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INDIAN CENTRE FOR PLASTICS IN THE ENVIRONMENT

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Recycling of Waste from Electronic and Electrical Equipment in the Netherlands

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Abstract:

An innovative research program in the Netherlands has shown that it is technically and economically feasible to collect and convert waste from electrical and electronic equipment, WEEE, into sound products for reuse. Redesign of equipment and improved waste treatment can lower the environmental impact in the whole lifecycle of these products. Mechanical testing and field tests have shown that the plastic fraction from WEEE treatment can be purified into its different plastic fractions for reuse in a technically and economically feasible way. Environmental studies have shown that dedicated dismantling, shredding and separation give the largest environmental improvements for larger equipment, e.g., equipment with a cathode ray tube, is treated in such a way. From an environmental point of view separate treatment of small equipment like mobile phones give better results compared to treatment of mixed equipment.

1. Introduction

The use of plastics in electronic and electrical equipment (E&E) is increasing rapidly, see Fig. 1. Besides plastics, steel and glass these products also contain toxic compounds, e.g., CFC's, flame retardants and heavy metals like mercury, copper, cadmium and lead. These components will leak into the environment when E&E discarded products are not treated in the right way. For this reason the Dutch government set up rules regarding the collection of different types of E&E products. Collected products are being dismantled and shredded in order to reclaim hazardous materials like CFC's but also useful materials like ferro and non-ferro metals. The plastic waste fraction was not seen as a useful stream for a long time and would therefore be incinerated or land filled.

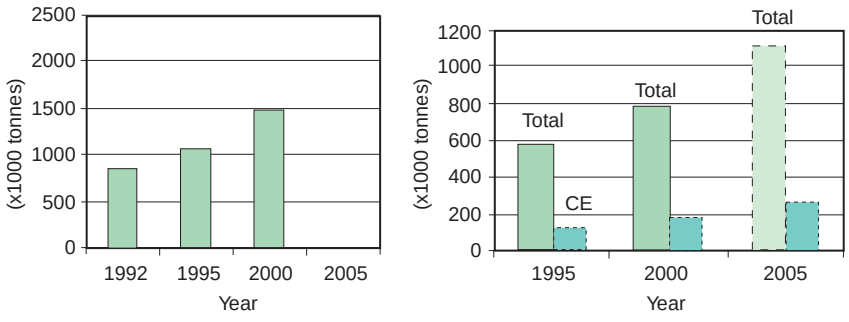

Figure 1. Use of plastics for electrical/electronic equipment and consumer electronics produced in Europe (left); Plastic waste production from all electrical/electronic equipment in Europe and plastic waste specifically from consumer electronic waste, CE (right) [4].

2. Program on improving the environmental impact CE

For the last 5 years an innovative research program (IOP Heavy Metals) was carried out to improve the environmental impact of E&E waste in the Netherlands. The objective of this program was to develop an environmentally sound recycling process for plastics from consumer electronics, which cleans the plastics not only from unwanted additives but also upgrades their material performance [1]. The research was focused in several areas of importance, schematically shown in Fig. 2, namely, 1) Design of E&E equipment for better end-of-life performance, 2) Improvement of E&E waste collection, 3) Improvement of technical processes to recycle the E&E waste, and 4) Development of an environmental database of all possible routes for E&E waste treatment.

3. Results

The results of the four sub-studies have shown that the environmental impact of the production, use and waste phase for E&E equipment can be improved. Redesign of the equipment leads to enormous savings in raw materials needed in production. Redesigned E&E equipment also has lower energy use during its use phase. However, the impact of redesigned E&E equipment on the waste phase is rather limited. Another important outcome is the fact that collection rates of smaller E&E equipment have to be increased since these are easily lost in the 'normal' municipal waste system. For bigger equipments like freezers and TV-sets collection in The Netherlands is very high (over 80%) [2]. The recycling of E&E waste in order to recover (precious) metals is quite sufficient in The Netherlands, however the fractions containing plastics were just land filled or incinerated, which is very expensive. Studies have shown that it is possible to improve the separation processes such that thermoplasts (e.g., PS, ABS, PE, PP) can be separated from the waste streams and consequently be used again, and in such a way keeping their material value rather than using only their energetic value.

