ENVIS

MANAGEMENT OF PLASTICS, POLYMER WASTES AND BIO-POLYMERS AND IMPACT OF PLASTICS ON THE ECO-SYSTEM

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INDIAN CENTRE FOR PLASTICS IN THE ENVIRONMENT

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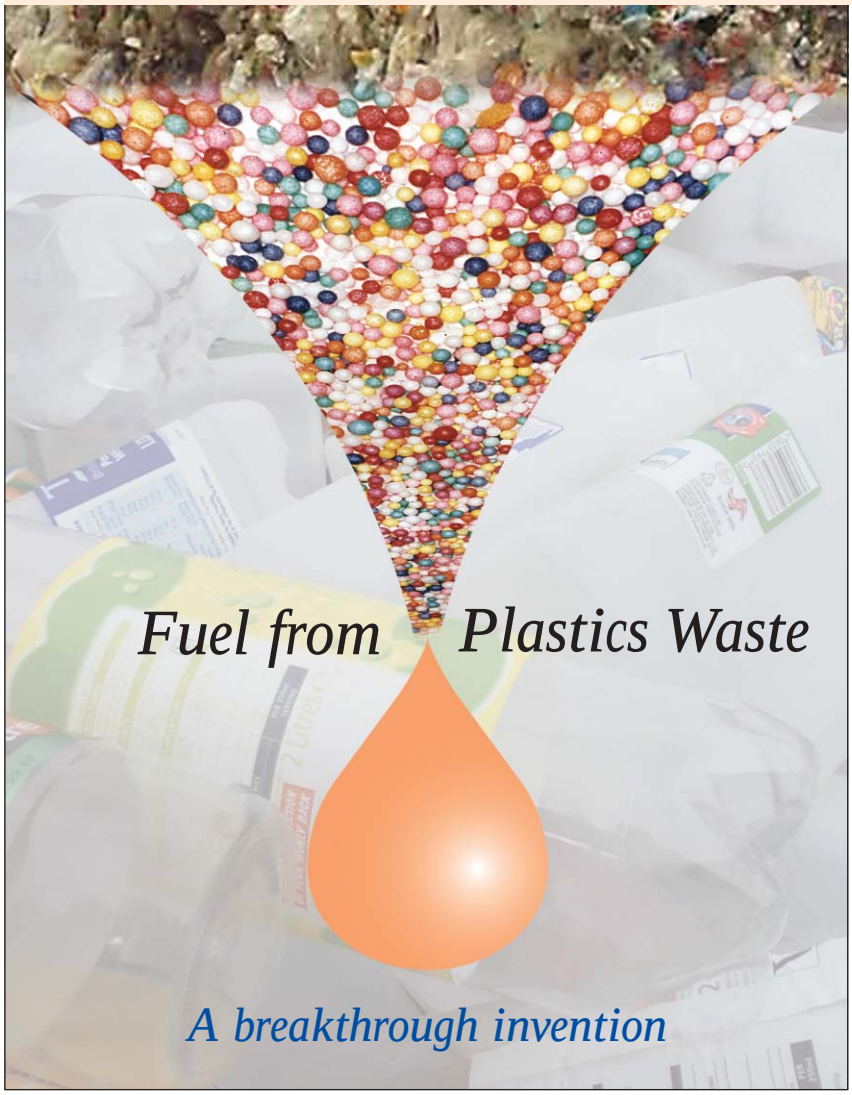


Plastics Waste as a Resource for Fuel

A Report from the Team comprising Mr. T. K. Bandopadhyay of ICPE and Dr. Shashikant Sharma of IPCL's R&D Department, who visited Nagpur. Text of the report is based on the information provided by the inventor.

Plastics have become an integral part and parcel of our lives due to its economic value, easy availability, easy processability, light-weight, durability and energy efficiency, besides other benefits.

Though many products made out of plastics are meant for long term durable use, there are many other plastic products, which are made for one time or short term use. Many of the plastics packaging materials fall under this category.

