazardous' nature of used / waste oil as presented in the earlier section, the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 define environmentally sound management of hazardous wastes as *'taking all steps required to ensure that the hazardous wastes are managed in a manner which shall protect health and the environment against the adverse effects which may result from such waste'*. The 'registration' of recyclers ensures that Environmentally Sound

Technologies (ESTs) are adopted in recycling / reprocessing of HW (as per Schedule IV) which includes waste / used oil. This is a cleaner practice.

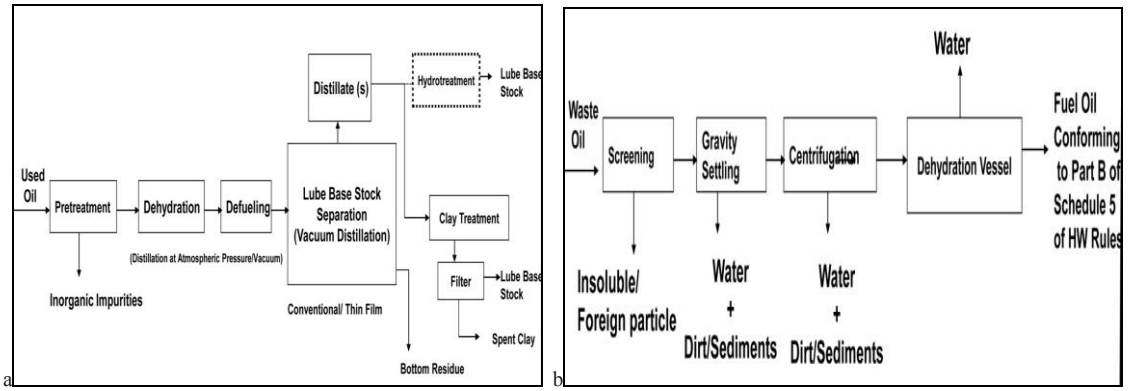
CPCB with the support of Ministry of Environment & Forests published '*Guidelines for Environmentally Sound Recycling of Hazardous Wastes*' as per Schedule – IV of HW Rules, 2008 in January 2010 [5]. The guidelines approved the following ESTs for used oil:

- Vacuum distillation with clay treatment
- Vacuum distillation with hydro-treating
- Thin film distillation
- EST for waste oil essentially includes centrifuging and dehydration of water and reducing the sediment to the desired level
- Any other EST other than that given in the guidelines may be adopted only with the approval of Central Pollution Control Board (CPCB).

Thus the term environmentally sound technology can be applied to all technologies and their transition to become more environmentally sound so as to significantly improve environmental performance relative to other technologies.

3.2.Generic Technologies in Reprocessing Used / Waste Oil

The Fig 6 below depicts the general process steps involved in reprocessing used oil and waste oil in India.



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(Batch or continuous process using stills or column thin film evaporator or evaporators in series operating under vacuum or any other equipment operating on basic principle of vacuum distillation)

Fig. 6a. Used Oil Re-refining Process – Basic Steps b. General Process Steps for Waste Oil Recycling Process.

3.3. Field survey of Spent Oil Reprocessing technologies in India

The summary of existing used oil recycling technologies being practised by registered units based on the field reports available with CPCB for the period 2009 –12 are given below at table 6. Although one of the major Environmentally Sound Technologies (ESTs) adopted is Vacuum Distillation, it is interesting to observe that thin film technology is also being adopted in some states.

The field survey of six used/waste oil reprocessing units of small & medium capacities visited by CPCB in 2012 are provided at table 7 which are analyzed for its adoption of environmentally sound technology. The salient features are also presented with respect to all the units visited.

In the spent oil (used & waste oil) recycling / reprocessing sector there is 'value along the process chain', the yield rate of recycling used oil has been reported to be over 90% with adoption of Environmentally Sound Technologies as per HW Rules, 2008.

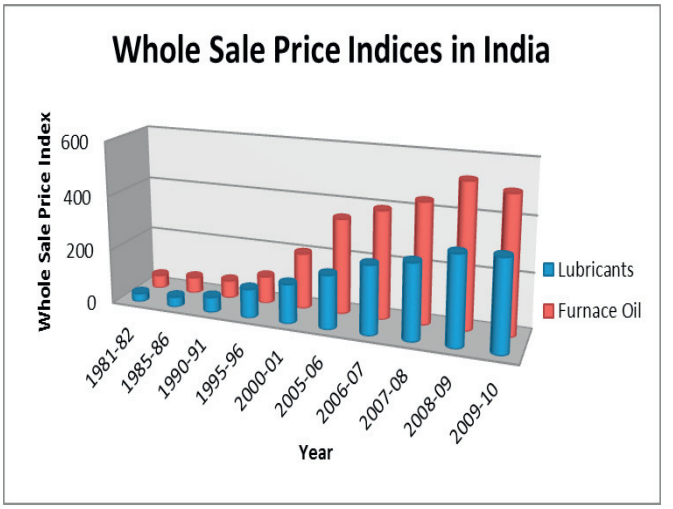
4. Cost Benefit Analysis

As the increased cost of utilizing depleting natural resources is being recognised, the HW Rules 2008 allows for recycling/re-processing of selected group of HW which includes used oil & waste oil. In recent years environmental considerations regarding the conservation of resources have further boosted interest in recycling spent oil which helps in the following ways:

- Conservation of valuable oil reserves by using the oil again and again.
- Significant saving of foreign exchange.
- Checks environmental degradation and saves ecology.
- recycling reduces the burden on storage and disposal facilities
- recycling also leads to significant reduction of carbon foot print

The regional sales of automotive lubes in the total base oils demand is estimated to be 40% implying that there will be a big scope for used oils recycling facilities in Asia, too [6]. The whole sale price indices of Lubricants and Furnace oil are presented in Fig. 7.