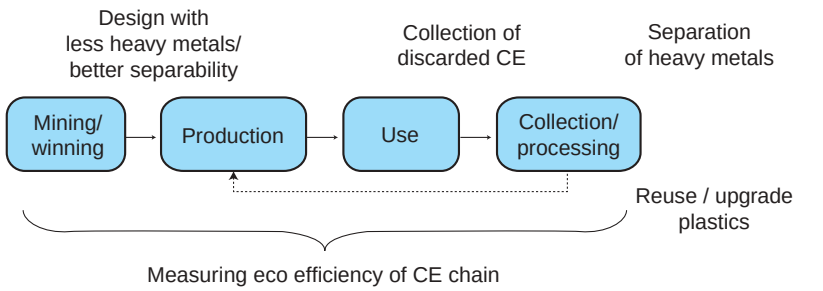

Figure 2. Life-cycle approach for improving environmental impact of consumer electronics.

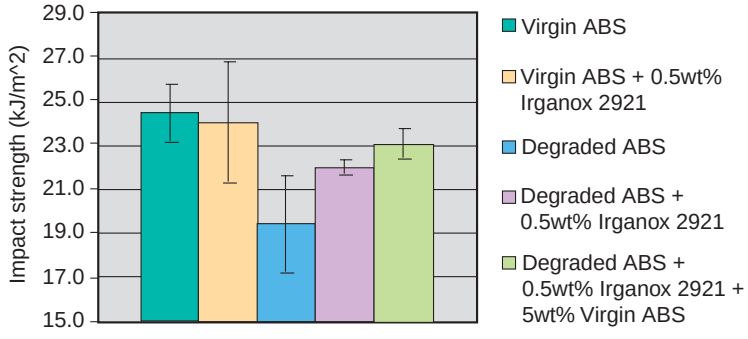

Figure 3. Impact strength of virgin ABS versus thermal degraded ABS and degraded ABS mixed with stabilizers/virgin ABS

In 2005 the specific plastic waste fractions from Dutch environmental stations who shredder fridges and freezers and also small and medium E&E waste products, are being treated and separated into their different plastic components in an economical feasible fashion. The separation techniques have evolved in such way that plastic fraction containing flame retardants can be separated from the non brominated waste stream, improving the usefulness of plastic recyclate.

In certain cases material properties can be upgraded using specific additives, e.g., siloxanes. Research on this issue has been carried out on ABS material because this is considered to become one of the most important plastic materials in E&E products in the near future. The outcome of mechanical impact tests have shown that via mixing of degraded plastic material with a combination of siloxane, stabilizer and virgin material, in low amounts, recyclate plastics can have the same mechanical impact characteristics and therefore the same usability as virgin materials. Fig. 3 shows results from impact strength tests on ABS, degraded ABS and degraded ABS mixed with thermal stabilizer (Irganox 2921). Fig. 4 shows results for ABS in combination with reactive diphenyldimethoxysilane, which are even more promising compared to treatment with thermal stabilizers and virgin material.

Research on polyesters, e.g., printed circuit boards and polycarbonate, have indicated that a process can be

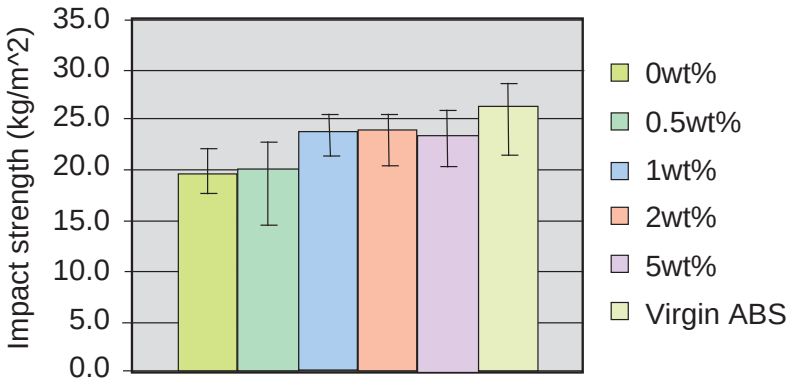

Figure 4. Impact strength of thermal degraded ABS (0wt%) versus degraded ABS mixed with 0.5-5 wt% reactive diphenyldimethoxysilane and virgin ABS.

developed that depolymerises plastics and separates the feedstock from metals and additives, using supercritical CO_2. Possible application lies in feedstock recycling of such plastics into monomers for the paint industries based on epoxy resins. It is clear that for any recycling plant based on this technology the scale of the facility should match waste amounts and market demands.