Though plastics are re-usable and re-cyclable, and hence there should not have been any problem of disposal of the plastics waste, however due to our poor littering habits and inadequate waste management system / infrastructure, plastics waste management / disposal continues to be a major problem for the civic authorities, especially in the urban areas.

Though various steps have already been either taken or initiated by the Government and the legal / civic authorities to reduce the problem of this waste management, an innovative invention by Prof.Alka Umesh Zadgaonkar of the Department of Applied Chemistry, G. H. Raisoni College of Engineering, Nagpur, Maharashtra, has created a hope and scope to tackle this problem more easily and more environmentally-friendly manner.

She has invented a catalyst system, which converts polymeric materials into liquid, solid and gaseous fuel.

Prof. Zadgaonkar has been working continuously on this invention since more than last 10 years and is now joined by her husband,

Dr. Umesh Zadgaonkar for manufacturing the fuel on a commercial scale.

Basically there are 4 different ways of recycling of plastics:

1. **Primary Recycling** – Conversion of waste plastics into products having performance level comparable to that of original products made from virgin plastics.

2. **Secondary Recycling** – Conversion of waste plastics into products having less demanding performance requirements than the original material.

3. **Tertiary Recycling** – The process of producing chemicals / fuels / similar products from waste plastics.

4. **Quaternary Recycling** – The process of recovering energy from waste plastics by incineration.

Prof. Zadgaonkar's invention deals with the **Tertiary Recycling**. Her work involved – use of post-consumer waste of plastics and other polymeric materials to produce fuel at a cheaper cost. The invented process has two major benefits:

- Easy disposal of plastics and other polymeric waste.

- Conversion of the waste into value-added fuel.

The Process

Under controlled reaction conditions, plastic materials undergo random De-polymerisation and is converted into three products:

a) Solid Fuel – Coke

b) Liquid Fuel – Combination of Gasoline, Kerosene, Diesel and Lube Oil.

c) Gaseous Fuel – LPG range gas.

The process consists of two steps:

i) Random De-polymerisation

- Loading of waste plastics into the reactor along with the Catalyst System.

- Random de-polymerisation of the waste plastics.

ii) Fractional Distillation

- Separation of various liquid fuels by virtue of the difference in their boiling points.

One important factor of the quality of the liquid fuel is that the sulphur content is less than 0.002 ppm – which is much lower than the level found in regular fuel.

Principles Involved

All plastics are polymers mostly containing carbon and hydrogen and few other elements like chlorine, nitrogen, etc. Polymers are made up of small molecules, called monomers, which combine together and form large molecules, called polymers.

When this long chain of polymers break at certain points, or when lower molecular weight fractions are formed, this is termed as degradation of polymers. This is reverse of polymerisation or de-polymerisation.

If such breaking of long polymeric chain or scission of bonds occur randomly, it is called 'Random De-polymerisation. Here the polymer degrades to lower molecular fragments.

In the process of conversion of waste plastics into fuels, random de-polymerisation is carried out in a

specially designed reactor in the absence of oxygen and in the presence of coal and certain catalytic additives. The maximum reaction temperature is 350 °C. There is total conversion of waste plastics into value-added fuel products.

Fuel Type	Conversion, volume in %
Solid Fuel (Coke) (remains at the bottom of the reactor)	5-7
Liquid Fuel (collected after condensation)	70-80%
Gaseous Fuel (LPG)	15-20%

Unique features of the process and product obtained are:

1. All types of Plastics Waste – PE, PP, PS / EPS, PET, PVC, ABS, PC including used CD's & Floppies having metal inserts, Laminated plastics – can be used in the process without any cleaning operation. Inputs should be dry.

2. Bio-medical plastics waste can be used.

3. About 1 litre of Fuel is produced from 1 kg of Plastics Waste. Bye-products are Coke and LPG Gaseous Fuel.

4. Any possible Dioxin formation is ruled out during the reaction involving PVC waste, due to the fact that the reaction is carried out in absence of oxygen, a prime requirement for Dioxin formation.

