Indian Centre for Plastics in the Environment

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ICPE NEWSLETTER

Fuel from Plastics Waste

A breakthrough invention

In this Issue

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Readers are welcome to send their suggestions, contributions, articles, case studies, and new developments for publication in the Newsletter to the ICPE address.

Forthcoming Events

IPLEX 05 Indian Plastics Exposition

Feb. 25-28, 2005
Chennai Trade Centre, Chennai

IPLEX-05 Indian Plastics Exposition is the offspring of conscious and concerted efforts of Plastindia Foundation, CIPET and all the Southern Plastics Manufacturers Associations.

IPLEX-05 will be the first of the series of expositions being organized in Chennai to promote the growth of Plastics Industry in the country in general and South India in particular.

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World's largest Packaging Fair

interpack 2005

International Fair on Packaging Machinery, Packaging, Confectionery Machinery, etc.
21-27 April, 2005
Düsseldorf, Germany

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

Progress Through Plastics

PLASTINDIA 2006

6th International Plastics Exhibition & Conference
9-14 February, 2006
Pragati Maidan, New Delhi

Plastindia 2006 is the most awaited event for product sourcing, technology exchange and joint venture.

Concurrent with the Exhibition, International Buyer Seller Meet will be scheduled.

The Plastindia Awards for encouraging and recognizing significant contribution by Indian companies to the Plastics Industry for developing innovative products, will continue to be a feature in Plastindia 2006.

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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 were deputed by ICPE management to visit 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, lightweight, 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 plastics 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 recyclable, 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. Dr. 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 fuels.

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.

The Zadgaonkars

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

Plastics scrap used to produce fuel

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, plastics materials undergo random de-polymerization and is converted into three products:

The laboratory of Prof. Dr. Alka Zadgaonkar.

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-polymerization

- Loading of waste plastics into the reactor along with the Catalyst System.
- Random de-polymerization 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 polymerization or de-polymerization.

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

In the process of conversion of waste plastics into fuels, random de-polymerization 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 plastics 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.

Dr. Shashikant Sharma (on the pillion) riding the motorcycle driven by the fuel produced from plastics waste.

A live demonstration of the production of Liquid Fuel was made in the presence of ICPE led team in the laboratory. Three kgs of plastics 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 for 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. 5.0 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 crore (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.

Feature

Evaluation Methods of Biodegradable Plastic Carry Bags

Dr. (Mrs.) Shilpa U. Nair
Principal Investigator, Microbiology/Biotechnology Division, The Bombay Textile Research Association (BTRA)

(Excerpts from the lecture delivered during a Seminar organized by ICPE)

The Concept of Biodegradable Plastics

For the management of plastics waste, the Ministry of Environment and Forest, Government of India has set up National Plastics Waste Management Task Force in 1996. It has laid down guidelines on plastics packaging, recycling. It levies penalties for littering and using banned films. To promote recycling, incentives are being provided to rag pickers and NGOs for increased collection of plastics from public places. Bureau of Indian Standards have issued Guidelines on recycling of plastics. In view of this, the Research and Development (R&D) have provided plastics, which will be environmentally degradable. There are expectations that in the near future most of the plastics will be degradable and compostable so that waste plastics can be handled the same way as wet food waste and agricultural waste.

What is Biodegradable?

Environmental concerns are now driving additive suppliers and polymer resin manufacturers to step up efforts to create innovative materials for the future. These promoters are incorporated into a butane-based linear low density polyethylene (LLDPE) at different levels. The properties of the blown films derived therefrom are investigated for its biodegradability. There is a difference between Degradable plastics, Biodegradable plastics, Photodegradable plastics, Thermally degradable plastics. Biodegradable plastics is the one in which degradation results from the action of naturally occurring microorganisms such as bacteria, fungi and algae. The compostable plastics also undergoes biological degradation during the composting process in a window within or up to 2-3 months to yield carbon dioxide, water, inorganic compounds and biomass consistent with other known compostable materials and leaves no visually distinguishable or toxic residues. There is a thin line dividing Biodegradable and Compostable plastics. When natural polymers synthesized in plants, animals and microorganisms are incorporated in polymerization of plastics, then the resultant product is biodegradable plastic. These additives can be the polymer of starch, cellulose, water-soluble polysaccharides-Xanthen, polyhydroxy butyrate (PHB), polyglutamic/aspartic acid or polyolefin products. When exposed to sunlight/U.V. rays photodegradable compounds act as oxygen catalyst in air and releases free bases, cutting the molecular chain making smaller biopolymers. As the molecular weight is reduced, the polymer is further broken down into smaller particles, which can be absorbed by microorganisms. Thus significant growth of microbial population is an excellent indicator of successful degradation process.

