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Recycling's technology

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Cleaner production

ABSTRACT

Purpose: Environmental problems have been considered as serious situation in the construction. Waste management is pressing harder with alarming signal warning the industry. This paper discusses the potential impact of biodegradable materials on waste management in terms of landfill, incineration, recycle/reuse composting.
Design/methodology/approach: This article reviewed the implementation of strategies of WEEE treatment and the recovery technologies of WEEE. It presented the current status of WEEE and corresponding responses adopted.
Findings: The possibility of managing the growing amount of waste and used appliances and equipment according to the accessible literature was shown and the importance of one of the most popular method of waste neutralization (recycling) was underlined.
Practical implications: The recycling of WEEE is important to introduce and develop cost-effective and environmentally friendly WEEE recycling technologies. it is also necessary to arouse and enhance public awareness regarding environmental protection by publicity, education and so forth, in order to change their traditional viewpoint on the end-of-life electric appliances or cars.
Originality/value: This article discusses how environmental science and technology can be applied to hazardous waste management to develop measures by which chemical wastes can be minimized, recycled, treated and disposed.
Keywords: Theoretical fundamentals of cleaner production; Recycling; Waste management; Materials

1. Introduction

The problem with the waste management has become one of the biggest challenges of our times. At the beginning of XXI century, this task is still one of the most difficult municipal problems and requires a solution as soon as possible. Precise observations of the acting hierarchy in waste management – prevention, reuse and restoration of the materials, burning waste to generate energy, neutralisation through thermal processing and safe storage serve to decrease the amount of waste and energy as well as raw materials. Waste management is achieved through different systems, integrating waste producers' activities, management and controlling executives and commune and/or contractors organising units due to the most rational waste management according to the rules mentioned. Waste storage determines how modern the waste management system is. The most important is the credible answer to the questions: -what? (waste amount and type), -where? (type of the landfill), -how? (the technology).

The crucial points in waste management are minimization of the waste production and maximization of their management and limitation of the waste storage in the environment to the necessary minimum [1÷3].

Subsequently, the ever-increasing amount of waste electric and electronic equipment (WEEE) has become a common problem facing the world. In view of the deleterious effects of WEEE on the environment and the valuable materials that can be reused in them, legislations in many countries have focused their attention on the management of WEEE, and new techniques have been developed for the recovery of WEEE [3].

2. Recycling technology

Recycling been one of the strategies in minimization of waste. Recycling means to recover for other use material that would

otherwise be considered waste. The popular meaning of "recycling" in most developed countries has come to refer to the widespread collection and reuse of single-use beverage containers. These containers are colleted and sorted into common groups, so that the raw materials from these items can be used again (recycled) [4].

To execute the idea of the recycling law, it is necessary to think about a material recycling of the used products when designing them. This means that all additives of the process have to be designed in the way do not disturb the later material recycling. From the economic point of view, recycling of waste is only attractive when recycled product is competitive in regions where a shortage of both raw materials and landfilling sites exists [5]. At the and of 2001, as a new aim, a recycling rate of 55-70% by the year 2006 was proposed. Further regulations that demanded a recycling of products according to their use are, e.g. the UE "end of Life Vehicles" Directive (2000/53/EEC) from September 2000. By 2005, at least 85% (80% material recycling) by the year 2015.

In creature the recycling would can treated as one from four strategy of protection of environment this is: thinning of, filtering, recycling and prevention.

It can be considered with different points of sight like: relating recirculation in productive wastes sphere and after consumption and utilization. This second sphere concerns the analyzed problem of recirculation of Industrial Technical Object (ITO) retreat from exploitations. Very difficult, if at all realizable, is the construction of total system of recirculation ITO.

The systems of recirculation should be subject to already well-known principle continuous it improving which concerns the improving, not only technology of recirculation, but improving the processes of projecting in direction possibly full and easy recirculation also.

In traditional formaldehyde manufacturer doesn't bear for used product responsibility or unwanted. European legislation alters this situation fundamentally or will intention to alter (ex. extended producer resposibility). The end of life of products (End-of-Life EoL) it's a moment which develop it will be stop the final user necessary. Analysis EoL it leads to model it supporting supplies (Resource Sustaiment). The regaining the products (EoL Produkt Recovery) it as ways of lengthening it can cycle of life of product to concern whole products of, their part, as and the materials and raw materials, is the generally regained value. The Fig. 1 represents the basic possibilities of salvage.

On all world and in Poland the lack is the information about total systems of recirculation ITO, no matter how the row of information exists on subject of systems and programmers of recycling sorted groups of machines, the most often functioning in frames of products one firm executed through these firms. Two the most well-known the recycling of cars as well as recycling of electric and electronic devices belong to them, regulated directive WEEE (Waste from Electric & Electronic Equipment).

In view of the environmental problems and high residual value of WEEE, WEEE management system should be established to extend the life cycle of EEE. The Waste Electrical and Electronic Equipment (WEEE) Directive became European law in February 2003, setting collection, recycling and recovery targets for all types of electrical products [5, 6].

