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**Research Paper**

# Polluting Effects of Wastes Generated in Engine Vehicle Repair-Service Businesses, Storage, Disposal and Reuse of Wastes

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***ABSTRACT:*** *Motor vehicle production is one of the sectors that show technological development depending on science and technology. Vehicle maintenance stations and auto repair shops that develop as a result of motor vehicle production are a sectoral occupational field that contributes greatly to employment. Waste materials are produced as a result of production processes, industrial and domestic solid wastes. Especially considering the environmental pollution effects of wastes originating from the motor vehicle repair sector, it is important to take more care because they are much more harmful than domestic wastes. In this sector; a large amount of different wastes are produced during maintenance operations performed after sales. The increasing amount of waste requires waste-free or low-waste production, recycling of wastes and disposal of the wastes in the most appropriate way in terms of economy and environment. The sector has a great responsibility in reducing the wastes originating from various maintenance operations of motor vehicles at their source, ensuring their reuse or recycling. This study includes informing vehicle maintenance stations and auto repair shop operators about modernization, reducing waste amounts, protecting the environment, reducing costs, reducing hazardous waste with clean production measures such as waste prevention, reduction and recycling.*

***KEYWORDS:*** *Automotive, Maintenance, Environment, Waste, Pollution, Disposal, Reuse*

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## I. INTRODUCTION

In many countries, auto repair shops are among the small businesses where hazardous waste is produced. These repair shops have the potential to produce pollution due to their main activities. Transportation of chemicals and repair work can cause environmental pollution(auto repair pollution). During after-sales operations in this sector, large amounts of various wastes are generated. The increasing amount of waste requires waste-free or as little waste as possible production, recycling of wastes and ultimately disposal of the resulting wastes in the most appropriate way for the economy and the environment. As a sector, "Automotive Repair Shops" is a profession that contributes greatly to employment. The sector has a great responsibility in reducing the wastes generated as a result of various maintenance operations of auto repair shops at their source, ensuring their reuse or recycling. Considering the environmental pollution effects of wastes originating from the motor vehicle repair sector in particular, it is important to show more care since they are much more harmful than household wastes. In this sector; a large amount of different wastes are produced during maintenance operations performed after sales. The increasing amount of waste requires; waste-free or as little waste as possible production, recycling of wastes and disposal of the generated wastes in the most appropriate way in terms of economy and environment. Since wastes originating from the motor vehicle repair sector in particular are much more harmful than household wastes, it is important for local governments to show more care. Environmental problems caused by waste generation are a problem that can only be solved by working together with local government, sector representatives and sector workplaces. The definition of Automobile Repair Shops refers to vehicle repair shops, automobile dealerships, bicycle/motorcycle repair shops, agricultural machinery repair shops, construction and heavy duty machinery-maintenance, fuel stations; transportation

companies, tire repair shops and other(vehicle maintenance companies, for example, forklifts used in warehouses) automobile repair shops. This study includes; providing modernization of repair shops, reducing waste amounts, protecting the environment, optimizing quality, guiding auto repair shop operators who want to reduce costs, reducing hazardous waste with clean production measures such as waste prevention, reduction and recycling. Clean production includes organizational and technical changes made to ensure a significant reduction in environmental pollution in repair, maintenance and service operations in workplaces. With these processes, quality will increase, and costs will decrease since more efficient materials and more efficient energy will be used. In addition, the reduction in environmental pollution will not be achieved by taking protective measures after the main process, but by using cleaner technologies at each stage of the process. As a broad concept, cleaner production refers to institutional and technical changes made in workplaces and processes to ensure a significant reduction in environmental pollution [1], [2], [3] and[ 4].

