ICPE
INDIAN CENTRE FOR PLASTICS IN THE ENVIRONMENT

Envis Eco-Echoes

Management of Plastics, Polymer wastes and Bio-polymers and Impact of Plastics on the Eco-system

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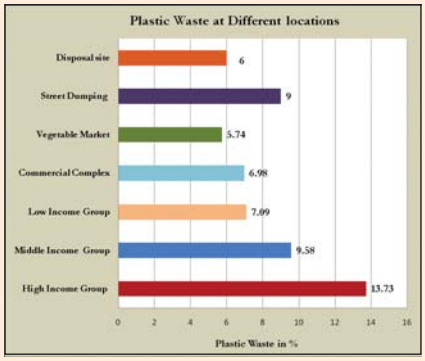

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Editorial

From this edition of ICPE ENVIS Newsletter, we have made some modifications in the design of the title page. All other attributes remain unchanged.

In this edition, we have focused on PVC – one of the most used plastics materials in the world including India. PVC is used in a variety of applications ranging from packaging of life saving blood (blood bag), pharmaceutical tablets and other life saving medical equipments, to surgical tubing, to transportation of potable water for quenching the thirst of millions of people across the country (rigid pipes), to supplying of irrigation water to millions of acres of agricultural fields (rigid and flexible irrigation pipes). PVC cables light our homes. PVC is extensively used for building construction – sidings, pipes, floorings, doors & windows and replaced wood and metals considerably, while providing a very long life to the products. PVC in cushions, upholstery, rain coats and shoes are required in our daily life. Still PVC is perhaps one of the most criticised plastics materials for wrong reasons. PVC is alleged for dioxin emission. Phthalates used in PVC as plasticiser are alleged to cause cancer And perhaps for this reason, PVC is one of the most researched products. Scientific studies have clearly proved that PVC is safe for use in many critical applications in modern day. We have carried a detailed Note on PVC in this edition.

While India is well below the world average in the consumption of plastics, nevertheless plastics are blamed for creating a waste management problem by chocking the drains and causing deaths to the stray animals when they try to eat the thrown away food waste within plastic bags and swallow the plastic bag. Although poor littering habits of our urban community coupled with inadequate infrastructure for the handling of the municipality solid waste are considered among the main reasons of such feeling, ICPE initiated independent studies by two different NGOs for characterisation of the MSW in Mumbai city. While it was revealed that plastics comprise around 5% of MSW in the landfill area, in line with the findings of some other national institutes, it was startling to know that more that 95% of the plastics waste that is carried to the largest landfill in the country, are picked up by the waste pickers for recycling!

This finding augments the basic principle that segregation of dry waste including plastics waste at source is required for a solution to our waste management problems. We have carried a brief report of the study in this edition.

Readers are welcome to send in their comments.

T. K. Bandopadhyay
Editor

PVC a Unique Polymer

T. K. Bandopadhyay
Sr. Technical Manager, ICPE, Mumbai

PVC occupies a unique position amongst the comity of all materials of construction. It is the only polymer which transgresses the boundaries of extreme elasticity to extreme rigidity with a unique range of flexural modulus values (3 MPa - 3000 MPa), thereby yielding a versatile range of products from soft rubber-like to very hard metal-like applications.

Over 80 per cent primary applications of PVC go into very long life (over 25 years) products thereby minimising the waste load on our eco-system. It is one of the few synthetic materials which, while supplementing and complementing scarce natural resources, have emerged as materials of construction meeting unique technoeconomic requirements of modern society. PVC is the predominant material that supports infrastructural requirements across the globe thereby meeting the developmental needs in this crucial sector; it would be impossible to conceive modern activities in building and construction, water supply, power distribution and telecommunication without the use of PVC. PVC has also played a very crucial role in meeting socio-economic needs particularly in developing economies. The low cost, yet aesthetic end products from this polymer have almost turned around the social lifestyles and societal demands and in meeting the aspirations of the poorer sections of economy.

Over 80 per cent primary applications of PVC go into very long life (more than 25 years) products thereby minimising the waste load on our eco-system.