Overall environmental evaluation of E&E production, use and waste processing has indicated that minimum recycling rates in terms of minimum mass ratio's set by the European Commission does not lead to an optimal environmental solution. A better tool has been developed which combines environmental savings with economical savings, which was called QWERTY/EE (Quotes for environmentally WEighted RecyclabiliTY and Eco-Efficiency) [3]. Reclaiming heavy metals and precious metals leads to the highest environmental improvements in the E&E chain. This can be understood from the fact that producing metals from ores create a much larger environmental burden when compared to metal production from scrap metal material. In the case of plastic recycling also such a difference is seen between virgin material and recyclate but the differences are less clear. It is clear, though, that it is easier and more eco-efficient to recycle plastics from large equipment compared to small equipment. Figure 5 reveals this matter.

4. Conclusions

The outcome of the four research projects has lead to new concepts for the recycling of plastics from consumer electronics [4]. With this concept it appears possible to remove unwanted additives from the plastics, like heavy metals, and upgrade the polymer properties to virgin qualities. In this way resources are saved and emissions of additives to the environment are prevented thus contributing to sustainable development.

The project has also revealed general improvement options in the design and waste phase of consumer electronics. Environmental issues like banning toxic metals, energy efficiency, minimisation of packaging materials and end-of-life design should play a much larger role when designing CE equipment as is the case right now. Laws on producer responsibility can play an important role in this respect. In order to reuse the material value of CE and also to minimise waste, like heavy metals, diffusing into our environment, the collection of small and medium equipment should be increased. Waste from large equipment seems to be much easier to control.

Measuring the eco-efficiency of the CE chain has revealed many interesting outcomes. Focusing on metal recovery gives the major improvement in terms of end-of-life processing of WEEE. Larger equipment should be fully recycled, in terms of metals, plastics and glass however for smaller equipment like cellular phones the emphasis should be on metal reclamation and utilization of the energy contents of the plastic materials. For medium sized equipment, like many CE, the route followed should focus on maximisation of the eco-efficiency: i.e., recover all material properties if possible and in other cases recovering the metals plus the energy value of the plastic fraction. The QWERTY/EE method has shown to be a very useful tool to check the eco-efficiency of different waste scenarios. Practical studies at Dutch recycling

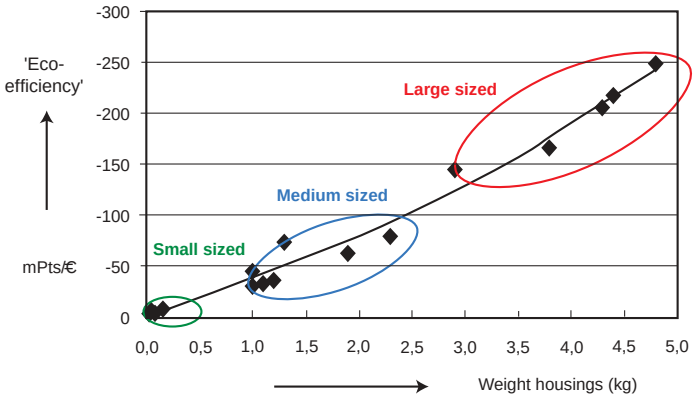

Figure 5. Environmental gains (savings) versus size of equipment recycled [3]

companies have revealed that in the Dutch situation the plastic fractions from CE can be separated into the different plastic fractions for reuse, in an economical, environmental and technical feasible manner. This would predict that the same, full material recycling of waste from electronic and electrical equipment, will be achievable in all other EU countries in the coming years.