Evaluation of Biodegradation in Laboratory

New polymers offering improved properties in their susceptibility to microbial attack have entered internationally. Their specific applications like food contact packaging, general waste collection, bio-medical waste disposal have made an issue that they are destined to composting operations. This necessitates assessing the propensity of a material to degrade biologically. As a result, standards have been developed and there is a need to evaluate degradable products for compliance with state and local authorities.

The testing begins with sampling of plastics to estimate properties of a lot and to provide material for evaluation of a test method. Sampling is a means employed to meet the problem of estimating the quality of a lot from the inspection of only part of the lot. In general, the physical and electrical properties of plastics are influenced by temperature and relative humidity in a

manner that materially affects the test results. In order that reliable and reproducible comparison can be obtained, it is necessary to standardize the humidity conditions as well as the temperature to which specimens of these materials are subjected prior to and during testing.

Ever since the introduction of 'biodegradable plastics' fifteen years ago, confusion and skepticism about claims and product performance has prevailed. This situation, sterns largely from plastics products that did not biodegrade as expected, yet were able to make claims because no scientifically-based test methods and standards have been developed. The American Society of Testing and Materials (ASTM) and International Standards Organization (ISO) have developed standards for testing biodegradability in different specified conditions. Many of these methods give similar results but often complement each other. Based on the nature of plastics and available route of disposal in a country, a few of the methods listed in the **Table** given below can be used for evaluating biodegradability of plastics.

There are three main actions by which degradable plastics are designed to degrade – biological, chemical or photo degradation or combination thereof. The final degradation of all degradable plastics materials, whether they be initially degraded by photo or chemical degradation will be by microorganisms. The most important thing is proper selection of test procedure based on the nature of plastics and the climatic condition of the country. By and large biodegradability is evaluated under the following conditions.

Table

ASTM G 21-96	Determining Resistance of Synthetic Polymeric Materials to Fungi.
ASTM 5210-92	Determining the Anaerobic Biodegradation of Plastic Materials in the Presence of Municipal Sewage Sludge.
ASTM 5526-94	Determining the Anaerobic Biodegradation of Plastics Materials under Accelerated Landfill Conditions.
ASTM 5247	Determining the Anaerobic Biodegradability of Degradable Plastics by Specific Micro-organisms.
ASTM 5338-98	Determining the Aerobic Biodegradation of Plastics by Specific Micro-organisms.
ASTM 5988-96	Determining the Aerobic Biodegradation in Soil of Plastics Materials or Residual Plastics Materials after Composting.
ASTM 6002-96	Assessing the Compostability of Environmentally Degradable Plastics.
ASTM 6003-96	Determining Weight Loss from Plastics Materials Exposed to Simulated Municipal Solid Waste (MSW) Aerobic Compost Environment.
ASTM 6400-99	Standard Specification for Compostable Plastics.

1. Pure Culture Method

Pure culture method uses specific Bacteria or Fungi. The laboratory method determines the effect of Bacteria/Fungi on plastics carry bags when plastics are kept in laboratory chambers under conditions of temperature and humidity favourable for such attack. The growth of microbes on specimen is visible under microscope. The rating is assigned to specimen based on the extent of growth of microbes. The test requires the use of adequate culture controls. The fungal culture method carried out in humidity chambers provides clue to fungal invasion by 15-20 days.

2. Compost Method

Composting is a managed process that controls the biological decomposition and transformation of biodegradable materials into a humus-like substance called compost. The controlled process bio-oxidation through mesophilic and thermophilic degradation results in the production of carbon dioxide, water, minerals and stabilized compost. Two types of composting environments are generated. One is a natural compost pit in the open and the other is laboratory scale soil contact apparatus. The static test uses a defined sand, soil and mature compost matrix to provide consortium of mesophilic and thermophilic bacteria and fungi. Biodegradation is measured based on the amount of material carbon converted to gaseous carbon (CO_2). Readily biodegradable materials can be screened in 30-60 days.

3. Anaerobic degradation in the presence of Municipal Sewage Sludge

This is an acceptable environment available over a wide geographical area in which

plastics is exposed. Because of enriched environment of sewage sludge, the microbes present are more diverse in composition than a typical aerobic environment that plastics encounter in usual disposal methods. In laboratory this accelerated method is assessed in sealed vessels inoculated with sewage microbes. Gaseous CO_2 and CH_4 is monitored by head space analysis using GCMS analyzer. A positive result of 60% or more usually indicate that material will biodegrade.