PVC is versatile in its processing techniques. The polymer can be calendared, extruded into rigid and flexible profiles, injection moulded, compression moulded, blow moulded, rotomoulded and slush moulded. It can be coated by various techniques like spread coating, spray coating, dip coating, fluid bed coating and it can also be cast. This inherent flexibility in processing techniques not only yields an amazing variety of products, but also provides impetus in meeting entrepreneurial aspirations at various levels of skills and investments.

PVC is the world's most thoroughly researched thermoplastic, particularly in terms of Health, Safety and environment (HSe) aspects and life Cycle Analysis (ICA). Finally, in spite of various sensitive environmental issues and the adverse role of Green Peace movements, PVC due to technological developments has not only survived, but is indeed slated to be the eco-friendly star of the decade. Defying the predictions of several pundits on maturation of these products in the life cycle, we can definitely look forward to strong growth in demand of PVC not only in traditional sectors, but also in emerging new sectors and applications on the global horizon.

Indian Scenario

PVC production started in India in the year 1961 when Calico Industries put up a plant

based on Calcium Carbide route. In 1967, the first alcohol based plant was commissioned by Chemplast. The Company also pioneered the production of paste (emulsion) grade in the country. The first integrated PVC complex based on naphtha cracker was established in 1968 by Nocil. In 1984, IPCl had set up a moderate size plant in its Baroda Complex. In 1991, Reliance Industries limited brought about a sea change in local production with a world scale plant (160 KT enhanced to 300 KT) based on imported feedstock. A similar size plant was installed by IPCl in its Gandhar Complex in 1996 / 97 with its own VCM feedstock plant. Today, we have an installed capacity of around 900 KT against a demand close to 1400 KT. A 220 KT plant coming up shortly would reduce the gap between the demand and supply scenario.

The major consumption sectors are irrigation / water supply (~ 38%), building & construction (~ 23%), the remaining being used in medical, footwear, profiles, packaging, etc.

Major applications include:

- Pipes – Rigid, Flexible and Heliflex (combination of rigid and flexible)
- Pipe Fittings
- Sheets – Rigid and Flexible
- Profiles – Window, Door and other Rigid and Flexible
- Cables – Electrical, Telecommunication, Automobile, etc.
- Blood Bags
- Catheters and other Tubes
- Packaging Film / Sheets
- Footwear

Environmental Concern

In recent years, PVC – Vinyls have come under intense scrutiny on environmental grounds particularly the apprehensions regarding emission of Chlorine products and dioxins, and adverse aspects of Phthalates – plasticisers used in compounding PVC. This note provides authentic information disproving the widespread misgivings.

Vinyl Chloride Monomer

PVC has been under severe attack for almost 20-25 years when it was discovered in mid 70s that VCM monomer induces angiosarcoma, a liver cancer. Initially the problem was restricted to occupational exposure during manufacture. However, concerns were expressed for risk to human beings. The PVC industry rose to the environmental challenge in a short time; first to reduce exposure of VCM during manufacture and then to contain it. The closed reactor technology coupled with clean reactor systems brought dramatic reduction in VCM exposure. Further, the treatment of VCM by solvent absorption activated charcoal eliminated the emission to atmosphere. The occluded residual VCM in PVC particles was brought down from a level as high as 1000 ppm to the level of 1 ppm by slurry stripping techniques. PVC industry has passed the critical acid test. Today, most of the PVC produced in the world contains very insignificant levels of residual VCM. not surprisingly, the Food and Drug regulatory bodies across the world do not consider the

extremely low levels of VCM in food packaging a human health or environmental risk. It is even considered to be safe in its use in medical field.

PVC & Disposal Issues – The Indian Scenario

Perhaps the biggest contemporary threat to PVC is the issue of its disposal, particularly from municipal solid waste (MSW). The major volumes of PVC are used in products like pipes, profiles and cables which have a long life - almost extending up to 50-100 years. PVC in packaging and disposable application (short life products) does not exceed 10-15% of the total consumption. latest figures show that 'short life' PVC products form only about 8% of total PVC produced. It is, therefore, not surprising to observe that PVC component in municipal waste is lowest (less than 0.5% by weight). PVC on account of its high chlorine content is considered by the environmentalist to be obnoxious. However, the fact remains that its presence at such low levels in municipal waste streams could not cause any significant problems. It is argued that PVC (because of its chlorine) when burnt can form HCl and an organic chloride product called Dioxin (2, 3, 7, 8 - tetrachlorodibenzo-o-dioxin). The Dioxin issue has been discussed separately.