Rapid and widespread urbanization and increasing consumer purchasing power as a result of the migration of people to large cities due to industrial developments have led to an unprecedented growth in the automobile sector, especially in developing countries. The unprecedented growth in the automobile sector has led to an increase in the number of automobile service stations and vehicle repair shops, especially in developing countries. These vehicle service businesses produce large amounts of waste containing objectionable levels of dirty oils and heavy metals, as well as other toxic compounds. In terms of the ecological environment, regular scientific monitoring of automobile service stations is of critical importance in the waste management of agricultural production areas and wetlands for sustainable agricultural production. Increasing environmental law regulations, together with ecological and environmental awareness, require strict monitoring of vehicle service station waste and its environmentally sustainable processing. However, the development of the automobile industry sector and the ever-increasing demand for automobiles increase the burden on the environment in terms of resources used and waste produced. End-of-life vehicles, storage of old scrap parts in scrap yards and landfills increase the environmental waste load by increasing the waste entering the environment from the automotive industry. The automotive service sector is a vital part of the automotive industry, which supports the manufacturing sector and makes a major contribution to the global economy. The increasing number of vehicles on the road is also increasing the demand for automotive service centres, auto mechanics workshops and car washes, collectively referred to here as service stations. However, most service stations worldwide lack appropriate government approvals and are therefore not fully equipped to scientifically handle the waste generated. This results in the unscientific disposal of large amounts of solid and liquid waste. Various physical and chemical methods have been used for the treatment of these wastes, but these processes are quite resource and energy intensive, produce additional sludge after treatment and lead to more chemicals entering the environment. Instead, biological solutions are emerging as an economically and environmentally viable alternative for waste management. As a result of the entry into force of Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles and their monitoring, the vehicle sector is a well-organized area in most developed countries [5] and [7].

## II. WASTES IN AUTOMOTIVE REPAIR SHOPS, DEFINITION AND PREVENTION OF WASTES

The automobile industry is an industry that uses a wide variety of materials. As a result of this diversity, it produces a wide variety of toxic gases, solids and liquid wastes that affect the environment in irreversible ways. As a result of special processes such as vehicle repair and periodic maintenance, automobile body maintenance, repair, painting, engine adjustment, various wastes that require additional disposal, mostly hazardous and largely recyclable, such as paint waste, cooling oil, fluid or metal dust and shavings are produced. There are often precautions and recovery measures that reduce costs for the most important hazardous wastes that can occur as a result of maintenance, service and repair processes in automobile repair shops. Since the prevention and disposal of many types of waste is determined by the manufacturer and due to the fixed change intervals determined, the disposal of engine oil, transmission oil, cooling and brake pad fluid is less or partially possible. EU rules aim to manage waste oils correctly, to ensure that they do not pollute the environment and to benefit from their high recovery potential. EU rules aim to ensure that waste oils are correctly managed, to avoid contaminating the environment and to take advantage of its high recovery potential. The management and disposal of waste oils and other hazardous wastes originating from auto repair shops are carried out in accordance with Directive 2008/98/EC on waste. Used oil, although it exhibits hazardous waste characteristics, is not managed as a hazardous waste on its own. However, if used oil is mixed with any amount listed between R315-261-30 and R315-261-32 or any combination of hazardous wastes, the mixture is subject to regulation and management as a hazardous waste. In addition, if used oil is mixed with a "characteristic" hazardous waste and the mixture exhibits hazardous waste characteristics, the mixture is managed as a hazardous waste. The Used Oil Management Standards (R315-15) assume that used oil containing more than 1,000 parts per million (ppm) of total halogens is mixed with chlorinated hazardous waste. The Used Oil

Management Standards (R315-15) also provide strong safeguards against potential misuse by addressing and prohibiting unsafe practices associated with improper storage, road lubrication, and weed suppression [2], [3], [8], [9] and 10].