5. This is a unique process in which 100% waste is converted into 100% value-added products.

6. The process does not create any pollution.

Though the fuel so produced from the plastics waste could be used for running a four-stroke / 100 cc motorcycle at a higher mileage rate, the inventor agrees that separation of petrol from the liquid fuel could be a complex operation. Nevertheless the product is good enough for use as an alternative clean fuel in boilers and other heating systems.

It is, however, not the first time that fuel has been produced out of plastics waste. A Japanese company, M/s. Ozmotec, is already manufacturing fuel out of plastics waste at an industrial plant in Japan employing the Pyrolysis process. However, Prof. Zadgaonkar's process is a continuous one and hence is cheaper, whereas the Japanese technology is a batch process and is comparatively costlier.

Also, a company, Plastic Energy, is contemplating to generate fuel from plastic waste at Hanford, California, USA though the company is facing initial resistance from the local residents on the question of possible toxic emissions during the manufacturing process.

In some other parts of the world, also similar attempts are being made. Successful laboratory work has been done by a Professor in Abadan Oil Industry University in Iran.

IOC's R&D Centre at Faridabad had made extensive trials and tested all the parameters of the process and issued certificate indicating the clean aspects of the process. (The laboratory model was taken to Faridabad and the inventor and her husband camped there for 15 days of trial). Gas Chromatographic studies carried out at IOC Research Centre indicated the presence of unsaturated hydrocarbons, i.e., mono-olefins as well as di-olefins. These fractions also showed the presence of chlorides. Hence, in the commercial plant unsaturated fractions and chlorides will be removed by hydrogenation and scrubbing the gases in water respectively. PON analysis also indicated the presence of aromatics in the liquid fraction. The carbon number analysis of raw liquid fraction indicated the presence of hydrocarbons with C10 to C30 carbon numbers.

A live demonstration of the production of Liquid Fuel was made in the presence of ICPE led team in the laboratory. Three kgs of plastic scrap was used to produce about 2 litres of Liquid Fuel in about

3 hrs. The reaction was terminated after the trial demo. The fuel obtained was used in smooth running of a motorcycle, which was experienced by the visiting members. However, the inventor does not wish to claim the product as a substitute of Petrol or Diesel at this stage. The present use would be as a fuel for running boilers and other heating purposes.

Inventor welcomed ICPE's assistance for arrangement of the supply of low-end plastics waste at a reasonable rate, within Rs. 5 per kg. The inventor also revealed that they expected the government / civic authorities to provide the Plastics Waste free of cost to them so that the cost of running the plant could be recovered from the sale of the fuel produced. However, they have received no such assurance till now.

At present they do not seek any financial assistance from any agency as State Bank of India (SBI) has already extended the loan of about Rs. 9.0 crores (Rs. 90.0 million) to this project.

On a query whether they would agree to install such a plant near Mumbai / any metropolitan city with the assistance of any third party, they informed that they would like to have experience first in the Nagpur Plant. They have welcomed ICPE's assistance for arrangement of low-end plastics waste at a reasonable rate around Rs. 5.0 per kg. The inventor also expects the civic authorities to arrange supply of Plastics Waste to this unit free of cost to take care of the cost of the plant, initially.

Greentech Bin makes Bio-composting Easy and Convenient

All biodegradable materials are naturally converted to compost by the microbes. The limitation of this process is the time duration. It takes several months. On an average, aerobic bio composting (stirring of waste periodically) takes only 25 to 30 days to fully stabilized compost. Aerobic bio composting accelerates biodegradation and results in the higher temperatures necessary for pathogen destruction. Use of a biological product such as Earth Life Bio Great Compost Activator can accelerate the composting process.

Advantages of Bio Composting

- Fast and simple process
- Highly efficient and high yielding
- No odour, pests, rodents
- Highly decentralised – can be implemented at the ward, sub-ward, society and even individual household level
- Low capital investment

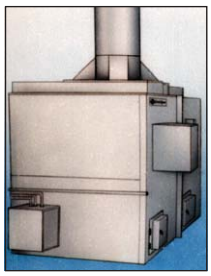
This bin is useful for Bungalows, Housing Colonies, Clubs, Hotels, Industries, Commercial Institutions for treating kitchen / garden waste.