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PLASTINDIA 2006

Asia's biggest and one of the largest fairs in the world of Plastics

6th International Plastics Exhibition & Conference

9th-14th February, 2006

Pragati Maidan, New Delhi

PLASTINDIA 2006, one of the largest plastics exhibition, offers an opportunity for global market leaders to meet, exchange ideas and view business prospects. It will provide an opportunity for both, members of the Indian plastics fraternity and their international counterparts, to discuss and display their latest innovations in plastics and a chance to showcase the status of the global industry in terms of market knowledge and polymer technology. It will be a forum where diverse skill sets and industry knowledge are brought together on a common platform.

A two-day conference will be held on 11th and 12th February, 2006, alongside the main event. The aim of this event, which is divided into sessions on business and technology, is to bring together eminent scholars, consultants, professionals, scientists and industrial experts for a fruitful engagement on issues concerning the Plastics Industry.

For further details contact:
PLASTINDIA FOUNDATION
Tel.: (022) 2683 2911
E-mail: plastindia@vsnl.com
www.plastindia.org

ICPE at Plastindia

ICPE will be participating in Plastindia 2006. Photographic and informative panels will be displayed to create greater awareness on the need for responsible disposal of waste and benefits of recycling of plastics waste.

Audio-visual presentations and educative films will also be screened.

Visit ICPE Stall No. 1, Hall 8, Pragati Maidan, New Delhi.

Solid Waste Management at Sanjay Gandhi National Park, Borivali, Mumbai

It was observed that this particular area of national importance was being subjected to littering of all sorts of dry waste both by the visitors as well as others.

ICPE took up the initiative to create an awareness and to instal a Solid Waste Management System inside the park so that the sanctity of the area could be maintained.

SGNP – Before Cleaning

SGNP – After Cleaning

The system comprised of collection – segregation – disposal/recycling of waste and also composting of food waste/organic waste.

The work is continuing.

Proposed Ban on Plastic Bags

News from India

ENVIRONMENT DEPARTMENT

Government of Maharashtra,
15th Floor, New Administrative Building, Madam Kama Road, Mantralaya, Mumbai - 400 032
Dated the 13th September, 2005

ORDER

ENVIRONMENT (PROTECTION) ACT, 1986.

DRAFT ORDER

No. Plastic. 2005/CR-38/T.C.III

(i) Every trader (including hawker), shopkeeper, wholesaler or retailer or any other person shall discontinue the use of polyethylene (plastic) bags, for packing, handling, storing, carrying or for any other purpose;

(ii) (a) The Municipal Commissioners of the Municipal Corporations and the Chief Officers of the Municipal Councils, within their respective areas; and

(b) The Collector of Districts, for areas other than those specified in clause (a) above;

shall ensure the compliance of the directions at (i) above.

By order and in the name of the Governor of Maharashtra.

B. P. PANDEY,
Principal Secretary to Government

Above are the salient points of the Draft Order. The public was asked to submit any comments within 30 days.

Press Meets

ICPE and Plastics Associations of Maharashtra had organised a number of Press Meets in various cities of the State. A Press Note was released during those Press Meets. Reproduced here is the Press Release.

Abstracts from the Press Release issued by ICPE

Maharashtra Government had issued a Draft Order on Discontinuation of Plastics bags ref 2005/CR-35T.C.III dated 13th September, 2005. The Draft Order squarely blames Polyethylene (plastic) bags as a potential source causing grave injury and damage to the environment and the health of human beings and animals. It has put total responsibility for blockage of gutters, sewers and drains of Mumbai after the deluge on 26th July, 2005, on Plastic bags.

Plastic bags have actually contributed in creating a sustainable, cost effective, energy efficient, hygienic and environmental friendly packaging system for edible commodities like milk, spices, edible oil, bread, confectioneries, rice, wheat flour, snack foods, medicines and a host of perishable products like fish, meat and poultry products. This has been possible due to non-toxic, inert excellent barrier properties, resistance to moisture and oxygen, non-breakability and light weight, sterilizable and resistance to bacterial and other microbial of plastics. For safe food and pharmaceutical packaging, certification has been received from leading Research Institutes of the country. Plastics conform to all the stringent requirements for safe and hygienic packaging system in

From l to r – Mr. S. Banerji, Exe. Secretary/Member, Exe. Committee – ICPE; Prof. Dr. Ashok Misra, Director - IIT (Mumbai); Mr. P. P. Kharas, Convenor-Communications, ICPE; Mr. Vijay Merchant, Member, GC-ICPE. On dais: Dr. U. K. Saroop, Member (Tech)-ICPE.

