

## MANAGEMENT OF AUTOMOBILE END OF LIFE

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### ABSTRACT

According to our statistics, we face with daily reduction of vehicles life in Iran and around the world, as a result, we will face with a very high volume of old cars, vehicles that must inevitably come out of transportation cycle, exit of vehicles will facilitate urban transportation and saving in fuel consumption and air purity, but leaving old cars outside of cities or remote will be harmful for environment and esthetic perspective and also it is impractical, due to the high number of old cars so the only way to deal with old cars is recycling them. In car recycling, we can get economic benefits in addition to get rid of heaps of scrap and waste. This research categorizes and offers administrative guidelines of people through studying thoroughly previous researches on vehicle depreciation management, in order to get ultimate goal of vehicles' end of life management that is to maximize the use of resources to minimize air pollution and environment and maintain and increase employment.

**KEYWORDS:** Environmental pollution, recycling, vehicles end of life.

### INTRODUCTION

Recycling is a process in which the waste materials are separated and are used as a raw material for new products, in other words, recycling is to return usable materials into production cycle or nature. Recycling includes steps, such as separation of recyclable materials (such as glass, plastic, metal, etc.) and processing materials, so that waste materials become re-re-usable through a process or processes

Vehicle recycling process:

About 75% of vehicle weight includes metals and other 25% is non-metallic materials such as rubber and glass that is waste. Marketable parts are removed and remainder is released into the environment or is sent to crusher. Crushers have large hammers to break the car body and mill vehicle and convert to small particles; metals are separated from non-iron and iron materials, other materials are waste. The waste materials contaminate land and soil and have adverse effects on environment. Today, developed countries try to minimize the amount of waste materials, especially in UK, British car recycling consortium has a project in cooperation with manufacturers and decollators that its goal is to reduce the amount of non-metallic waste materials. They provide potential recycling method for non-metallic materials. Using these methods we can get the amount of waste material to 8% and the aim is to get the amount to 5 percent until 2015. Decollators have direct access to information through manufacturers. They use these data in order to identify and separate the different types of plastic in a particular model of car.

Research objectives:

- Reducing the volume of waste entering the environment
- Reducing the need for landfill and incineration
- Reducing the need for production or entrance of raw materials from abroad
- Increasing national production
- Creating jobs
- Increased levels of public health

Justify the need to execute:

According to statistics, we face with the reduction of vehicles daily life in Iran and around the world so that the car's life in Iran is 25 years and in America is 11 years, as well as cargo fleet life of country like trucks has declined to 10 years and this figure in Europe is 7 years and is reducing to 5 years, bus life is 12 year and city buses life is dropped to 8 years and the useful life of minibus is 10 years, as a result, we are faced with too many old cars, vehicles that must

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inevitably come out of transportation cycle. Exit of these vehicles will facilitate urban transportation and saving fuel consumption and air purity. (Adel Niya Nia, 2009).

Two methods are used to deal with old cars. The first method is to release old cars out of the cities or remote areas. This method creates non-esthetic vision in addition to its harmful effects on environment and is impractical due to high number of old cars. The second method of dealing with old cars is to recycle them. In car recycling, we can get economic benefits in addition to get rid of heaps of scrap and waste. Recycling vehicles require extensive and different measures that are duty of various agencies, organizations that are run with geographically dispersed locations and diverse management structures. Coordinating, organizing and controlling and in other words, integration management of recycling old cars is essential in order to organize above mentioned measures.

#### Literature:

Smith *et al.*, examine the problem of abandoned vehicles in UK and state that increased vehicles reduce significantly the price of steel scraps and create disharmony in car registration system for licensing, while the second hand vehicle is available with low price. However, implementation of old cars ending life plan enhances the action and enhances the disposal costs of old cars. When the vehicle reaches the end of its life its owners face two ways, deliver for recycling or simply leave on roads and a large number of UK drivers accept the second option in order to not pay the recycling cost; this has many problems such as environmental pollution, loss of car parking space and create a danger to children because of breakable tools. This article deals with potential effects of abandoned cars based on recommendations of Ministry of Transportation and offers three strategies for reducing abandoned cars:

- 1- Implementing End of Life of Vehicles (ELV) guidance
- 2- The reforms of car registration system for licensing
- 3- Intensified behavior of local authorities with drivers who abandon vehicles. (Smith *et al.*, 2012).