4. Active Hand Fill Conditions

Soil having vegetation is an active soil environment. It has bacterial population in the order of 10^9-10^{11} organisms per gram. Burial of plastics bags in such landfill exposes the plastics to biodegradation and hydrolysis. Such changes can affect degradation as well as volume reduction. The ASTM test method conducted on plastics specimen before and after exposure can determine the extent of biodegradation based on the degree to which material property is changed. This is evaluated, based on weight loss and loss in tensile strength of plastics specimen.

Are we ready for Biodegradable Plastics?

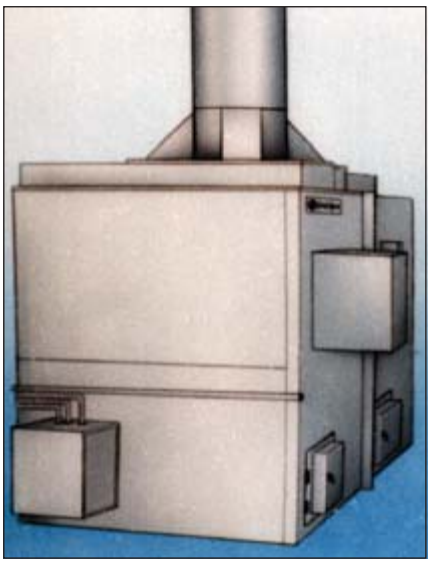
For successful introduction of biodegradable plastics bags, primary requirement should be evaluation of its biodegradable property before plastic manufacturer can receive the certifying logo. It must provide data from independent laboratories that their products meet the specification for biodegradability criteria defined by the ASTM methods. There should be national consensus to which ASTM method should be adopted. After submission of reports, independent scientists review the data to ensure that all testings were conducted properly and all requirements met. Another most essential aspect includes clear identification of disposal route of plastics for the given country, appropriate recovery systems and processing infrastructure required. The product must be tested against nationally agreed standards to ensure that the disposal routes are appropriate and were environmentally sustainable. Further work is also required to understand the fate and consequences of recalcitrant residues of the plastic, full life cycle assessment (LAC) work on the production, use and disposal of biodegradable polymers with reference to conventional impact of introduction of plastics into the use.

The proven plastics carry bags be allotted the 'Biodegradable Logo'. It is also necessary that biodegradable bags be given a unique standard colour such as bright lime green, green, etc., so that they can easily be differentiated from non-degradable plastics in a composting environment. This will facilitate the picking up of non-biodegradable plastics while the biodegradable can be left *in-situ*. The introduction of biodegradable bags in consumer market requires effective education to public that biodegradable plastics do not degrade instantly and hence to avoid the potential to increase of littering.

Managing Immunization 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 immunization waste management.

Effective planning has enabled it to manage the huge quantity of immunization 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 immunization activities. This system ensures that the waste generated at outreach settings is brought back safely and treated at the hospital through steam sterilization processes.



(Source: www.toxicslink.org)

ICPE at Indpak 2004 International & Food Tech Exhibition

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

ICPE participated in the above exhibition and 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-Echoes, 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 included:

- 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.

ICPE's Participation in

Plastivision India 2004 Exhibition

Mumbai, 23rd–27th Dec. 2004

An inside view of ICPE Pavilion

ICPE participated in the Plastivision India 2004 Exhibition organized by All India Plastics Manufacturers' Association (AIPMA), at NSE Complex, Goregaon, Mumbai, during 23rd-27th December, 2004.

AIPMA had given ICPE an open space of about 300 sq.mts. free of cost and ICPE pavilion was fabricated on an area of about 250 sq. mts.

Mr. J. B. Kamat, Executive Senior Vice-President, IPCL, keenly observing the tar road model made with plastics waste

ICPE pavilion included following exhibits:

- Sample of Tar Road with Plastics Waste
- Sample of Fuel produced out of Plastics Waste
- Synthetic Chip Board made out of Multi-layer Plastics Laminates
- Actual Mute Model of a Plastics Recycling Plant
- Continuous Screening of Audio-Visual Films on Plastics Recycling / Waste Management
- Panels describing ICPE Activities, Initiatives, Myths & Realities, Recycling of Plastics, etc.

Booklets on Frequently Asked Questions and Newsletters on Tar Road and Waste Segregation at Source were distributed to the visitors.

Through this exhibition, ICPE tried to bring general awareness among the public about Management of Municipality Solid Waste in general and Management of Plastics Waste in particular. Many visitors took keen interest in the exhibits in ICPE pavilion. Important suggestions have been received from different places and also requests for ICPE's help in the Waste Management Programme / Tar Road Construction Programme, etc., in their localities / cities.