## 2.1 Waste Oils

Waste oil, waste transmission oil, waste machine oil, waste engine oil, are formed from burnt or burnt oils as a result of oil change (engine-gearbox-differential) operations in machines and vehicles. Reusing engine oils that have completed their lifespan and become waste products for various purposes, mixing them with fuel or burning them in uncontrolled environments causes soil, air and water pollution. These oils; mineral-based chlorinated and non-chlorinated engine, gear box and lubrication oils, synthetic engine, gear and lubrication oils are easily biodegradable. As waste definition content; synthetic or mineral oils containing additives, foreign substances, chlorine-free (water, metal particles, rust, etc.) have a liquid consistency and an average density between 0.95–0.99 t/m³. In order to prevent, reduce and clean early replacement, oils should be changed only when necessary and at intervals recommended by the manufacturer, taking into account warranty conditions. Using long-term, high-quality oil and oil filters, extending the service life of the oil by using a fine dust filter and using secondary oil as much as possible contribute to reducing the amount of waste oil. Ensuring that only waste oils with known waste sources and other liquids/foreign substances do not enter the collection containers forms the basis of clean replacement. Recycling used oils prevents environmental pollution and also prevents resource waste. With the processes defined as external recovery processes, Category I waste engine oils are used for secondary use through regeneration and refining. Category II waste engine oils are sent to licensed facilities for energy production. Waste industrial oils that do not exceed the Category II limit value in terms of chlorine and total halogen parameters can also be sent to recovery facilities for recovery. For storage or transportation purposes; fixed plastic or steel tanks with ventilation, fullness indicator and overflow control, consisting of containers that can store up to 1250 liters and are filled with fixed connected pipes, are used. In addition, the filling process can do manually, small quantities are used in fixed or replaceable plastic or metal containers (tanks). While fresh oil keeps your engine running smoothly, used oil can become a potential environmental hazard if not disposed of properly. Discarded oil can leak into the ground and pollute soil and water resources. Recycling used engine oil is a good option to prevent this pollution. Recycling used engine oil not only protects the environment but also provides re-refined lube oil and fuel oil, which are defined as valuable resources. The re-refining process consists of a series of processes that reflect how crude oil is converted into natural oil. These processes are; collection, pre-treatment, distillation, hydrogen refining, blending. Collection begins with the collection of used oil from service stations, repair shops, and even individual households that change their own oil. Before re-refining begins, the used oil undergoes a preliminary cleaning. At this stage, large particles such as dirt, metal shavings, and water that may have accumulated in the used engine oil during its service life are removed. In the distillation process, the pre-treated oil is heated under vacuum. This is a gentle separation process where the valuable base oil is separated from contaminants at a lower temperature than traditional oil refining, preserving the quality of the base oil. While the distillation process removes dirt, metal shavings and water impurities, stubborn contaminants such as sulfur and oxygen may remain. Hydrogenation is the process where hydrogenation comes into play. In this process, hydrogen gas reacts with a catalyst to effectively neutralize these remaining contaminants such as sulfur and oxygen, resulting in a cleaner and purer base oil. In the blending process, the re-refined base oil is blended with specific additives, which enhance the oil's performance characteristics and strengthen it for specific applications. These additives are special components that set the optimum performance of the engine as a high-performance or heavy-duty motor oil. With this meticulous process, re-refining removes a wide range of contaminants, including metals, dirt and harmful by-products of engine combustion. The resulting re-refined oil meets the same stringent standards as virgin oil and is reused as a high-quality oil. Recycling used engine oil is a win-win process. This process prevents waste engine oil from polluting the environment while also protecting the environment by reducing the need for virgin oil production. In addition, valuable resources such as re-refined lubricating oil and fuel oil are produced. For example, used engine oil from an agricultural tractor engine can be used in the tractor engine as re-refined lubricating oil and recycled fuel oil [1], [2] and [12]. Figure 1 shows the schematic system for the disposal of used engine oil for reuse.