The interesting point of this article at the beginning of study is that prior to the automobile recycling, vehicles must be collected and good guidelines are presented for this issue in this paper and another thing that was suitable to be incorporated in this article is to express advantages of recycled cars that can have an important contribution in tendency of drivers to deliver their vehicles for recycle.

Gold speaks about recycling old or damaged cars in Canada. There is a determined framework for management of vehicles' end of life in Canada on national level, every year six hundred thousand cars and other vehicles reach the end of their life, they offer if auto recycling and parts recovery take place and parts that can be used for recycle or for replacement of parts in other vehicles, before the vehicle is sent to crush parts are removed and are sold for recycling, reuse or reconstruction with the aid of computerized databases. (Gould, 2008).

Faltcher stated that Netherlands has the highest recycling rate of vehicles in the world and until 2008, approximately 85.6% of vehicles will be recovered that in Europe this figure is equivalent to 84.4%. They suggested their opinions about the auto recycling system and stated that commitments are made in accordance with instructions of vehicles' end of life management and suggested that cost of waste disposal to be paid by car owners as part of vehicle registration fee (Faltcher, 2009).

The paper deals with the automatic recovery system, if we conclude two articles together, the good result achieved is that if the cost of waste disposal is paid by car owners from the beginning and they know that if they deliver their car for recycling, some of payments may be returned back through selling some parts and this will motivate owners.

Amral and Frayo offered practical and economic infrastructure to address the challenge of vehicles' end of life, they stated that Europe Association estimates annual amount of waste from vehicles' end of life with less than 8 passenger seats and trucks more than 3-5 tons as 8 to 9 million. These figures led to the creation of new environmental policy in Europe. Procedures that are expressed focus on technical requirements of automobile design and also emphasize on using recycled after end of car.

- 1 - Vehicles in market must not include lead, mercury, cadmium and chromium.
- 2- The recycling of 85% of vehicles after 1980.
- 3- Recycle and recover 75% the vehicles produced before 1980.
- 4- Recycle and reuse up to 95% by 2015.
- 5 - Remove plastic parts up to 14% of vehicle, increases the vehicle recycling rate to 80% that is economically very important. (Amral and Frayo, 2006).

Vermilen *et al.* researched on recycling of cars, so that recycle can be feasible using thermal, chemical or metallurgical technology processes. About 70% of car weight is made of ferrous metals and 6% is made of non-ferrous metals. Therefore, the highest percentage of recycled material weight is of scrape metals. 80% of recycling targets is achieved until January 2006 through recycling metals and other recyclable parts and these targets are executed by 2015 as part of instruction, now some of environmental benefits have been achieved as a result of instructions including:

1. Increased number of technical feasibility studies for recycling plastics
2. The specific environmental and health-related improvements
3. The degree of energy savings from oil waste regeneration
4. Reduction of sulfuric acid and lead disposal from battery
5. Reduction of rubber and glass volume in waste sites

The aim is to get 95% recycled car until 2015, countries must make more efforts to recycle glass, plastic; the amount of plastic recycling is currently very low. (Vermilen *et al.*, 2011).

Gerald and Kendlikar provide guidelines for automobile end of life, their goal is to reduce waste and improve environmental performance. They also hope to achieve green innovation and improved utilization of alternative vehicles in discussion on ELV away from the narrow focus on recycling. They stated Europe Union's objectives to prevent waste of vehicles at end of life and to protect the environment through reusing and recycling automobile parts for vehicle manufacturers and equipment as follows:

1. Efforts to reduce the use of hazardous substances in designing vehicles
2. Designing and producing vehicle that is easy to recycle and recover
3. Increased use of recycled materials in manufacturing automobiles.

They present vehicle recycle progress from 2000 to 2015 using fishbone diagram and suggest that recyclable materials such as wood and aluminum are used instead of plastic that its consumption is 50% more than past 20 years. (Gerald and Kandlikar, 2007).

Three articles deal with directions of vehicles' end of life (ELV) and their aim is to reduce waste and improve environmental performance, but they can provide more explanations on recycled materials and their application in industry, for example, they can note on waste oil applications.