HCl is alleged by the environmentalists to be responsible for acid rain and Dioxin is considered to be toxic. PVC component in MSW is very low compared to other wastes fed to incinerators. A new study that analysed 1700 test results from incinerators and similar combustor equipments at 155 facilities concluded that there is no relationship between the chlorine content of wastes and dioxin emissions from combustion process. It is the operating parameters of combustor which are critical factors in dioxin generation. The contribution to all the acid gases from the burning of PVC is less than 0.25% and with the incinerators fitted with efficient gas scrubbers, this figure is lower.

Acid Rain

Several research works carried out at reputed institutes indicate that atmospheric acidity caused by HCl from PVC is a very minor source (less than 0.25%). Most of the acid

generated comes from automobile pollution (nitrogen Oxide) and power plants (Sulphur Dioxide).

Dioxins

At present, there is insufficient data to make a detailed assessment of the eDC/VCM/PVC industry's role as a source of Dioxins. However, current analysis indicates that the eDC/VCM/PVC industry is a minimal emission source. Waste combustion accounts for 95% of all known emissions with Municipal and Medical wastes incineration being the dominant source. A study has concluded that there is no relationship between the chlorine content of wastes and dioxin emission from combustor process. Dioxin formation takes place in the post combustion zone at a temperature zone around 400°C-600°C by catalytic reaction with fly ash in the presence of hydrochloric acid. At temperatures above 850°C dioxins are destroyed. It is the operating parameters of combustor which are critical factors in dioxin generation. A survey of dioxin emissions in Netherlands shows that contribution to dioxin levels from PVC is very small as compared to wastes from other sources. (Refer Table 1).

Fire in offices which contain PVC have always given rise to controversy concerning dioxin emissions. Investigation of these fires with high PVC content indicate very little, if any emitted dioxin in the immediate vicinity of the fire. This was shown at Miranda (Spain), where after a fire involving 15 tonnes of VCM/PVC, only 0.006 to 0.007 µg (I-TeQ) per Kg of soil was found at around 100 meters from the factory while it was not possible to detect traces of dioxin in the water used to extinguish the fire at the analytical sensitivity of 0.14 µg (ppt). At lengerich, with 500 MT of PVC, authorities have published an official report which gave values of 0.1 to 5 µg/m^2 at a distance of 100 metres, which are not considered dangerous. These values are comparable to those of stubble burning (1 g per hectare) and wood fire (13 to 28 µg per tonne).

Dioxin formation in the fire involving copper cables with PVC insulation is expected to be 7.4 to 14 µg per tonne which is much less as compared to PVC-free cables insulated with paper and with lead (21 µg/tonne).

Table 1: Dioxin Emissions

Emission Source	Dioxin Emissions (I-TEQ) Min.	µgm/MT max
Incineration of Hospital Waste	800	5000
Incineration of Household Waste	7	277
Incineration of Contaminated Wood	25	500
Incineration of Clean Wood	13	29
Recycling of Copper/Brass/Bronze	5	35
Recycling of Aluminum Scrap	1.7	35
PVC Fire	0.006-007	7

Source: The Vinyl Institute, USA

It would be impossible to conceive modern activities in building & construction, water supply, power distribution and telecommunication without the use of PVC.

A two year study undertaken voluntarily by the Vinyl Institute in the U.S. shows that Vinyl is, at most, a negligible source of dioxin. In fact, dioxin emission in 2000 has declined by 50% since 1970, a period in which PVC production has more than trebled.

A review of the data generated in Europe shows the vinyl industry as a minor contributor to dioxin levels. Vinyl constitutes only 1% of the total chemical processes in general and hence represents only about one half of 1% of the dioxin source. The dioxin levels found in vinyl production are comparable to the amounts present in grass or soil and pose no threat to human health.