## 2.2 Solvents

Solvents are wastes of products such as solvent mixtures, cold cleaners, washing gasoline and liquids, organic cleaning agents, main bases, paint and varnish cleaners(halogen-free). Waste source of solvents and solvent mixtures; cleaning of degreasing parts, mostly with the help of pliers, cloth and washing bench. Waste definition contents; generally the residues of halogen-free solvents (greases, oils, dirt, water) with a liquid consistency of approximately 0.8-1.2 t/m³ originating from use in the mixture. Storage or transportation containers; storage or transportation operations are carried out in metal or plastic stoppered containers or

similar, storage(60-200 liters), special containers such as 250-1000 liters. In order to prevent and reduce solvent type waste and to produce clean work, the parts are cleaned mechanically beforehand with a cloth or brush so that as little dirt(oil, grease, etc.) as possible is mixed into the solvent. In cascade application, solvent containers are used, the most contaminated solvent container is used for preliminary cleaning, the least contaminated solvent container is used for final cleaning, and since less solvent will be consumed with this application, waste generation is prevented by 80%. Since the machine will use the parts washing device (parts cleaning device is recommended) to clean small parts, it will use the cleaning agent by circulating and recycling, and compared to manual parts cleaning, it will provide 85% savings by purchasing the cleaning material. If the amount of solvent is large in the recycling process carried out within the company, the mixture prepared with the distillation device should be tested first and the missing amount should be completed by changing the proportions of the mixture [1], [2], [3], [4] and [5].

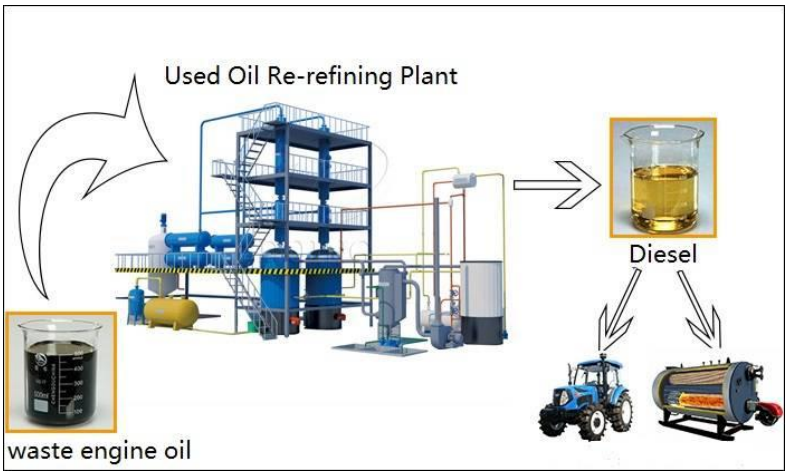


**Figure 1:** The schematic system the used engine oil for reuse [12].

## 2.3 Packaging Contaminated with Residual Oil or Hazardous Substances

Paint cans, spray cans (non-pressurized), containing hazardous residues (residues not emptied), general metal-plastic, composite packaging and packaging contaminated with hazardous substances constitute this waste group. These wastes are waste sources consisting of partially used, unused, unusable and unemptied containers. These wastes are; metal, plastic or composite packaging containing hazardous substances (deteriorated polish, solvent, glue, oil, cleaning agent etc.), aluminum and tin spray cans containing propellant gas (Pentane, Butane, CO2) and compressed air other than the material to be used (polish, cleaning agent, brake cleaner, rust cleaner). Storage or transportation of such waste is done in a storage container with a clamp ring, with special lidded containers (250-1000 liters). In order to prevent and reduce the packaging contaminated with residual oil and hazardous substances or to prevent the expensive disposal cost of the purchased package in clean production, care should be taken to ensure that the amount is suitable for use(expiration date). Packaging as large as possible and as small as necessary should be preferred, and if possible, reusable packaging (containers, barrels) should be used. If a substance/chemical sample is taken for trial purposes, it should be returned to the supplier if the sample is not finished. Spray cans should be refillable pump spray cans (easier to fill and does not contain volatile gas) rather than volatile gas type. Also, substances in refillable packages are cheaper than those sold in spray cans. It should be checked whether some substances can be applied with a brush or cloth, and attention should be paid to completely emptying empty containers and collecting them separately (cans, canisters, tubes, spray cans free of residues are non-hazardous waste) [1], [2], [3], [4] and [5].