Greentech Bin is manufactured and marketed in India under licence from Perbara International, Australia by Spiro Bioventures Pvt. Ltd.

(Courtesy: Spiro Bioventures Pvt. Ltd., Panvel, Navi Mumbai)

Managing immunisation waste the right way

Himalayan Institute Hospital Trust, a 700-bed multi disciplinary hospital in Uttaranchal, is a good example of how planning for waste management and integrating it into the project from the beginning can lead to effective immunisation waste management.



Effective planning has enabled it to manage the huge quantity of immunisation waste generated at its outreach activities. Concern for public health and the environment has enabled the hospital to integrate a remarkable waste management system in its immunisation activities. This system ensures that the waste generated at outreach settings is brought back safely and treated at the hospital through steam sterilisation processes.

(Source: www.toxicslink.org.)

ICPE at Indpak 2004 International & Food Tech Exhibition

Hitex, Hyderabad, 10th-13th September, 2004

ICPE displayed panels, publications and brochures depicting its set-up and activities and highlights of plastics as a useful resource for the mankind. Panels highlighting recyclability of plastics, various end use applications of recyclates attracted the attention of a large number of visitors to the exhibition including academicians and students from the Dairy Technology, Printing and Engineering.

The dignitaries among the visitors included representatives from Sabar Dairy, ITC Ltd., National Institute of Nutrition, APEDA, K. C. Das Pvt. Ltd., Bikaji and Satnam.

The exhibition was inaugurated by the Hon'ble Chief Minister of the State of Andhra Pradesh, Dr. Y. S. Rajasekhara Reddy.

Towards information dissemination and promotion the copies of Eco Echos, Envis, Myths and Realities (English & Telugu) and other literature were distributed. From among the visitors, specific information requested include – Recycling of plastics, recycling technology, sources of supply of polymers, biodegradable plastics, design features of plastics towards source reduction, machinery for recycling plastics, use of waste plastics, markets for recyclates, literature on use of plastics in road construction, etc. Requests were also received for copies of ICPE publications on a regular basis and articles by the Times of India group.

Concurrent to the exhibition, a two-day Technical Seminar was held under the theme "Packaging Machinery and Systems – Developments and Trends". Plastics packaging was a highlight in the overall coverage with leading personalities from India and overseas. Some significant topics related to plastics include:

- Multi-layer films – design considerations for specific performances.
- Developments in flexography.
- Concept/features of bag-in-box systems & applications.
- PET sheet/film manufacturing-important aspects & applications.

The reflections of participation of ICPE are indicative of the spread and promotion of ICPE – its role and contribution and positive response from various faculties – academics, industry and common masses.

EU Supports Restrictions on Phthalates in Children's Toys

The EU's Competitiveness Council has unanimously backed an agreement restricting the use of certain phthalates in toys and child care items (ECN 13th September). On the basis of the text agreed by the Council, articles containing DEHP, DBP and BBP cannot be placed on the market if the substances are used in preparations at greater than 0.1% in the plasticised material.

Toys and childcare items where DINP, DDP and DNOP have been used will be banned only if they are intended for children under three years, can be placed in their mouths or the substances are used in concentrations greater than 0.1% in the plasticised material.

The Council said the measures are based on the precautionary principle and therefore will be subject to review. A common position will be formally adopted and sent to the European Parliament for a second reading. The European Council for Plasticisers and Intermediates (ECPI), which has retained lawyers to consider the implications of the decision, reiterated its objection to the outcome in relation to DINP, which has been deemed safe for use in children's toys in the US since 2003.

"The EU has ignored its own risk assessment criteria. Industry as a whole should be concerned as risk assessment is integral to the operation of Reach. But we await the decision of the Parliament," said ECPI Deputy Director. "This is an entirely political decision that misuses the precautionary principle. In terms of plasticizer use, toys represent a very small proportion, but the decision is nevertheless very concerning because it will inevitably force toy manufacturers to use alternatives about which far less is known" – said the ECPI Director.