The vinyl industry's voluntary dioxin characterisation program for reassessment of dioxin levels further confirms vinyl's minimal contribution to dioxin emissions. Sampling data from various points in the vinyl production process show emissions of about 24 gms of dioxin to air, land or water or less than 1% of the 3000 gms that the ePA estimates are emitted annually by sources throughout the country. The recent dioxin source inventory shows most dioxin coming from municipal waste incinerators, backyard trash burning, landfill and forest fire. [Vinyl and the environment -environmental Briefs - December 1999].

The US environmental Protection Agency has always contained one mystery: the signal of the existence of a large 'unknown' source of dioxin. One of these mystery resources is located to backyard trash burning. An increased amount of vinyl in the trash barrels did not produce high amounts of dioxin. Further, the design and the operating conditions of the incinerator and not the vinyl content of the waste are the determining factors in dioxin generation and emission. [Vinyl and the environment - environmental Briefs - July 1999].

Greenpeace and the other environmental groups accuse the chlorine industry to be the main source of dioxins in the environment. But, the whole chlorine industry and the PVC industry are only a minor source of dioxins today. The most important sources are identified as below:

- Commercial/municipal waste
- Burning of fuel (coal, wood, oil)
- Burning of household waste
- Chlorine bleaching of pulp and paper
- Some chemical manufacturing process (not known for commodity plastics)
- Forest fire
- Cigarette smoke

The amount of PVC or chlorine plays no important role in the amount of dioxins formed at incinerators. From more than seventy experiments at municipal incinerators, all over the

world, there is evidence to prove that there is no relation between chlorine input and dioxin emissions.

On a production of 500,000 tonnes per year, about 4 gms of dioxin were formed. This is 500 times lower than the figures suggested by Greenpeace. After cleanup in a biological wastewater treatment and the incineration of the sludge of the waste treatment and the off-gases, about 40 milligrams of dioxins are released to air and about 10 milligrams are released to water per year. Thus, only 30 to 80 milligrams of dioxins per year are released from a PVC factory producing hundred thousand tonnes of PVC. now-a-days, the dioxin levels are the same as much in 1975, even though the chlorine and PVC production is enormously higher than in those times.

PVC and Fire

PVC polymer because of its chlorine content is inherently fire resistant. In fact, among all the common polymers, PVC is the most resistant to fire. not only it is better than the common plastics, it certainly shows some interesting advantages over conventional materials like wood. The self ignition as well as flash ignition temperatures of PVC polymer as well as rigid PVC products like window profiles having more than 80-85% content of PVC polymer are almost 150 °C higher than wood, clearly indicating that PVC would be more resistant than wood to initiate fire on its own or when heat is increased due to fire emanating from other sources. For spreading of fire, oxygen is essential - PVC polymer and products used in infrastructure/buildings like pipes, conduits, profiles or even flooring and wires/cables have limiting oxygen index ranging from 30 to 50 compared to 21 limiting oxygen index of wood. It is, therefore, quite natural that all the building institutes around the world not only approve such PVC products for building/infrastructure, but also provide it the highest ranking among the alternate materials that can be used for such applications.

In fact, rigid PVC products generally extinguish by themselves once the fire source is eliminated.

It requires high temperatures, continuity of fire and abundant supply of fresh oxygen to sustain fire in these PVC products. PVC products tend to provide some benefits in fire situations. First of all, burning of PVC tends to reduce or maintain heat instead of increasing it. Secondly, when PVC burns, it releases hydrogen chloride and relatively small amount of carbon monoxide.

Generally, other materials like cotton, wood, etc., on burning produce carbon monoxide which is odourless, but very toxic. Hydrochloric acid which has irritating smell warns the victims even when it is present in small quantity. Thirty

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Hypothesis on endocrine disruption and other health issues (ECVM report)

A number of scientific papers have given rise to concern about a possible general reduction in male sperm counts and other reproductive disorders. These have resulted in a hypothesis that certain products in the environment which mimic the natural female hormone estrogen may be the cause. This has become known as the hormone – or endocrine – disruption theory. However, there is no study based on sound science that shows this actually occurs.

