Minimising Pollution From Lubricants in Service Stations

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Why lubricants are of concern…

- **Base oil**

More than 95 % of these materials are mineral oil based. In view of their high eco-toxicity and low biodegradability, mineral oil-based lubricants make up a considerable threat to the environment

- **Additives**

The main classes of additives are: succinimide ashless dispersants, calcium sulphonates, calcium phenates, zinc dialkyldithiophosphates, oxidation inhibitors, and anti-wear inhibitors **– the key issue is persistence in the environment!**

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Waste/Used Oil generally contains…

- Used oil contains
  - wear metals such as iron, tin and copper
  - lead from leaded petrol used by motorists.
  - Zinc arises from the additive packages in lubricating oils.
  - Many organic molecules arise from the breakdown of additives and base oils.
  - The most harmful is the polycyclic aromatic hydrocarbon (PAH) such as benz(a)pyrene and chrysene. Petrol engines generate the most PAH molecules per 1000 km, with diesel engines below that and two-stroke engines generating the least amount of PAHs.

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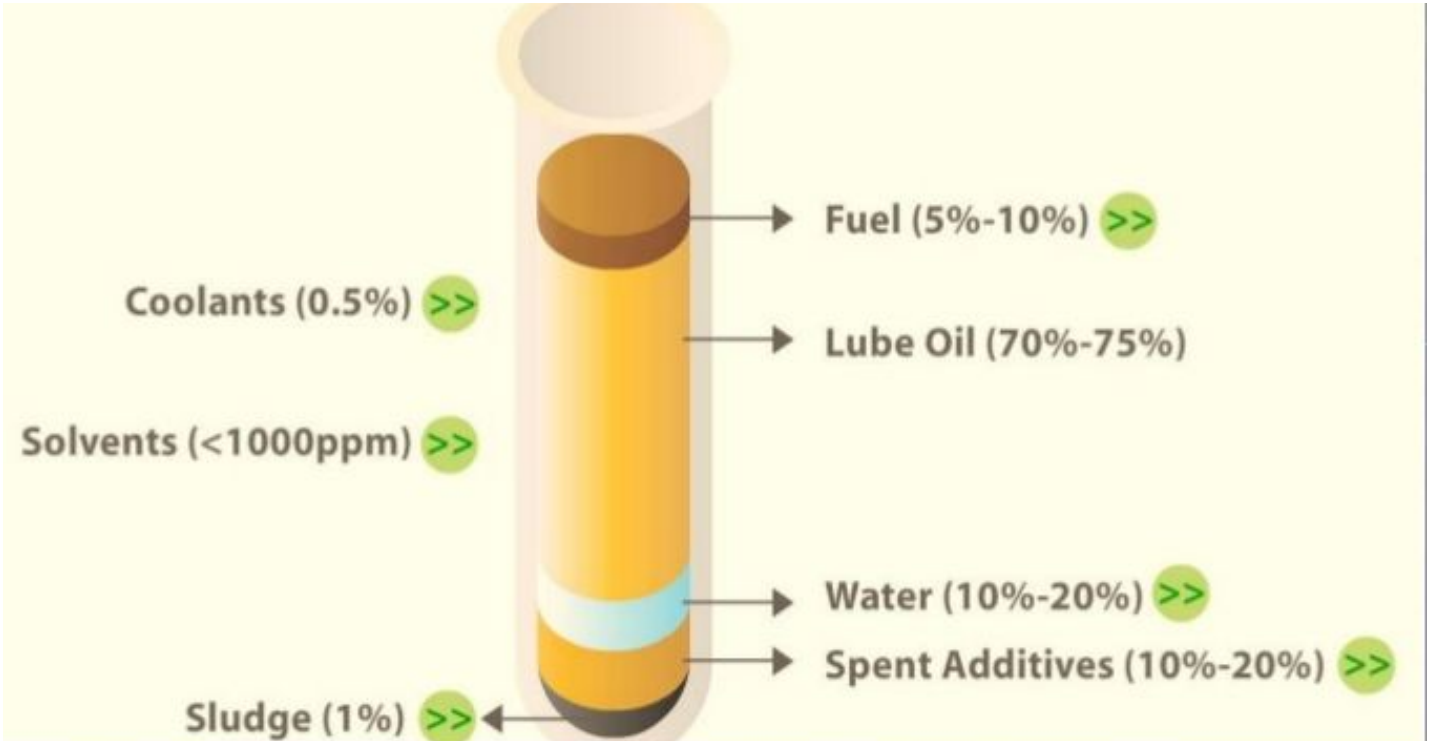
Composition of used oil



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Environmental Health

- Water, air and soil contamination with waste oil causes compromise of environmental health
- Heavy metals and other persistent compounds getting into the food chain may cause serious issues in aquatic environments
- Contamination of the soil by wastewater containing detergents, fuel, oil and grease soil causes it to lose its useful properties such as fertility, water-holding capacity, permeability and binding capacity (Moorthi *et.al*, 2008).