## 2.4 Solid Grease and Oil Contaminated Materials

Oil containers, oil filters, cleaning cloths contaminated with hazardous substances, filter materials, protective clothing, workshop dust, welding equipment filters constitute this type of waste. Storage and transportation operations are carried out with reusable containers, clamp-lid containers, special containers (250-1000 liters) or similar containers. For prevention, reduction and clean production, cleaning cloths should always be used many times, whether they are disposable or reusable. The need for cleaning cloths can be significantly reduced by using slightly dirty cleaning cloths in pre-cleaning and clean ones in final cleaning. Absorbent cloths or catch containers are used instead of disposable cloths to catch overflowing and dripping liquids. If disposable cloths are used (non-clumping paper cloths), they are collected separately and can be given to energy recovery in an appropriate manner due to their high calorific value [1], [2], [3], [4] and 5].

## 2.5 Brake Fluids

Brake fluid wastes are liquid wastes resulting from vehicle maintenance-repair and scrap vehicle dismantling processes. The waste content is defined as contaminated glycolether, the liquid is in a paste-like consistency, and the density value is approximately 0.8 t/m³. Storage and transportation processes are carried out in plastic containers (up to 120 liters), metal-clamped lidded containers (up to 200 liters), special containers (air-proof to reduce moisture intake in the air) or similar containers. Since brake fluids must be changed at certain intervals, it is not possible to prevent it. Brake fluids, which have the ability to attract and absorb water, should be collected in special containers in order not to absorb moisture from the air and thus to minimize disposal costs. Material recovery and energy recovery of glycolether for use in the production of new brake fluid is possible [1], [2], [3], [4] and [5].

## 2.6 Antifreeze Liquids

Antifreeze liquids containing hazardous substances are wastes resulting from maintenance operations, breakdowns and scrapping operations at regular intervals. Contaminated (e.g. rust, metal) ethylene glycol and water mixture is defined as wastes with a liquid consistency and a density of approximately 0.95 t/m³. Storage or transport containers for waste are metal-clamped lidded containers (up to 200 liters), special containers (e.g. 250-1000 liters). Coolants should be collected in lidded containers so that they are not contaminated with water and disposal costs can be reduced. Reuse is possible and for this purpose, coolants are filled into a 200 liter clamped lidded container with a tap at the level of one third. Heavy aerosols settle to the bottom and even light oil drops collect on the surface and coolant can be taken from the middle of the container. Distillation can be used for external recovery of new coolant, its calorific value is below 3 MJ/kg and it is not suitable for energy recovery [1], [2], [3], [4] and [5].

## 2.7 Waste Oil Filters

Waste oil filters are wastes that are formed as a result of oil filter changes in machines and vehicles. Oil filters generally contain a metal case, strainer, filter and contaminated waste oil. Engine oil collects heavy metals and other particles during the operating period of the engines. This substance is quite polluting and harms the ecosystem. When used oil is thrown away, it not only pollutes the soil but can also mix with groundwater. Approximately 706 million gallons of waste oil mixes into the seas and oceans every year. Most of this is due to improper disposal of used oil. When engine oil is replaced with new oil, the old oil is only dirty and has not deteriorated. Used oil should never be thrown away and should be stored in a hard plastic container until the oil is recycled. In storage or transportation, it should be stored in clamped lid containers, special containers (250-1000 liter containers). The recycling process cleans the oil and provides the opportunity to reuse it. The most effective measure in prevention and reduction is to change the oil filter only when necessary or foreseen, taking into account the vehicle manufacturer's instructions. In internal processes and recycling, an oil filter processing device that will separate metal, oil and paper contaminated with oil should be used. In external recycling processes, for example, metal and oil should be separated by special processing and the contaminated part should be separated [1] and [11]. Figure 2 shows contaminated waste oil filters.