Members of Press.

Dr. S. Shivram, Director NCL, Pune & Member, GC-ICPE, is addressing the Press Meet at Pune.

contact with food and pharmaceutical products, hence in no way can be injurious to human health.

According to a published report of Municipal Corporation of Greater Mumbai in 2001, Plastics constitute just 0.75% of the solid waste in Mumbai. Similarly in the report of Central Pollution Control Board, MoEF, GoI, typical composition of Plastics in Municipal Solid Waste on an average was reported as 0.62%. Some agencies quote the total plastics in the waste stream of Mumbai as around 4-5%. However, all the agencies acknowledge that proportion of plastics in urban solid waste in India is much less than those found in countries in the advanced world who have managed their MSW much better than us without discontinuing the use of Plastic bags.

The discontinuation of Plastic bags will severely hit the consumer, as Plastic packaging is inevitable for storing, carrying and delivery of essential commodities at affordable price.

Milk Packaging is substantially dependent upon Plastics as 95% of packed milk is pouch packed.

Plastic bags play an important role in packaging of bread, confectionery items, all range of Farsan / Namkeen and bakery products.

In case Plastic bags/packaging is replaced with alternative materials like paper, cloth, jute, metal, etc., it would lead to a major penalty on the environment as weight of packaging would go up by 3 times and cost of the packaging and volume of waste will almost double. Hence, these cannot be eco-viable alternatives.

Discontinuation of use of Plastic bags in Maharashtra will have serious economic implications. More than 1000 factories across the State of Maharashtra manufacturing Plastic bags with a turnover of Rs. 1000 crores generating Rs. 246 crores of tax revenue provide direct and indirect employment to more than 2.5 lakh people.

Plastics Industry and Indian Centre for Plastics in the Environment, as responsible members of the society, have continuously engaged themselves in developing techniques to recycle all these wastes into value added or non-critical materials of use.

Plastics Industry understands its responsibility and has joined hands with the local civic authorities in managing not only Plastic wastes but also all dry solid wastes. A Scientist in a Nagpur-based college has developed a process for continuous production of Industrial Fuel out of any thermoplastic waste. Plastics Industry is closely working with the inventor to enhance the process and to add further value to Plastic wastes. The Road Department of MCGM has already conducted successful trails for utilizing Plastics Waste in the construction of asphalt road in the main city – Mumbai.

Discontinuation of Plastic bags is no solution and will rather multiply the problem many fold. This will add to the woes of common man. The challenge facing us is to improve the solid waste management system and address littering habits of masses by educating them and creating awareness. Industry is committed to work together and share responsibility for these efforts.

Strict implementation of existing law by restricting manufacture, storage, sale and usage of Plastics carry bags as per MoEF Gazette Notification issued in 1999 and revised during 2003 is the need of the hour. Introduce printing of manufacturer's name in all individual carry bags, with proper declaration of thickness and recycling mark.

Mr. Harpal Singh, President, AIPMA, addressing a Press Meet in Mumbai. Mr. Ajay Desai and Mr. Arvind Mehta are seated to his right & left respectively.

Nagpur Factory which manufactures Fuel from Plastics Waste.

Industry would be willing to arrange for buy back of used plastics material including carry bags if a proper scheme can be indicated by Government/BMC, etc. Government/BMC need to provide space at suitable places for such collection.

In order to encourage scientific recycling of Plastics products particularly carry bags, Industry would help set up recycling plants complying with all environmental standards at a desirable place. State Government in cooperation with BMC may provide land, supply power at reasonable rates. Industry would join hands with local authorities in taking up appropriate awareness drive among the citizens for proper solid waste management.

After receiving the objections/suggestions from the Industry Associations and general public, the Government of Maharashtra has constituted a Committee to look into the matter and make recommendations to the Government.

Let's Beach this Bad Idea on Litter

International News

"Irresponsible human behaviour cannot be addressed by banning products in society."