This management system comprises collection, classification, pre-treatment, etc., and five conventional end-of-life treatment strategies. In accordance with the potential economic and environmental efficiency, these strategies can be categorized as follows [7÷10]

1) reuse: the recovery and trade of used products or their components as originally designed;
2) servicing: a strategy aimed at extending the usage stage of a product by repair or maintenance;
3) remanufacturing: the process of removing specific parts of the waste product for further reuse in new products;
4) recycling (with or without disassembly): including the treatment, recovery, and reprocessing of materials contained in the used products or components in order to replace the virgin materials in the production of new goods;
5) disposal: the processes of incineration (with or without energy recovery) or landfill [11,12].

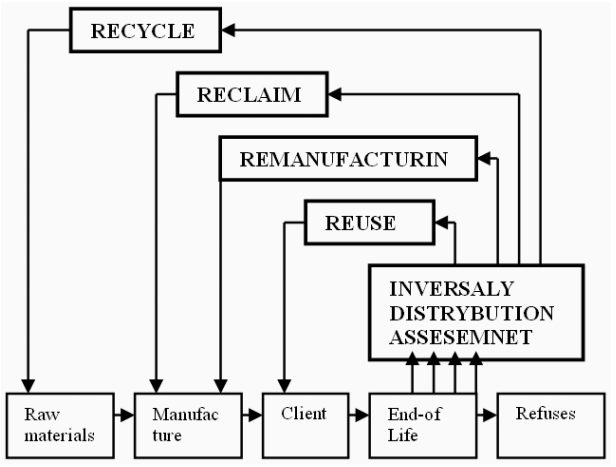

Fig. 1 Diagram of recovery

Recycling of scrap industrial impurities and products occurs an a large scale with a number of different materials. Most of these materials are not hazardous, but as with most large scale industrial operations, their recycle may involve the use or production of hazardous substances [13]. Every year all over the world permanent increase of the amount of plastic waste from different branch of economy and industry is observed. In most cases waste are directed to the landfills, but due to their long degradation time keeping them at the landfill is disadvantageous.

The hope for the improvement in this area is the increase of plastic waste recycling. It will bring economical and ecological profits. Nowadays around 10% of solid waste is plastic, which includes 80% of polyolefin's such as polyethylene and polypropylene, 12% of polystyrene and 5% of polyvinyl chloride. The main source of plastic waste is the wrapper industry, car industry, electro-machinery industry and building industry [8,10,11].

3. Recycling of cars and electric and electronic equipment

Recycling of car vehicles contributes to the reduction of natural environment threats. Every year in all countries thousands

of cars become withdrawn. It gives over 160 000 tonnes of plastic waste.

From among systems of recycling of cars as the example can exchange the systems of Toyota and the Mercedes.

Recycling should be treated as crucial aspect during whole technical lifespan of the vehicle from the conceptual assumptions till the final scrapping. That is why tasks orientated to maximize the reduction of the waste amount and undergone reprocessing of all the elements, which can be re-used at the level of the vehicle construction, production, exploitation and scrapping are undertaken [8, 14].

Effective exploitation of the resources by the usage of waste materials or using them as a source of energy decrease unfavorable influence at the natural environment and a potential threat resulting from waste storage at the landfills. At present the average of 75-80% of car mass withdrawn from exploitation mainly in metal parts, made of steel as well as non-ferrous metals is recycled. The rest 20-25% of their mass mainly as heterogeneous mixture of different materials such as plastic, gums, glass, textiles etc, remain unmanaged. First of all the dismantlement stations remove from the scrapped cars liquids, engine, tyres, gear-box, the battery, catalytic reactors and other elements usually re-used or recycled. Next in the process of the wreck crumbling in so called shredder non-ferrous metals, steel and plastic become separated from the rest of the vehicle. While non-ferrous and steel metals are remelting the remains from the process of crumbling are directed to the landfills as waste. The actions orientated to the permanent increase of the waste usage and promoting re-usage and recycling of the parts scrapped are necessary to gain the most effective natural sources' application and the limitation of the deposited waste until the level of the lost materials reaches zero. The technology elaborated gives the effective usage of all materials originated from the crumbling processes [14, 15].

Car dismantlement withdrawn from the exploitation is a first step in the recycling process (Fig. 2). The precision and quality of this task realization determine the possibility of re-usage or re-processing the components and the subunits.

According to the European Union directives at most 15% of the scrapped car is allowed to deposited at the landfill, and after 2015 only 5% of the scrapped car. The rest of the materials should undergone recycling with the possibility of re-usage [15-17].