Lee *et al.*, have conducted researches on plastic coated metals that are important from aesthetics or performance point of views and are used increasingly and in a wide range in automobile industry and if we do not recycle it, it will create significant problems for environment so its recycle is very important not only for resource recycling but also for environment protection; Crusher hammer is used to recycle it and free metal from plastic substrates. A new method is suggested for this isolation based on studies that is a two-stage magnetic separation and is a practical approach, efficient, economical and environmental friend method. (Lee *et al.*, 2009).

This paper discusses a little more professionally, and deals with a particular recycling and since a scientific and practical proposal is provided, it is noteworthy.

Suu *et al.*, provided a comparative analysis of recycling laws (ELV) among three countries of Japan, Korea and China in order to promote international cooperation among three countries; they suggest that the advent of automobile recycling laws in Japan, South Korea and China is different according to the local situation, however, there is potential for international cooperation and their aim is to minimize the negative environmental impacts through recycling. (Suu *et al.*, 2011).

This article considers an interesting approach, the comparison between countries that helps to be aware of strengths and weaknesses of each other. Taghvai *et al.*, have examined recycling and re-conversion of waste like preventing indiscriminate looting of natural resources, reduced energy consumption and reduced amount of waste disposal to reduce costs. Recycling and reuse of raw materials after consumption will result in reduced consumption of raw materials. Therefore, recycling is important for ecologists in terms of environmental protection and for economists in term of reduced extraction costs and material production. This article discusses on recycled nylon from tire cord and this recycled polyamide can be raw material for production of plastic parts and new products that is economically affordable and has relatively simple and low cost production process. (Taghvai *et al.*, 2006). Ebrahimi and colleagues stated that increased use of tire and removing them from environment is one of the biggest environmental problems in recent years for many countries. Reusing tires in order to restore them to natural cycles or their safety management are of the major challenges that we face. New uses of old tires are very interesting and appropriate solutions to reduce

waste, costs and increase the quality and safety of our environment. In this paper, we describe the way of recycling tires and different uses of old tires. Unfortunately, there is no systematic program for safety management and recycling of old tires in Iran. According to the rapid growth rate of tire consumption, due to the increasing use of vehicles in Iran we will face soon with serious problems in this field. (Ebrahimi *et al.*, 2005).

Two later papers explore the old tires and possibility of recycling them. New uses of old tires is very interesting and appropriate solution to reduce waste, costs and increase the quality and safety of our environment.

Miller and his colleagues talk about recycling old cars in Canada. They identified recyclable car parts in Figure 1. They also gave an explanation on how to recycle and reuse some parts.

## MATERIALS AND METHODS

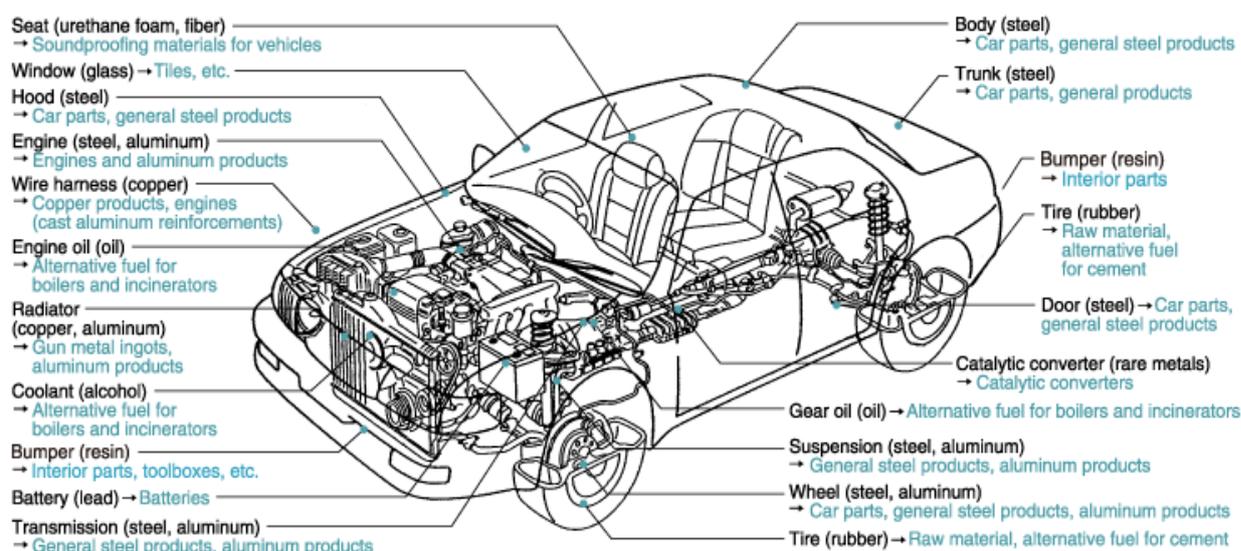


Figure 1 - A view of automobile parts and recyclable materials (Toyota)