If popular disposable products are banned, they'll just be replaced with alternate ones. Greater enforcement and education are better ideas.

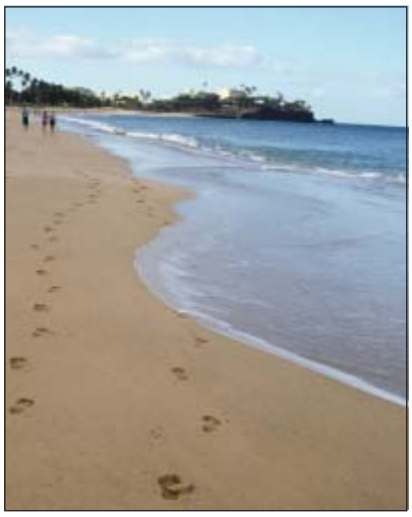
Jean-Michel Cousteau

Seeking to reduce beach litter, efforts are under way in Los Angeles, Orange and Ventura counties to ban various plastic products. **That's like banning food because people are overweight.**

California's beaches are a natural treasure, and we need the public's help to protect them. But bans don't work.

If a county or community bans Styrofoam and plastic carry-out containers, coffee cups, picnic ware and similar items, individuals and businesses will switch to other disposable products, such as glass, aluminum and wax-covered cardboard. The amount of litter will not change, only its composition. That's why bans are overly simplistic and don't get to the real cause of the problem.

I have spent my entire life protecting our oceans and beaches, and trusting education will ultimately produce the best safeguards for our environment. But I'm also a realist.



I understand human behavior and realize that good intentions are not good enough.

The products we use aren't the problem; people who litter are. It's a matter of thoughtless behavior.

Litter comes from local residents, tourists and "day trippers," and people who live, work and commute many miles away, whose litter is picked up by drainage systems, washed out to sea and redeposited on our beaches.

According to the California Coastal Commission, the more than 40,000 volunteers who participated in Coastal Cleanup Day in September picked up nearly 800,000 pounds of trash from the Golden State's 1,100 miles of coastline. We need to do something to reduce this.

But approaching the problem by banning certain materials – as the city of Malibu and Ventura County have done – won't work and may actually give citizens the false hope that they've "solved" the problem.

For example, Malibu's early September decision to adopt a citywide ban on serving food and drinks in Styrofoam containers does not stop visitors from bringing other throwaway products, including plastics, to the beach. Ventura County's resolution that no plastics of any kind can be used during county-sponsored events similarly does not stop vendors from using other disposable containers.

Officials who are serious about protecting the environment are not without options.

First, they can enhance and enforce existing anti-litter laws.

Littering is illegal in California. But only law enforcement officers are allowed to give out tickets, and they generally have higher priorities. Besides, many judges consider the current $1,000 fine excessive. So the law isn't uniformly enforced.

The dynamics have to change. Beach communities should consider deputizing public works employees – such as beach sanitation workers, lifeguards and parking meter attendants – to cite offenders.

Judges need to understand that littering is a serious problem, and perhaps be less tolerant of offenders by levying the $1,000 fine.

Public officials also can increase their support for public education efforts designed to discourage littering and encourage recycling. The focus of these initiatives should include plastics, aluminum, paper, glass and other materials. Several private organizations, such as Keep California Beautiful, are doing this successfully, and their efforts should be lauded and expanded.

Additionally, some industries are sponsoring a program called "Bring it Back Plus," encouraging people to not only pick up their own trash as they depart the beach, but pick up some of what was left behind by others.

Public education and stricter enforcement of existing litter laws, with appropriate penalties, would help remind both our fellow Californians and the thousands of visitors who come here each year that it is their responsibility to keep California clean.

Unfortunately, there will always be litterbugs among us. Bans have no effect on such people. Irresponsible human behavior cannot be addressed by eliminating products in society. People need to be aware that what they do, or don't do, can harm the planet where we all reside.

Jean-Michel Cousteau, son of the famed ocean explorer Jacques Cousteau, is the founder of the California-based Oceans Future Society.

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Months		Hits
July	:	67,137
August	:	60,429
September	:	62,227

Indian Centre for Plastics in the Environment

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