Visitors at ICPE Pavilion

During the Exhibition, Seminars were organized by AIPMA. Prof. P. V. Narayanan, Advisor, ICPE, chaired one session of such Seminars on "Unleashing India's True Potential in Plastics".

Prof. P. V. Narayanan shared his expertise and experience with the delegates and had a very interactive discussion.

Prof. P. V. Narayanan chairing a session in the Seminar

Initiative

Tar Road with Plastics Waste – A Successful Experiment in Mumbai

In the Vol.5 • Issue 2 of Eco-Echoes, an article on 'Use of Plastics Waste in the Construction of Tar Road' was published. The advantages of using Waste Plastics in such construction was discussed in the article. Subsequent to this, ICPE organized a Technical Presentation to the Team of Road Engineers and the officials of Solid Waste Management Department (SWM) of Municipal Corporation of Greater Mumbai (MCGM) on 8th October, 2004 on the subject. Dr. R. Vasudevan of Thiagarajar College of Engineering (TCE), Madurai, the principal coordinator of the ICPE co-sponsored Tar Road Project, and Mr. T. K. Bandopadhyay, Technical Manager of ICPE made the joint presentation.

Dr. R. Vasudevan making presentation to MCGM officials

The MCGM officials were satisfied with the technical presentation and invited ICPE to co-ordinate and assist MCGM in laying the road using low-end plastics waste, which is causing a waste management problems to the Municipal Corporation. Accordingly a trial was organized for mixing of Plastics Waste with stones and bitumen in MCGM's high speed Central Mixing Plant at Worli and to use the mixed aggregate for the construction / repair work of Tar Road.

Accordingly the trial was organized on 6th and 7th December, 2004. Waste plastics replaced about 7-8% by weight of bitumen. (For new road, this goes up to 15%). Stripping test conducted after the mixing operation proved that the adhesion of the "stone – plastics waste – bitumen aggregate" was good.

Screening of plastics waste to the required size

1st Road Laying / Repairing Place was at New Prabhadevi Road (G-S Ward), 2nd Road Laying / Repairing Place was Opp. Poonam Park, Parsee Lane, Lal Baugh area (F-S Ward).

Mixing of plastics waste with stone

Tar Road laying in progress

It was observed that Plastics Waste could be successfully mixed with stones and bitumen at the high-speed asphalt plant and the condition of the Tar Road, when laid properly, was good. Cost of waste plastics was around Rs.6 per kg vis-à-vis cost of bitumen being around Rs.14 per kg. Hence there was a saving in cost of Tar Road construction. Condition of the road, inspected after 7 days, was found to be good. Proposal has now been made to MCGM to adopt this technology for constructing Tar Roads in the Mumbai Municipal area.

Completed road after 7 days

Initiative

ICPE on Plastics Recycling & Waste Management – Experience in Mumbai Wards and Eco-Sensitive Hill Station, Matheran

Compiled by **T. K. Bandopadhyay,** *Technical Manager, ICPE*

Waste Management

Segregation of recyclable waste at source

In all parts of the country, people by and large do salvage reusable or saleable material from waste and sell it for a price, e.g., newspapers, glass bottles, empty tins, plastics bags, old clothes, etc., and to that extent such reusable/recyclable waste material is not thrown out for disposal. However, a lot of recyclable dry waste such as waste paper, plastics, broken glass, metal, packaging material, etc., is not segregated and is thrown on the streets along with domestic/trade/institutional waste. Such waste is picked up to some extent by poor rag pickers for their livelihood. At times they empty the dustbins and spread the contents around for effective sorting and collection. By throwing such recyclable material on the streets or into a common dustbin, the quality of recyclable material deteriorates as it gets soiled by wet waste, which often contains contaminated and hazardous wastes.

Households and establishments, who throw such waste on the streets or in the municipal bins unsegregated, thus do not seriously practise segregation of recyclable waste at source. At least 15% of the total waste can conveniently be segregated at source for recycling, which is being thrown on the streets in absence of the practice of segregation of waste at source. Part of this waste is picked up by rag pickers in a soiled condition and sold to middle men at a low price, who in turn pass on the material to the recycling industry at a higher price after cleaning or segregation and the waste that remains uncollected finds its way to the dumping grounds.

Rag pickers with van

"Land filling" Practices

By and large, crude dumping of waste is done in the country without following the principles of sanitary land filling. As negligible segregation of waste at source takes place, all waste including hospital infectious waste generally finds its way to the disposal site. Quite often industrial hazardous waste is also deposited at dump sites meant for domestic waste.