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Effect of waste oil on soil

Parameters	Uncontaminated soil sample 'A'	Contaminated soil sample 'B'
Bulk density (g/cm^3)	1.10	1.15
Soil capilarity (cm/h)	8.10	0.04
Soil porosity (ml)	110	80
Water holding capacity (WHC) (ml)	55.0	15.0

Table 2.2 Effects of waste lubricating oil on the chemical properties of soil

Parameters	Uncontaminated soil sample 'A'	Contaminated soil sample 'B'
Soil pH	6.5	6.0
Phosphorus content (ppm)	80	40
Potassium content (ppm)	98	60
Organic carbon	2.15	3.05
Moisture content (%)	3.5	9.9

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Public Health Hazards

- Heavy metals and persistent compounds get into the food chain and enter human bodies and may
  - Cause cancers
  - disruptions to proper functioning of the endocrine system
  - Damage to other organs including liver and kidneys
  - Reduced immunity

- Fumes/aerosols causes lung inflammation and issues in the respiratory system (asthma), eye irritations

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How lubricants cause pollution during services

- Disposal of waste oil – as bulk and contamination with other waste streams
- It contaminates air, soil and water
- Finally reaches to the ocean
- Each wash consumes an average of 151.4 to 227.4 liter of water depending on size of the vehicle (Yasin S et al, 2012)
- During high pressure water spraying, fumes of lubricants (aerosols) are released

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Sri Lankan context- wastewater discharge quality from Service Stations

Parameter	Measured value	CEA standard for discharging Treated effluent into inland Water ways (with 1: 8 dilution)
pH (at ambient temperature)	6.8	6 – 8.5
BOD (mg/l)	1150	30 (significant deviation)
COD (mg/l)	3048	250 (significant deviation)
TSS (mg/l)	1364	50 (significant deviation)
Ammonical Nitrogen	12	50
Oil and grease	104	10 (significant deviation)
Sulfides	3.2	2.0
Phenolic compounds (as Phenolic OH)	0.1	1.0

Pollution control guidelines, CEA, 2001

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How to minimise impacts through pollution….

- Policy measures
  - Ban lubricants with extremely harmful substances
  - Promote recycling of waste oil
  - Promote plant based oils rather mineral oils
- Legislative measures
  - To regularise importation
  - To regularise local blending
  - To ensure environmentally sound disposals/ discharges
    - WW generated should be treated to meet CEA stipulated standards prior disposal
- Effective enforcement
- Less expensive technologies

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Mandatory requirements to minimise the pollution

- Use a properly cemented and covered area to carry out work where there is a possibility of oil leaks eg: Dismantling and servicing of engines, removal and cleaning of filters
- Prevent oil spillage on the floor by using collecting trays
- Store collected oil in impermeable vessels (eg: Plastic/Metal can with lid)
- Dispose the collected waste oil in an appropriate manner
- Installing vapour recovery system
- Good housekeeping practises

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Treatment mechanisms

- Treatment plants for Wastewater
- Facilitate natural assimilation of pollutants through constructed wetlands/ natural vegetation
- Used oil refining

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Treating the wastewater….

- Stages of treatment
  - Oil separation (OG trap)
  - Facilitate coagulation and flocculation (alum and polyelectrolite)
  - pH adjustment (lime)
  - Sedimentation tank
  - Sand filter
  - Disposal either to
    - Recycle in the process
    - Discharge into the sewer lines
    - Land disposal

https://www.flagshipindia.in/etp-for-reusable-water-1.html

- Guide to On-site Wastewater Management for Industrial and Commercial Establishments and other Institutions -Guide for Vehicle Service Station Owners and Managers, IWMI

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Cost effective and natural ways of assimilating pollutants….

- Jatropha - Endaru
- Common flax
- Reed species – Beru thanakola
- Sorghum

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Used oil refining – industry scale

- Environmentally sound
  - Reduced risk of
    - ground water contamination
    - Pollution of water
    - Contamination of soil
    - Impacts to biodiversity
  - Preserve Natural Resources in terms of base oil consumption
  - Reduce wastewater treatment costs
  - Reduce improper burning of waste oil as fuel which generate toxic fumes and air pollution
- Reduced dependence on base oil imports and saving foreign exchange
- Creation of a new industry and more employment
- opportunities

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An alternative at industry level -Bio-lubricants or plant based oils

- Excellent tribological properties (ester functions stick well to metal surfaces)
- lower friction coefficients than mineral-oil-based fluids
- lower evaporation —up to 20 % less than mineral-oil-based fluids
- higher viscosity index (multi-range oils)
- excellent biodegradability
- high flashpoints
- low water pollution classification.

At present it seems that the best compromise between performance, price and biodegradability are high oleic oils.

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THANK YOU!

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