**Figure 2:** The contaminated waste oil filters

## 2.8 Residues from Grit Chambers/Oil Separators and precautions

Car repair shops should be structured as businesses that do not produce wastewater or produce the least amount of wastewater. When no wastewater is produced, only wastewater from sanitary facilities will be discharged into the city sewer. In this case, the repair shop does not need to have an oil separator and a sand

chamber. Vehicle and engine washes should be carried out in vehicle washing facilities equipped with a suitable oil and emulsion removal treatment system and wastewater treatment plant. According to a report by the International Car Wash Association, a home car wash can use between 80 and 140 gallons (300 and 530 l) of water, while a garage car wash uses approximately 30-45 gallons(115-170 l). An additional amount of water is also used to wash floors and other washing equipment, thus increasing water consumption and the volume of wastewater discharged [6]. During maintenance operations, oil, gasoline and dirt contamination of separators should be prevented as much as possible, and since liquid is used, absorbent cloths are always used, and dirty floors are cleaned with dirty cloths. High-pressure cleaning devices are operated at relatively low pressure (< 60 bar) and low temperature (< 60 ° C), and cleaning agents suitable for separation in the separator are used. High pressure cleaning is completely abandoned, and the dirt and solid materials in the sand chamber are cleaned dry (broom) or with a machine (floor cleaning machine). Dry sweeping dust (sand/dust) is generally disposed of with household waste and cleaned wet after the floor sweeping process. The coarse mud left in front of the repair shop by trucks, agricultural machines and off-road vehicles is swept. The filling rate of the oil separator is measured monthly and when the emptying intervals are arranged according to the filling rate, approximately 90% of the cost can be saved. Sludges in oil/water separators are defined as oil separator contents, residues from grit chambers, solids from grit chambers and oil/water separators, sludges from oil/water separators, interceptor sludges, oil from oil/water separators, oily water from oil/water separators, mixed wastes from grit chambers and oil/water separators. These waste residues accumulate in oil and gasoline separators. Sand chambers and oil separators in auto repair shops, gas stations and similar businesses that work with gasoline and diesel oil must be emptied at regular intervals. In addition, water, oil and fuel, solids (sand), sometimes cleaning agent, dirt and solid oil are formed in mixtures. These wastes are liquid oil separator contents, in the form of mud-like-solid waste products with an average density of 0.9-1.2 t/m³. Oil separator contents and sand chamber residues are not hazardous materials as a rule. This waste is generally not stored, in case of disposal, it is directly drawn from the sand chamber or oil separator by a sewage truck and transported to storage areas [1], [2], [3, ] [4] and [5]. Figure 3 shows the illegal discharge of vehicle waste from motor vehicles into shallow groundwater at vehicle maintenance stations.