The waste deposited at the dump site is generally neither spread nor compacted on a regular basis. It is also not covered with inert material. Thus, very unhygienic conditions prevail on the dump site.

Segregation of Recyclable Waste

It is essential to save the recyclable waste material from going to the waste processing and disposal sites and using up landfill space. Salvaging it at source for recycling could make profitable use of such material. This will save national resource and also save the cost and efforts to dispose of such waste. This can be done by forming a habit of keeping recyclable waste material separate from food waste and other bio-degradable wastes, in a separate bag or bin at the source of waste generation, by having a two-bin system for storage of waste at homes, shops and establishments where the domestic food waste (cooked and uncooked) goes into the municipal system and recyclable waste can be handed over to the waste collectors (rag pickers) at the doorstep.

The following measures may be taken by the local bodies towards the segregation of recyclable waste:

The local bodies may mobilize NGOs or co-operatives to take up the work of organizing street ragpickers and convert them to door-step "waste collectors" by motivating them to stop picking up soiled and contaminated solid waste from the streets, bins or disposal sites and instead improve their lot by collecting recyclable clean material from the doorstep on daily basis. The local bodies may, considering the important role of rag pickers in reducing the waste and the cost to the local body in

Dry waste at housing colonies

Dry waste being carried for loading into Municipality van

transportation of such waste, even consider extending financial help to NGOs and co-operatives in providing some tools and equipment to the rag pickers for efficient performance of their work in the informal sector.

The local bodies may actively associate resident associations, trade & industry associations, CBOs and NGOs in creating awareness among the people to segregate recyclable material at source and hand it over to a designated identified waste collector. The local body may give priority to the source segregation of recyclable waste by shops and establishments and later concentrate on segregation at the household level.

The upgraded rag pickers on becoming doorstep waste-collectors may be given an identity card by the NGOs organizing them, so that they may have acceptability in society. The local body may notify such an arrangement made by the NGOs and advise the people to cooperate.

This arrangement could be made on "no payment on either side basis" or people may negotiate payment to such waste collectors for the doorstep service provided to sustain their efforts.

(Based on the recommendations made by the Committee constituted by the Hon'ble Supreme Court of India, in 1999.)

Municipality van with dry waste on way to segregation area

ICPE Initiative:

ICPE engaged itself to implement the recommendations of the committee, and associated itself with some NGOs and the local bodies in helping the collection, segregation and diverting the segregated dry waste to recycling process and thus stopping their way to the landfills. Experimental Waste Management System was initiated at some wards of Mumbai following the above guideline.

Waste Management System at Brihan Mumbai Municipal Corporation:

In Mumbai, constant effort is being made to separate the dry and wet wastes at the source itself, so that the dry wastes could be further segregated into different types of wastes and could be sent for recycling, resulting in lesser load to the landfill sites.

There is an increasing activity among various Local Self Government Councils to treat the wet waste also through vermiculture or similar process to generate compost, which can be used as fertilizer.

Loading of dry waste in Municipality van

Segregation of dry waste

ICPE along with some NGOs have joined hands with BMC in some Wards of Mumbai to propagate the Proper Solid Waste Management culture among the citizens.

Though it is an uphill task, at least in some areas of different Wards, (like in 'A' and 'D' Wards) of Mumbai, the results are evident.

Here is a brief description of the work being practised:

'A' – Ward (Cuffe Parade Area):

1. BMC has given a secured area and a shed for segregation of dry wastes.
2. BMC has also provided two 1-tonner vans with drivers, free of cost, to move in the locality for 8 hours to collect dry wastes from households.
3. BMC has given Identity badges to the rag pickers who have been identified by the NGO's.
4. Some rag pickers accompany the BMC vans and collect dry wastes from doorsteps of the households/society buildings and bring those to the BMC allotted sheds for segregation.

Packing of segregated dry waste

Storing of segregated dry waste in a secured place

5. The dry wastes are product-wise segregated into: paper, plastics, metal and others. Obviously, within each product, there are different categories, e.g., in metal, there would be iron, aluminium foil, etc. In plastics, there would be PE, PP films, polystyrene cups, HDPE solid items/caps, etc.
6. These segregated dry wastes are stored in the secured sheds for disposal.
7. When sufficient quantity of scrap is accumulated, scrap dealers come to these sheds, weigh the scraps and pay the rag pickers/coordinators, the cost of the scraps, and collect the dry wastes. Generally, this collection takes place once in a week. (In some places, where the sheds are not well secured, rag pickers dispose of their segregated wastes every alternate day, or even daily to the recyclers/traders).
8. The wet wastes are collected by separate BMC vans from the household localities – directly to the landfills.