Extensive research is being carried out by the chemical industry and others in Europe, the united States and elsewhere, into endocrine disruption theory. Phthalates have been implicated as one of a number of possible hormone-mimicking chemicals, but they are not the only substances under scrutiny along with many naturally occurring substances (phyto-estrogens) found in plants and vegetables.

Concerns have been raised about a possible endocrine effect of some phthalates, although the most recent studies, which include in-vitro and in-vivo tests on DeHP, have shown that there is no reason that the suspected phthalates would produce estrogenic effects in humans.

It is, therefore, very unlikely that any significant risk to human reproductive health is associated with phthalate use. However, they continue to be rigorously researched and scientifically assessed to confirm they are safe to use and pose no threat to health or the environment. Such assessments are currently being undertaken on phthalates (DBP, DeHP, DInP and BBP) under the EU's Risk Assessment Procedure (Council Regulation [eeP] 793/93).

While the International Agency for Research on Cancer (IARC), part of WHO, used to classify DeHP in the 1990s as 'an agent possibly carcinogenic to humans', this was based only on rodent studies and did not take into account more recent understanding of the underlying mechanisms. During the early 2000, it has changed its classification of DeHP to group 3 ('not classifiable as a human carcinogen') based on existing scientific evidence that supports the safety of DeHP as a component of PVC life saving medical products like blood bags.

In addition, the Specialised Experts Working Group of the European Commission has concluded that there is no evidence to warrant classification of DeHP as a carcinogen. Recently, three independent panels convened by Baxter Healthcare Corporation confirmed that DeHP does not pose a human cancer risk.

With regard to cancer, it is important to note that since 1980 a large number of investigations have shown that feeding high levels of phthalates to rodents over their lifetime causes a large increase in micro bodies in the liver called peroxisomes. This 'perixisome proliferation' leads to the formation of liver tumors. However, when these chemicals are given to non-rodent species such as marmosets and monkeys (primates considered to be metabolically closer to humans), such liver peroxisome proliferation and liver damage is not seen. The changes seen in rats are, therefore, likely to be a species-specific effect.

The European plasticiser industry (represented by the European Council for Plasticisers and Intermediated - eCPI) is conscious of the genuine public concern which now exists around the use of phthalates and takes this very seriously. The industry is in favour of proper scientific evaluation and a public debate, and considers that it has a duty to respond to public concern by ensuring that there is an open exchange of information about the performance of its products. Clearly, if there were scientific evidence that any single product presented a serious health risk, the plasticiser industry would have no hesitation in withdrawing it.

Influenced by insufficient information, some international organisations had been alleging that phthalate plasticisers present in the PVC toys pose health problems to children who could put those toys into their mouth. Although enough scientific evidence was not available to prove this allegation, the European Parliament, in July 2005, had imposed a ban on the use of phthalates – DeHP, DBP, DInP, DnOP and DIDP, in toys and childcare articles, where their concentration exceeds 0.1% by mass of the plasticised material. This action of the European Parliament, taken on the basis of majority vote, caused dissatisfaction in the scientific fraternity, as the scientific data did not call for such an action. However, in a recent development, the same European union (eu) confirmed on 13th April, 2006 that the most widely used plasticisers are not classified as hazardous and pose no risk to either human health or the environment from their current use. The publication in the European union's official journal of the outcome of the EU Risk Assessments for DInP marks the end of a 10 year process of yet another extensive scientific evaluation by regulators and provides confirmation of safety for users across Europe (and elsewhere).

The industry is also committed to supporting and, where appropriate, commissioning further scientific research to make sure that the current use of phthalates poses no hazard to the health of people or the environment.

minutes of burning PVC in a typical office space make lethal dose of HCl. long before this, 'CO' released from wood & other organic materials kill inmates without giving any warning. Due to these two distinct benefits, the fire authorities favour PVC products.

Experiments conducted by Boston Fire Dept. as well as Harvard university have shown that in a typical building fire, HCl levels did not exceed more than 300 ppm. At such levels, there is no danger to human/animal fire victims.