Comparative survey of cost benefit analyses of six recycling units are analysed and tabulated at Table 8.



Source: Ministry of Commerce & Industry

Fig. 7. Whole Sale Price Index of Lubricants and Furnace Oil in India.

Table 6. Statewise Process technology adoption in used oil recycling sector.

Sl.	State	Type of recyclers	Process Technology	Products	EST
1	Andhra Pradesh	Small - 19 Mega - 3	Vacuum Distillation, Thin Film Evaporation	Reclamated/Reclaimed Base Oil, Light Oil, lubricating Oil, Light Friction Oil	Yes
2	Assam	Small - 4	Vacuum Distillation	Reclaimed Engine Oil, Lubricating Oil, Light Fraction Oil,	Yes
3	Bihar	Small - 2	Vacuum Distillation	Base Oil, Light Fuel Oil	Yes
4	Chhattisgarh	Small - 4 Medium - 3	Not available	Not available	-
5	Gujarat	Small - 26 Medium – 4 Mega- 5	Acid treatment	Lubricating Oil	No
6	Haryana	Small - 21	Vacuum distillation	Refine d Lubricating Oil, Machine/Machinery Oil, Rubber Process Oil, Re-refined Oil, Refined Base Oil, Spindle Oil, Engine Oil, Gas Oil,	Yes
7	Jharkhand	Mega - 1	Acid treatment	Re-refined lubrication Oil, Distillate Oil, Grease, Hydraulic Oil, Coolant, Lube Oil	No
8	Karnataka	Small - 15 Mega - 2	Vacuum distillation	Lubricating Oil	Yes
9	Kerala	Small - 2 Medium - 1	Vacuum distillation	Lubricating Oil	Yes
10	Madhya Pradesh	Small - 13 Medium – 3 Mega - 1	No information	No information	-
11	Maharashtra	Small - 25 Medium – 13 Mega - 3	Acid Clay process	Re-refined lubricating Oil, Spindle Oil	No
12	Meghalaya	Small - 1	- No information	No information	-
13	Orissa	Small - 5	Double vacuum distillation and acid treatment	Re-refined Oil (Lube Grade / Fuel Grade), Lubricating Oil of various grade, Light Fraction Oil, Reclaimed Used lubricating, Industrial Diesel Oil	No
14	Pondicherry	Small - 1	No information	No information	-
15	Punjab	Small - 9	Vacuum Distillation with Clay	No information	Yes
16	Rajasthan	Small - 19 Medium – 3 Mega - 2	Double vacuum distillation and acid treatment	Re-refined base/lubricating oil, Transformer Oil, Rubber process oil	No
17	Tamil Nadu	Small - 13	Vacuum Distillation	Reclaimed base oil	Yes
18	Uttar Pradesh	Small - 20 Medium – 2 Mega - 2	Thin Film Evaporation, Vacuum distillation	Re-refined Used oil, Refined transfer/lube oil, lubricating oil, paraffin wax	Yes
19	West Bengal	Small - 7 Mega - 2	Double vacuum distillation and acid treatment	Lubricating Base Oil, Light Fraction Oil	Yes

Table 7. Comparative Survey of some Used & Waste Oil Recyclers.

Reprocessor 6	Reprocessor 5	Reprocessor 4	Reprocessor 3	Reprocessor 2	Reprocessor 1	Reprocessor
Small: TAMIL NADU	Small : P U N J A B			Small : UTTAR PRADESH	Medium : UTTAR PRADESH	Type /State
Waste - 9500	Used-2400	Used-1500	Used-1200	Used-6000	Used-10000	Registered Capacity (KLA)
Thin Film Evaporator	Vacuum distillation with Clay	Vacuum distillation with Clay	Vacuum distillation with Clay	Vacuum distillation with Clay	Wiped Thin Film Evaporation	Re-refining Technology
Yes	Yes	Yes	Yes	Yes	Yes	Effluent Treatment Plant
Yes	Yes	Yes	No	No	Yes	Captive Incinerator
Competitive hubs of unorganized Acid Clay based household units because it is less capital intensive with operating temperature just around 250 C	No Quality assurance or characterization/certification of Raw Material Procured	Adulterated Raw Material i.e Water content/Hazardous Chemicals	Illegal Marketing of Used Oil for burning in the furnace	No Trained Staff/Technical Manpower due to resource constraint (Man & Money)	No market for Re-refined oil as that of virgin oil (BP, Indian Oil, HP)	Constraints
New Innovations are proposed to be made. Polymer based Regeneration of Used oil with intact reuse of the catalyst (Polymer)	Disposal of residues from the used oil recycling is convenient because of the location of Common Hazardous Waste Incinerator	Interstate movement of Used oil is possible after submission of NOC by the Purchaser under intimation to the recycling state whereas the same is restricted in few states	There is barely any ‘solid waste ‘ disposed from this sector as all ‘wastes’ have fuel potential for use in co-processing or use in cement kilns	Clay consumption reduced from 8-10% to 2% by using expensive proprietary Fullers Earth @ Rs.50/- per kg	Presently known/proven way is hydrogen gas with Cobalt/Molybdenum crystal OR activated clay treatment. Capital intensive. Ideal for units ≥ 10000 KLA	Salient Features