In some societies, local self-government council or the societies themselves are collecting the wet wastes also for composting, resulting into zero garbage concept. However, this is not yet widely practised in general.

ICPE has provided collection bins, hand gloves, aprons, masks, etc. to the rag pickers, and promotional literature to the society members. ICPE also interacted with BMC, NGOs and others for co-ordination of the activities apart from providing training to rag pickers and conducting awareness programmes to the general public, school children, members of the housing societies, etc.

ICPE provided dedicated coordinators to the NGOs for effective monitoring of the pilot projects in the initial stage.

BMC as well as the concerned localities are happy with the activities carried out at 'A' and 'D' Wards.

Activity has now been extended to some other wards also.

Segregated dry waste being weighed and sold to recyclers / traders

The NGOs which are closely working with ICPE in these projects are: Stree Mukti Sanghatana, NAGAR, and FORCE, etc.

The model of Dry Waste Management of Cuffe Parade ('A' Ward), Mumbai was followed at Matheran also.

Solid Waste Management Projects in Mumbai Wards

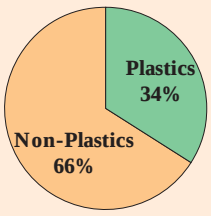
4 Wards under Project: A, D, F (North) and S

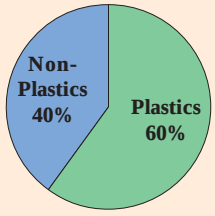
Comparative Assessment of the Segregation Activities during 2003 & 2004

Total quantity and value of Dry Wastes collected and segregated in 2003 and 2004 in the ICPE monitored projects in Mumbai Wards were analysed and the figures are given below:

2003

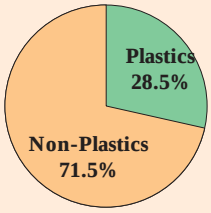
Weight (kg)			Value Earned (Rs.)		
Plastics	Non-Plastics	Total	Plastics	Non-Plastics	Total
2,17,161	4,06,483	6,23,644	14,19,759	9,40,766	23,60,525

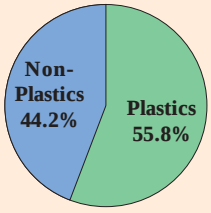




2004

Weight (kg)			Value Earned (Rs.)		
Plastics	Non-Plastics	Total	Plastics	Non-Plastics	Total
2,46,323	6,15,803	8,62,126	18,39,997	14,59,680	32,99,677





Observations:

a) There is a significant improvement in the annual figures of 2004 compared to that in 2003.
b) The average income for the rag pickers has gone up from Rs. 3,396 per month in 2003 to Rs. 4,741 per month in 2004 (Total number of rag pickers is 58).

Matheran, a popular hill station located in the State of Maharashtra, is the smallest hill station of India with an area of about 7.25 sq kms and local population of approx. 4,500. The annual number of tourists is approx. 2,50,000. Around 63% of Matheran is Reserved Forest and the bungalow plots are largely forested. The climax forests support a variety of species of flora and fauna and are also home to a number of endangered species. This eco-system is extremely sensitive and given the area and other factors, even small amounts of pressure on the ecology and environment have enormous impact on it. The Supreme Court declared Matheran as eco-sensitive and the Ministry of Environment and Forests issued a draft notification on 6th February, 2002 declaring Matheran and surrounding areas as eco-sensitive.

Course of Action:

One of the main problems of Matheran was the disposal of solid wastes, almost entirely comprising PET bottles and laminates, which were thrown into the forests. ICPE took up the initiative of presenting a solution to their waste management problems and decided to provide help, assistance and expertise to Matheran. Members from ICPE addressed the Municipal Councilors on Solid Waste Management and Plastics and the Environment, which had a tremendous impact on them. The broad plan of action was then laid down – the representative of Hotelier's Association assured that all hotels would separate the plastic wastes, the Council would have separate bins for plastics and would conduct meetings with the local residents to garner their support and participation. The Council also agreed to set aside a plot where all the dry wastes collected would be stored. ICPE took up the responsibility of taking it away from there. It was decided to approach the railways to transport the plastic waste to Neral in the freight trains that otherwise went back empty.

Initial condition – 2001

It was found that Parle products sold the most at Matheran. Figures were obtained from Parle Bisleri and they quoted that the average number of PET bottles supplied to Matheran was 20,000-25,000 per month. The weight of empty bottles was stated as 1-1.5 tons every month. The weight of laminates was found to be approx. 500 kgs per month.