Hydrogen Chloride being corrosive was thought to contribute to corrosion of concrete structure. However, large scale experiments have proved that HCl emitted in fire from PVC products do not corrode such structures.

Effect of Phthalates

Phthalates are among the most studied materials in the world. Based on the best evidence to date, the producers of phthalates strongly believe that these products are safe and pose no risk to children or adults properly using products containing phthalate esters.

Phthalates are important since they make plastic flexible. These phthalates have undergone extensive health and safety testing. A phthalate commonly used in children's toys is DInP. There is an extensive database that includes test results from studies that examined possible liver and kidney effects, cancer, reproduction and development as well as endocrine modulation. Based on the extensive data available, there is no scientifically validated evidence that shows that the use of phthalates in human toys poses a human health risk. The Phthalate esters Panel stands by the extensive research and testing that shows that phthalates in toys are safe for intended use. The Consumer Products Safety commission has stated that the amount children may ingest does not reach to harmful levels. [Phthalate esters Panel - November 2000].

DBP exposure in people was recently studied by the Centers for Disease Control and Prevention (CDC). Results were consistent with prior levels of exposure. The average DBP exposures were more than 60 times below the level mentioned by the US ePA. There were earlier claims that the presence of plasticisers in vinyl flooring and wall covering could lead to childhood asthma. These claims have been discredited by the Institute of Medicine of the national Academies of Science. The researchers have placed plasticisers in the study's lowest category claiming that they could find only insufficient evidence. [Vinyl and the environment - environmental Briefs - May 2000].

In addition, phthalate esters have been shown to be readily biodegradable in tests conducted using a number of

A study has concluded that there is no relationship between the chlorine content of wastes and dioxin emission from combustor process.

different protocols. In addition, the phthalate esters are easily photo degraded and biodegraded and hence they do not tend to persist in the environment.

A blue ribbon panel headed by Surgeon General C. Everett Kopp has declared that vinyl toys and medical products made with phthalate plasticisers are not harmful to children or adults. In fact, the panel has revealed that the use of phthalates in some medical devices makes them safer than alternative materials. Dr. Koop has reassured that the use of vinyl toys and medical products are safe. [Vinyl and the environment – August 2000 Briefs].

All aspects of the toxicology of phthalates are currently being assessed in a number of international forums, the most important of which are outlined here:

The Scientific Committee on Toxicity, eco toxicity and the environment (CSTee) has issued opinions on the migration of phthalates from soft PVC toys and childcare articles in April and November 1999. In these opinions, it has evaluated the extensive toxicity data available on the phthalates, identified no Observable Adverse effect levels (nOAel) and, after applying a safety factor of 100, defined Tolerable Daily Intakes (TDI) for each of six phthalates. The TDI values have been coupled with a worst case exposure scenario to give guidance values for migration. If the guideline values are not exceeded then these phthalates can be used safely.

Thus, all toxicological concerns have been taken into consideration by the CSTee and they have concluded that the listed and assessed phthalates can be used safely in toys provided that the guideline values for migration are not exceeded.

United States Consumer Product Safety Commission (CPSC), has evaluated the potential health risk to children less than 3 years of age from tethers, rattles and toys made from PVC containing DInP. The evaluation included both in-vivo and in-vitro measurement of the migration of DInP during mouthing.

Based on this migration data and the 'time of mouthing' information obtained by the Dutch Consensus Group, the CPSC concluded that 'few if any children are at risk from liver or other organ toxicity from the release of DinP from these products' [The use of Phthalate Plasticizers in Soft Toys-environmental Briefs - April 2000].

Vinyl Recycling

Vinyl is primarily derived from the salt which is a virtually unlimited natural resource. The process of manufacturing vinyl has minimal releases to the environment. Because vinyl is so durable, its use on long - lived applications provides additional resources. When vinyl products do reach the end of their lives, they can be recycled into other useful products.