This latest move ends the temporary ban on phthalates put in place in 1999 on the basis that the substances were harmful to human health. The discontent felt by the ECPI is based on a European risk assessment indicating that DINP is safe. But this was superseded in June this year when the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) overruled the report.

Point

- **What is DEHP?**
- **Whether DEHP, which is used for manufacturing PVC toys, is poisonous?**
- **Whether it is required to ban manufacturing of toys using DEHP?**
- **Whether it is required that manufacturers should declare the ingredients used in the toy if DEHP is used?**

Counter Point

Di-2-Ethyl Hexyl Phthalate (DEHP) is a plasticizer used extensively mainly in the production of flexible PVC for applications ranging from floor covering to roofing sheets to soft toys. Concerns have been raised regarding the possible negative impact of the use of phthalates on human health due to alleged carcinogenic effects. Several exhaustive scientific studies conducted over the last 20 years have dispelled much of these concerns. In February 2000, after 20 years of extensive studies, the International Agency for Research on Cancer (IARC), which is a WHO organization, reviewed all the new data and concluded that DEHP should no longer be classified as a potential human carcinogen. European Union Scientific Committee for Toxicity and the Environment (CCSTEE) has also come to the same conclusion in 1998. Though further studies are continuing, it would be incorrect to label all products containing DEHP as poisonous.

In the United States, DEHP is the preferred phthalate plasticizer in medical applications because other phthalates have not been certified by the U.S. Food and Drug Administration for use in products such as intravenous bags.

Flexible vinyl medical products typically contain 30 to 40 per cent DEHP by weight, but that figure can reach 80 per cent in applications where flexibility is critical, such as in tubing.

The PVC industry in Europe pointed out that in more than 40 years of use, there is not one known case of a child's health suffering as a result of using soft PVC toys. Industry groups such as the European Council for Plasticizers and Intermediates, and the European Council of Vinyl Manufacturers were angered by the ban.

Both groups argued that the ban was enacted contrary to European Union rules, which stipulate that the EU's Scientific Committee for Toxicity, Ecotoxicity and the Environment (CSTEE) must warn of "immediate and serious risk".

CSTEE did not call for a ban or say there was "an immediate and serious risk," claimed the groups.

World's Largest PET Life Cycle Assessment – One-Way PET Levels With Refillable Glass

Excerpts from the study conducted by IFEU in Heidelberg, Germany, for the German Market.

The current German Packaging Ordinance (1988) imposes a mandatory deposit on one-way packaging systems if certain refillable quotas are not met. In January 2003, a mandatory deposit on one-way packaging holding waters, soft drinks and beer was introduced. Cartons and pouches were excluded from the deposit since they have been classified as ecologically favourable by the German Ministry of Environment, based on Life Cycle Assessments conducted by IFEU under the auspices of UBA. The UBA LCA used refillable glass as their benchmark and one-way PET was one of the product categories deemed as 'ecologically unfavourble'.

Petcore, is the European Trade Association representing the interests of PET beverage packaging sector and it is a reputable clearing house for sustainable sector practices, particularly in the field of post-consumer collection and recycling.

When several scientists and business stakeholders voiced their concern over the German 'favourable/ unfavourable' classification, Petcore shared this concern.

It was found that only 50 percent of the ecological benefits were allocated to the PET bottles. Petcore commissioned IFEU to conduct the study, using realistic data in full accordance with UBA practices. The study was actively supported by Forum PET in Bad homburg and a number of local beverage businesses.

Scope

The study compares the effects of soft drinks and mineral waters packaged in one-way PET versus refillable glass, both under kerbside collection and under deposits.

Key results

- Under source, separated collection conditions such as DSD, the environmental effects of one-way PET are similar to those of refillable glass.
- Under deposits, the environmental performance of one-way PET deteriorates which is mainly due to the fact that most one-way PET deposit bottles are shipped to the Far East for recycling. This difference would disappear if deposit bottles were to be recycled in Europe, as in the case of DSD bottles.

Sensitivity analysis indicates that transport distances and bottle weights are important parameters that could, in the future swing the balance to either side. Furthermore, significant energy savings are anticipated in next generation PET manufacturing technologies.