A small committee was then formed to tackle the Solid Waste Management issues of Matheran – authorities from Matheran Bachao Samiti (MBS), ICPE, MCGM and Bisleri. A series of meetings were held in the Municipal Council office of Matheran to address the Councilors, hoteliers, shop owners and the local people. ICPE made a visit to Matheran jointly with MBS, MCGM authorities and Bisleri in August 2002. It was seen that all the material that went up the hill (bottled water, packaged foodstuff, etc.) was not brought down. Owing to the lack of sufficient number of garbage bins PET bottles, laminates and other dry wastes were littered along the railway tracks and all over the hill (market area, tourist points, etc.). Hoteliers dumped their dry wastes in their backyards.

During the meeting with the Councilors, a broad overview was given about ICPE and its segregation projects. The model Cuffe Parade project was also described. Leaflets, giving details of the segregation process and the proper disposal of plastics, were distributed. MCGM authorities provided details of vermiculture and Advanced Locality Management (ALM). It was then proposed that the

Council members make a visit to Mumbai to study the segregation projects and the SWM methods of MCGM for the proper implementation of the Waste Management Project at Matheran. It was also proposed that awareness activities be conducted in the schools and among the local people for better understanding of the project. Thus Matheran cleaning project started with the help of all involved.

Community Awareness Programme

A review was taken in October 2002, and it was then seen that there was a remarkable improvement in the dry waste management of Matheran. The roads and market area were found to be litter free. The civic sense of the local people had improved. Dry wastes were collected by the Municipal Council from all over the hill and brought to a central location. The Council had taken up a contract for the collection and storage of dry wastes. However, a need was felt for a proper system of disposal of dry wastes to be jointly worked out by the Municipal Council, hoteliers' association, shop owners and the local people with the initial help and guidance of ICPE.

Awareness among school children

Some practical measures were taken for easy handling of the dry wastes, especially the PET bottles, which are light in weight but high in volume.

Demonstration of a PET bottle crushing unit by Bisleri at Matheran

M/s. Bisleri installed Compactor Machine, which crushes the PET bottles to a thin layer of sheet.

M/s. Bisleri had organized their own collection system to take back crushed PET bottles to nearby centres for recycling.

ICPE organized other recyclers/ traders to take back plastics and other wastes, for recycling.

Further efforts were made for handling the wet (biodegradable) wastes for converting those to compost through vermiculture process.

The larger hotels were advised to have their own vermiculture pits, whereas the smaller hotels could send their wet wastes to some common compost bins.

Segregated garbage

In November 2002, the Expert Committee on New and Proposed Eco Sensitive Zones constituted by the Ministry of Environment and Forests visited the Eco–Sensitive Zone of Matheran. After the visit, the Chairman of the Committee, Prof. Dr. H. Y. Mohan Ram, stated that the hill station of Matheran was clean and free of garbage. He said that he had seen all the hill stations in India, and no other hill station was as clean of garbage as Matheran.

Segregated garbage disposal

Awareness Campaign during Ganpati Festival

ICPE in association with MCGM had organized Banner Campaign on "Two-Bin Culture" during Ganpati Festival in various Wards of MCGM.

Seminar on

'Plastics Waste in Road Construction & Bin Culture'

Jointly organized by ICPE, IPF and Plastindia Foundation

Kolkata, 20th August, 2004

The above seminar was organized mainly for making a presentation to the Kolkata Municipal Corporation officials and others on the technology involved in utilizing Plastics Waste in the construction of Tar Road. ICPE organized the visit of Dr. R. Vasudevan of Thiagarajar College of Engineering (TCE), Madurai, to Kolkata for this purpose.

During the same occasion, prizes were distributed among the wining students who participated in ICPE's 'It's My World' – All India Art Contest.

Top: Dignitaries on the dais.

Bottom: Prize winning students of schools in Kolkata area.

Domestic News

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 decentralized – 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)

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, organized by UNEP, was attended by experts from governments, expert institutions, Secretariat of the Basel Convention, civil society organizations, 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 emphasized the need for recycling and reuse of end-of-life electronic equipment to minimize 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 tons 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

EU Funds Polymer Research

Industry and academia from Latvia and Lithuania are collaborating on the development of environmentally friendly building materials based on the 25% of polymer waste that is currently non-recyclable.

The research involves the use of polymer concrete, which is made by using a melted polymer as a binding agent instead of cement. One advantage of the technology is said to be the ease with which raw materials can be prepared. It is also said to be economically profitable to process even small amounts of polymer waste.

The research will look at the properties of polymer concrete in terms of ageing and physical and mechanical properties. It will also look at the best application for the material and seek to solve some technological problems associated with it.