The salvage and recirculation of electric and electronic equipment is developed very good and similarly how in case of cars the recycling they are organized and realized through individual firms. The UE worked out remembered earlier the directive WEEE relating the used electric and electronic equipment to assure the initiating the uniform systems of assembling, the processing and recycling of electric wastes and electronic. The Hewlet - Packard firm it is one of first, which initiated the system of recycling for one's equipment. HP has recycled computer and printer hardware since 1987. Our end-of-life programs benefit our customers and the environment as well as our business. In addition to the millions of products that we recycle, we collect approximately 2.5 million hardware products each year that are refurbished, resold or donated. From 1992 year firm HP replenished about Program the system of recycling Planning for Environment. Thanks him the process of production of equipment HP fulfils following conditions: the protection of supplies by considerable utilization in its products of materials recycling, applying for environment and materials safe processes, the easiness of renewed introducing to circulation. In 2004 year firms like HP, Braun Electrolux and Sony established first Pan - European organization of salvage of used electric equipment and electronic - Europan Platform of Recycling (EPR). EPR makes possible member's firms fulfillment one's obligations relating receiving products, applied by Directive WEEE, near competitive costs, with advantage for customers and environment. The systems of recycling were created through many electric and electronic firms and they develop, more often hugging their working the area of Polish dynamically. The equally interesting system was created through firm Xerox, which based working of her system the principle of leasing. Instead, to sell one's devices it gives back it in leasing, guaranteeing in this the way returns of these devices to firm after resignation with exploitation.

In this way it was possible effectively and cheap to plan and realize recycling [14-17].

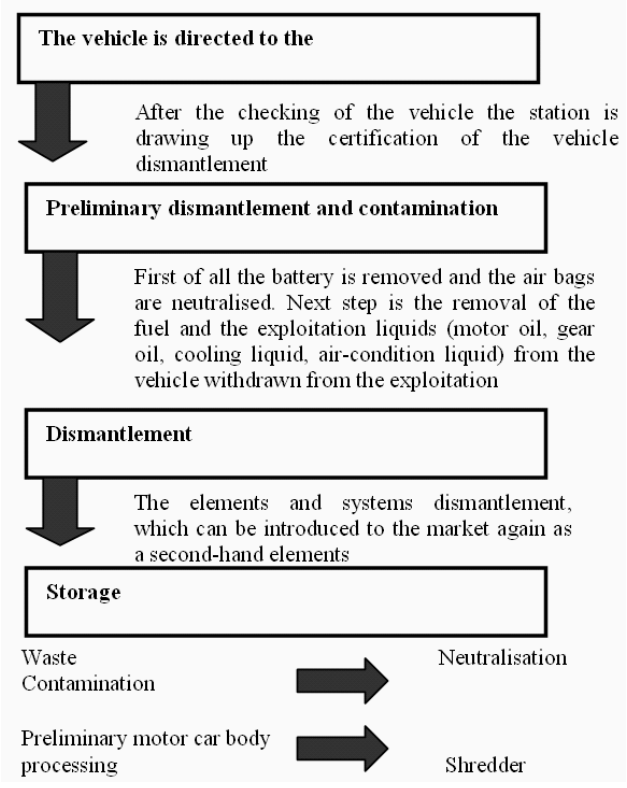

Fig. 2. Effective vehicle scrappin [14]

4. Conclusions

As environmental protection had been pressing hardly in all over the world, the pollution generation from construction activities seems difficult to control. The most effective way to reduce the waste problem in construction is agreed in implementing reuse, recycling and reduce the construction materials in construction activities.

Recycling of systems will be increasingly important. Since many materials are bonded, it is important to choose adhesives that do not disturb the recycling of the primary materials.

In order to simplify recycling for the future, adhesives with "switches enclosed" are being developed which will allow us to disband system components into separate parts after use for reuse or material recycling [12].

In view of the environmental impact induced by WEEE and the high residual value of the materials contained in WEEE, the recycling of WEEE is attracting wide attention. It is important to introduce and develop cost-effective and environmentally friendly WEEE recycling technologies, and to implement green design and cleaner production concepts within the electronics industry to comply with the upcoming EU legislations in a proactive manner. Besides, it is also necessary to arouse and enhance public awareness regarding environmental protection by publicity, education and so forth, in order to change their traditional viewpoint on the end-of-life electric appliances or cars. Although awareness and readiness for implementing improvements is increasing rapidly, there are many obstacles to manage end-of-life products safely and effectively in industrializing countries:

- The construction of total and universal system of recycling industrial technical objects is the undertaking practically unfeasible. Undertaking such is however possible under condition that it will concern the exclusively material recycling, of the raw material or chemical.
- The lack of a safe WEEE recycling infrastructure in the formal sector and thus reliance on the capacities of the informal sector may pose severe risks to the environment and human health. However, collecting and pre processing can be handled efficiently by the informal sector and – the same time – can offer numerous job opportunities.
- The lack of international standards for simple but efficient WEEE management systems delays their implementation. As a first step, the collection of "best practice" examples or "lessons learnt" from carefully designed pilot implementations in industrializing countries would help to accelerate the mitigation process [9, 11, 14].

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