Conclusion

This study shows without doubt that one-way PET bottles are as 'ecologically favourable' as refillable glass under non-deposit circumstances.

A plausible alternative could be to revise the Packaging Ordinance, such that ecologically favourable packaging systems would be included in a deposit without being discriminated when compared to refillable packaging.

It cannot be explained to consumers that they should return the empty bottles to the store if they are subsequently transported to the other side of the world for recycling. This way we are losing environmental gain that is the prime reason behind bottles collection.

This study has shown that it does not matter whether collected PET is recycled into polyester fibre, sheet, strapping or back into PET bottles: they all offer equal benefits to the ecological profile of PET. Mandatory or semi mandatory requirements to recycle PET bottles into PET bottles would be ridiculous.

Public perception does not always match reality. Not many people comprehend that PET bottles, even for single use, are as good as their glass counterparts. This calls for further improvements in balanced, reputable education, independent and irrespective of local political agendas.

PVC Pipes for Drainage

PVC pipes are resistant to virtually all of the chemical concentrations found in domestic and industrial wastewater. Sulfide corrosion does not occur with PVC pipe. Abrasion wear is less than for traditional pipes. All of these factors eliminate, or at least prolong, the need to replace or repair sanitary sewers. Another environmental benefit afforded by PVC sanitary sewers is that associated with PVC's excellent durability.

PVC pipe manufacturing is a safe, clean process. It does not involve the use of any materials defined as hazardous. Cooling waters are recycled and scrap pieces are held for recovery of PVC. Being a neighbour to a PVC pipe, production facility is more like being a neighbour to a warehouse facility, than a manufacturing facility.

E-waste Problem in Asia-Pacific

An expert group meeting on 'E-waste Management in Asia and the Pacific' was held from June 22 to 23, 2004, at United Nations Environment Programme (UNEP) Regional Office in Bangkok, Thailand. The meeting, organised by UNEP, was attended by experts from governments, expert institutions, Secretariat of the Basel Convention, civil society organisations, and UNEP. There were also experts from the USA, China, India, Thailand and Japan, among others.

The UNEP, in collaboration with the various governments in the region, expert institutions, and relevant agencies, has plans to promote e-waste management in Asia and the Pacific by initiating a regional level activity for knowledge-sharing.

Objectives of the meeting include:

- Assessment of e-wastes at the national and sub-regional levels.
- Discussion of a strategy for promoting e-waste management in the region.

A number of Asian countries are generally considered to be the main importers of e-wastes generated around the world. Importing countries try to earn significant income from refurbishing used PCs and disassembling obsolete PCs, monitors, and circuit boards and then recovering the gold, copper and other precious metals.

The environmentally sound management of electronic wastes is an important element of the Strategic Plan now being developed by the member governments of the Basel Convention. The UNEP Regional Strategy for Asia and the Pacific has identified e-waste as an emerging environmental issue for the region. Despite the initiatives by some of the countries, agencies with the mandate on waste management in the region have no specific knowledge of composition of e-wastes and their management.

Prescription for tackling e-waste

The Minister for Communications and Information Technology, Govt. of India, has emphasised the need for recycling and reuse of end-of-life electronic equipment to minimise electronic waste generation.

A recent study by the U.S. Environmental Protection Agency shows that e-waste already forms approximately one per cent of the municipal solid waste stream. Research also shows that the generation of e-waste in Europe is increasing three times faster than other municipal waste.

Preventive steps

India generates 1,050 tonnes of electronic scrap a year and although a wide range of environmental legislations are available, more attention should be paid to tackling electronic waste. "The share of electronics in generation of overall industrial waste may not be very high at this stage but it is necessary for us to take preventive steps to contain this before it reaches unmanageable proportions."

Welcome step

The concept of environmental management through use of cleaner technologies initiated jointly by Department of Information Technology, Govt. of India and United Nations Development Programme is a "welcome step" which will ensure reduction in waste generation.

Source: www.toxicslink.org

www.envis-icpe.com

Website hits for the months August - October 2004

Months		Hits
August	:	22,829
September	:	23,108
October	:	26,026

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