Among parts that can be used for re-use include: AC compressor, carburetor calipers water pump, steer pump power, generator, starter and motor. Among parts that can be used for recycling: Batteries, catalytic converters, tires and radiator can be named. Battery, fluids, tires, mercury switch, airbag can be used for re-use in batteries, fuel, fluids such as antifreeze, windshield washer fluid and tires.

Almost 76% of car weight is averagely from metal that is primarily steel. In Canada, 42% of all steel is obtained from recycled metal and it is estimated that reusing metals will save energy up to 74% and water consumption up to 40%.

Plastic: Plastic constitutes about 10% of vehicle weight that currently amount of recycled plastic is very low; despite the fact that plastic use is increased in cars there is no increase in recycle.

Various polymers are used in manufacturing automobiles; Polypropylene constitutes about 40% of car plastic and is used in bumper, wheel arch liners and dashboards. Polyethylene and polyurethane are commonly used in chair floor and they are easily recyclable and there is a market for all of these polymers; Polyvinyl chloride constitutes 12% of plastics used in vehicles and its recycle is very difficult and when dispose, with the release of dioxins, converts it to ash. One way to increase the plastic recycle is to identify various plastic polymers used in car manufacturing. Tires: Tire recycling programs have already been set everywhere. Rubber constitutes about 3% of its weight; burned rubber is used for fuel production and recycled rubber is used for manufacturing products such as automobile products or as protective lining for truck boxes or ingredients of new tires. Glass: Car windshield is 3% of vehicle weight and has low priority in recycling, as a result, 18 to 20 million pounds of glass are used per year and are disposed in municipal

landfill sites of Canada. There is a strong plastic film between two layers of glass that is recyclable and becomes cases like floor tiles and we can separate the glass from plastic materials that it is too expensive.

**Battery:** More than 90% of lead acid is recovered in Canada, although batteries constitute only 1% of vehicle weight, its recycling is important because of lead presence that is dangerous.

**Fluids:** Motor oil and lubricants are recyclable that can be used in liquid detergents, windshield washer and antifreeze.

**Textiles:** Textiles constitute 1% of automobiles weight that are generally discarded as residue.

The ultimate goal of vehicles' end of life management is to maximize the use of resources for minimizing air pollution and maintaining and increasing employment.

Suppliers and manufacturers of parts have the greatest effect on potential waste management of vehicle. Vehicle manufacturers have to work on designing so that all parts of vehicle can be removed and reused or recycled in order to achieve this goal in an ideal world. Recycled materials create jobs and income 10 times more than waste material treatment (Fltchr, 2009).

## RESULTS AND DISCUSSION

Recycling is a process whereby waste materials are separated and are used as raw materials for new products; about 75% of vehicle weight includes metals and 25% includes other non-metallic materials such as rubber and glass that are waste. The waste contaminates land and soil and has adverse effects on environment. Today, developed countries try to minimize the amount of waste materials, especially in UK, British car recycling consortium has a project in cooperation with manufacturers and decollators that its goal is to reduce the amount of non-metallic waste materials. Then they review previous researches; the interesting thing on reviewed articles was that before care recycling, vehicles must be collected and good guidelines are presented for this issue, also, we must express advantages of recycled cars that can have an important contribution in tendency of drivers to deliver their vehicles for recycle. If the cost of waste disposal is paid by car owners from the beginning and they know that if they deliver their car for recycling, some of payments may be returned back through selling some parts and this will motivate owners. Then, ultimate goal of vehicles' end of life management is expressed, that is to maximize the use of resources in order to minimize air pollution and environment for maintaining and increasing employment. In future researches, executive items can be expressed in terms of more recycle and recycling can be investigated completely in vehicles other than cars.

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