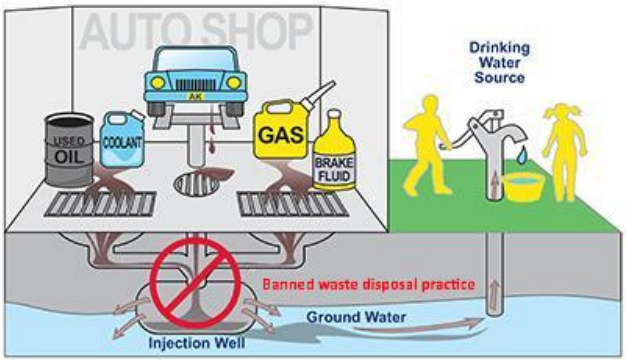


**Figure 3:** Allowing shop fluids to flow into groundwater is against the law [12].

## III. CONCLUSIONS AND RECOMMENDATIONS

The motor vehicle industry is one of the growing sectors worldwide. Motor vehicles produce large amounts of various wastes during both their production and after-sales maintenance operations. The most basic solution to reduce such wastes is waste-free or as little waste as possible, waste recycling and disposal of the generated wastes in the most appropriate way in terms of economy and environment. Increasing awareness about the environment has contributed to awareness and measures regarding disposal of produced wastes. New approaches regarding wastes in the automotive industry are being made by taking into account the environmental impacts of wastes originating from maintenance and service operations, and such studies are supported by new incentives in many countries of the world. Although it varies from country to country, authorized, private and other maintenance and repair stations are required to comply with the laws determined according to the regulations requested for the re-evaluation of such waste products and environmental aspects. These stations must show due care and attention to the three basic principles of waste management: producing less waste, recycling waste, and disposing of waste without harming the environment. When motor vehicle maintenance and repair stations take into consideration the following recommendations regarding solid, liquid or gaseous waste, they will contribute to great improvements in the ecological environment.

- Regarding the evaluation and recovery of waste oils, scientists generally express their views on regenerating waste oils into base oil through appropriate filtering, purification and refinery processes, and

generating energy by burning them with appropriate combustion systems in a way that prevents environmental pollution.

- In vehicle maintenance businesses, water and other washing product wastes are discharged into the city sewerage system as dirty water without being treated and in an uncontrolled manner. It is possible to have a cleaner environment with less wastewater if the relevant local institutions fulfill their authorities and responsibilities in this regard.
- Battery manufacturers should give importance to returning old battery waste to manufacturers for recycling through their dealers and training their dealers and repairmen on reducing environmental pollution.
- Informative and awareness-raising training should be provided on the environmental impacts of waste in cooperation with professional chambers and local governments.

## REFERENCES

[1]. T.C. Çevre ve Orman Bakanlığı., Türkiye'de Sanayiden Kaynaklanan Tehlikeli Atıkların Yönetiminin İyileştirilmesi, Oto Tamirhaneleri, LIFE06 TCY/TR/292, HAWAMAN Projesi, 2009 (Turkish).
[2]. Environmental Protection Agency (EPA), The Automotive Repair Industry Guides to Pollution Prevention, 1991.
[3]. Kansas State University, Pollution Prevention for the Automotive Maintenance and Repair Industry, 2004.
[4]. Department of Environment and Climate Change NSW. Environmental Action Forautomotive Servicing and Repairs, ISBN 978/ 1 74122 508 2 DECC 2008/77 May 2008.
[5]. Pooja Singh., Nikita Berawala., Yogesh Pati., Automobile service station waste assessment and promising biological treatment alternatives: a review, Environmental Monitoring and Assessment An International Journal Devoted to Progress in the Use of Monitoring Data in Assessing Environmental Risks to Humans and the Environment., Vol. 194:753 Springer (2022).
[6]. Asha M. Nair., Chandan. K.S., Harish. H.P.,Mini Liza. G., Recycling of Waste Water Collected from Automobile Service Station, Procedia Environmental Sciences 35:289-297 December 2016,
[7]. The European Parliament and of the Council, End-of-life vehicles, Directive 2000/53/EC,18 September 2000.
[8]. Mildenberger, U., Khare, A. Planning for an environoment-friendly car., Technovation, 20(4), 205–214. 2000.
[9]. https://environment.ec.europa.eu/topics/waste-and-recycling/wasteoil.Waste Framework Directive. 2022
[10]. https://deq.utah.gov/category/waste-management. Regulation of Used Oil as a Hazardous Waste
[11]. Kaitlyn Haberlin., Recycling Your Used Motor Oil and Filters Is Easy and Free - Hazardous Waste Recycling/Disposal 2021.
[12]. https://www.purepathtech.com., What are the Uses of Recycling Used Engine Oil?., PurePath Chemical Engineering Technology Co.,Limited. 2021.