Table 8. Cost Benefit Analysis Survey of Used & Waste Oil Recyclers.

Reprocessor 6	Reprocessor 5	Reprocessor 4	Reprocessor 3	Reprocessor 2	Reprocessor 1	Reprocessor
Used/Waste: TAMIL NADU		Used/Waste: P U N J A B		Used/Waste: UTTAR PRADESH		**Type /State**
Small	Small	Small	Small	Small	Medium	**Small/Medium**
Rs. 30 / litre	Rs. 30 / litre	Rs. 35 / litre	Rs. 30 / litre	Rs. 45 / litre	Rs. 30 / litre	**Purchase Cost of Raw Material (Used /Waste Oil) INR per litre**
Rs. 1 / litre	Rs. 2 / litre	Rs. 4/ litre	Rs. 2 / litre	Rs. 1 /litre	Rs. 0.50-0.75 / litre	**Manfg.Cost of Clay INR per Kg**
Rs. 3 / litre	Rs. 4 / litre	Rs. 6 / litre	Rs. 6 / litre	Rs. 5 / litre (operation at a full capacity)	Rs.5 / litre at full capacity	**Cost of Treatment / Recycling INR per litre**
Rs. 31 -38/ litre	Rs. 35-45 / litre	Rs. 40-45 / litre	Rs. 35-45 / litre	Rs. 35-40 / litre	Rs. 25 -35/ litre	**Cost of Re-refined Oil INR per Litre**
Separate Process technique and equipment for treatment of used and waste oil which harness re-refined products of unique grade & quality with a cost effective technique. This minimizes cross contamination too	Collection and transportation of spent oil is not economical and hence need for generators of oil to be proximity to recyclers	In general reprocessing of spent oil is energy intensive though reprocessing spent oil takes only about one-third the energy of refining crude oil to obtain lubricant quality	The cost of reprocessing spent oil depends on the type of treatment technology for example The hydrogen based process is capital intensive	Clay consumption reduced from 8-10% to 2% by using expensive proprietary Fullers Earth @Rs.50/- per kg (high quality product with less eject)	The distillate output from Evaporator kept around 125 C to heat the used oil for pre-filtering/de-hydration step as a cost/energy conservation step	**Remarks**

5. Issues

The SWOT analysis is prepared to identify the available opportunities and challenges to be solved in the Spent Oil Reprocessing sector as below.

Strength	**Weakness**
The spent oil (used & waste oil) sector has always drawn attention for two main reasons (a) The activity is mainly in the domain of SMEs and (b) Secondly there is 'value along the process chain' Re-refining used oil takes only about one-third the energy of refining crude oil	Energy intensive Highly Water polluting Highly Air Polluting No Technology Upgradation Labour intensive Cost of the collection & subsequent transportation to the recycling unit. 'Cluster' development offers an 'integrated approach' for the promotion and development of SMEs sector, however this feature is not very conspicuous in this sector.
Opportunities A growing importance of spent oils is waste-to-energy option associated with regeneration, recovery of spent oil and this option is centered upon its use as a fuel.	**Threat** Hazardous Waste RED Category Waste Less Skilled Manpower Inter State boundary Restrictions Raw Material Availability Unorganized SMEs Illegal Market for Used/Waste Oil Unauthorized Usage as Furnace Oil/dumping/landfilling

6. Conclusion & Future Prospects

World lubricant demand increases at 1.6 percent per year to 40.5 million metric tons in 2012. In view of above several bio-based lubricants have also been introduced in the market. Further genetically modified vegetable oils, such as high-oleic sunflower and rapeseed, are also beginning to find use in application where higher oxidative stability is needed. Vegetable oils offer biodegradability and low toxicity. Obviously during the formulation of a biodegradable and low toxicity fluid the additives must be biodegradable and have low toxicity.

The higher price of bio lubricants (both on the basis of vegetable oils and especially based on synthetic esters) is the main restriction for the development of bio lubricants at the current time. They are generally between 1.5 and 5 times more expensive than conventional lubricants. Economical and environmental balance needs to be performed in order to minimize the higher price i.e economic cost versus true cost. Hence there is huge scope for reprocessing of used/waste oil sector in India at present.

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