The main participant in the project is Latvia's Partners, a member of Latvia's Green Dot Organization. Virginijus, an industrial waste collection company based in Lithuania, is the other partner. Universities of both countries are also participating.

Known as Sandplast, the project is being supported by the US's Eureka initiative with a grant of Euro 300,000. The initiative aims to enhance European competitiveness by supporting business, research centres and universities to carry out pan-European projects to develop innovative products and services.

Major Milestone Reached in Plastics Recycling

Source: The American Plastics Council
www.plasticsresource.com

Years of hard work and heavy investment are finally paying off for MBA Polymers, Inc. (MBA), and its early research and development champion, the American Plastics Council (APC). In January 2004, Chief Executive Officer Mike Biddle, announced that the company is launching its first full-scale, state-of-the-art commercial plastics recycling facility in Guangzhou, China. According to MBA, the plant will have the capacity to process 40,000 tons of mixed plastics per year, primarily from EOL electronics, appliances, and other durable goods.

The multi-million-dollar joint venture between MBA and Guangzhou Iron & Steel Enterprises Holdings, Ltd. (GISE), is a unique marriage of companies with complementary interests: GISE was the first company in China to establish a metal shredding and recycling operation, and MBA is among the first companies in North America to recycle mixed engineering plastics, which remain in shredded material after metal is removed. "The opening of this facility is a major milestone for recycling plastics from EOL electronics and further confirmation that commercially viable technology exists," said Dr. Michael Fisher, Director of Technology for the APC. "It also is a perfect example of how thoughtful organizations in the same industry can work together to enable market development."

"In addition to funding research and development through grants," commented Fisher, "APC has worked with MBA since 1992 to publish numerous papers, deliver multiple presentations, and conduct a variety of workshops – all in an effort to promote viable plastics recycling for EOL electronics."

Fisher's comments refer to the fact that, for ten years, APC has provided grants to support state-of-the-art research centers – like the MBA facilities in Berkley and Richmond, California – in order to identify ways to effectively recover plastics from EOL durable goods. Biddle's technical and business expertise, coupled with APC's plastics knowledge and research support, resulted in the development and testing of much of the equipment that defines successful plastics recycling from EOL durable goods today.

The nature of the long-term APC/MBA partnership began to change several years ago when MBA started to focus more on commercial plastics recycling opportunities. "APC's role is to promote plastics recycling innovation by supporting research, development, and the communication of results – not to engage in commercial endeavors," said Fisher. "We are, however, extremely proud that our foresight and investment helped contribute to this giant leap forward for plastics recycling."

Biddle chose to site MBA's first commercial-scale facility in China because that is where significant portions of durable products are manufactured. In an article in Plastics News, Biddle said his customers in China essentially gave him an ultimatum: "If you want to do business with us, you have to sell plastics to us in China." MBA's California facility will remain in operation, although those in charge of sourcing say they continue to struggle to find an adequate supply of shredded plastics. Biddle cites the lack of a collection infrastructure as the major hurdle to running their CA plant to capacity.

Resource Conservation

When the topic of resource conservation and plastics comes up, many focus solely on recycling — but recycling is only part of the story. Conserving resources means using less raw materials and energy throughout a product's entire life — from its development and manufacture to its use, possible reuse or recovery — including recycling — and disposal. Plastics' unique characteristics — lightweight, durability, formability — enable the material to conserve more resources during a product's life when compared to other materials. In fact, despite the fact that plastic plays a role in almost every facet of our lives, its production accounts for only 4 per cent of the United States energy consumption.

Conserving the Environment

The plastics industry is concerned that it should take appropriate care of resources and the environment. The advantages of plastics over other raw materials are apparent from the beginning of their life-cycle. Research shows that it often takes less energy to make products in plastics, and although most plastics depend on oil, coal or gas they are responsible for only a small fraction of the national consumption of these fuels. In addition, as plastics are lighter and easier to store and transport, energy savings are made. As well as developments in the recycling of plastics, there have been interesting advances in the production of degradable plastics for products which need only a limited life.

The world is logging on to

Plastics





There's no 'Alt'

'Enter' plastics – and your whole world changes. Log on and your computer's plastic components 'Del'ete hassles and make connectivity easier. Advanced plastics help make the miracles of modern technology happen.

In a host of everyday uses, they redefine convenience and modernity, in fact, there's no 'Esc'aping the fact that plastics are an integral part of life today. There's just no 'Alt'.

Plastic. Fantastic!

Issued in the public interest by the Indian Centre for Plastics in the Environment (ICPE)
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Indian Centre for Plastics in the Environment

ICPE
REUSE • RECYCLE • RECOVER

Plastics. Use wisely ... Dispose responsibly.