Even after a useful span of decades, vinyl products can be recycled into new applications lasting decades more. In the US, more than 3,500 communities accept vinyl in their recycling program. More than one billion pounds of vinyl were recycled from post-industrial and post-consumer sources in 1999, disclaiming the claims that vinyl cannot be recycled. Independent consulting firm Principal Partners have found that nearly all scrap is recycled back into the vinyl manufacturing process resulting in a notably high resource-efficient process. The plastics such as those used in milk jugs and soda bottles have higher recycling rates because of the presence of vinyl. The industry has helped develop the equipment that automatically separates vinyl from other post-consumer plastic packaging and expand recycling for non-packaging waste such as construction and demolition scrap. The use of incineration facilities together with the associated energy plays a complementary role to recycling and has allowed reducing the volumes going into landfill.

Just one year after the Auto vinyl recycling initiative began its activity of the recycling of automotive scrap, the coalition of the French Vinyl, automobile and equipment manufacturers was successful in its interim goal of recycling 5000 metric tonnes of vinyl the group reported that 1740 metric tones of automotive vinyl production scrap and vinyl products from end-of-life vehicles have already been processed by the recycling companies. now, the company is focusing its initiatives to developing new products from these recycled material in the automotive industry and other sectors. The coalition expects to be recovering more than 80 per cent of all vinyl automobile parts.

Ten vinyl manufacturers in Europe have teamed up to build a pilot plant to evaluate the technologies for vinyl recycling. The project is being funded by members of the European Council of Vinyl Manufacturers.

Solvay has recently announced a new technology called vinyl loop for recycling vinyl compound- based products. This process uses a solvent to separate vinyls from other materials such as polyester found in applications like architectural canvas and tarpaulins. The process is also found to be useful to recycle vinyl compounds from cables, pharmaceutical blister packs, floor coating and car dashboards. Meanwhile, Japan's Toll Corp. announced recently a technology to recycle carpet panels and vinyl floor covering. The recovered wall covering is used to manufacture flooring and the carpet is recycled into new carpet material.

PVC and Municipal Waste Incineration

The amount of PVC in municipal household waste is less than 1 per cent. Then PVC is combusted, it is converted into carbon dioxide, water, hydrogen chloride and metal chlorides. However, PVC provides considerably less CO2 per kg of materials than the combustion of other materials such as oil, wood and coal. PVC, therefore, makes smaller contribution in green house effects. HCl is a hazardous acid gas which must be removed from the emissions of all municipal and industrial waste materials for separate treatment.

Dioxins - which are generated as byproducts from industrial and combustion process - can also be produced in waste

incinerator. However, with advantage of modern incinerator technology, the control of all hazardous emissions is a matter of safe and effective operation of an incinerator.

There is scientific evidence that PVC's presence in municipal waste stream plays no special role in the amount of dioxin forced and released from incinerators.

Another comprehensive study by the Association of Plastics Manufacturers in europe (APMe) into combustion of mixed plastic waste and municipal solid waste of the Würzburg incineration plant in Germany demonstrated that increasing the overall content of waste plastics, including PVC – did not produce any measurable increases in the production of dioxins and furans. All gaseous emissions recorded during the project met the German emission Standards.

Conclusion

PVC shall continue to serve important sectors like building and construction, agriculture and medical applications, among others. PVC is not only safe to use – but contributes to the health, safety and well being of human kind. PVC performs well in a total evaluation when compared to alternative materials. The wide range of properties at optimum price and environmental performance in line with – and at times better than the alternative materials, make PVC a very competitive and ideal material of choice.

Awareness Programmes in Schools/Colleges

Miranda House College, Delhi University

On the invitation of MH Vatavaran, the environmental Society, an awareness programme was conducted on 'Plastics and Environment' for science and arts students and faculty at Miranda House College, Delhi University on September 9, 2009. About 50 students and 10 teachers attended the programme. The college has set up a vermicompost site within the campus. MH Vatavaran has been awarded funds by the Ministry of Environment, Govt. of Delhi to set up an herbal garden, facilities for mushroom cultivation and a polyloom to recycle plastic bags and sheets.

ICPE Participation in IPLEX '09 Exhibition, Chennai

ICPE participated in the IPLEX '09 Exhibition during September 4th to 7th, 2009 at Chennai. The Exhibition was organised by all major Plastics Associations of Southern

Region and was supported by Plastindia Foundation. The theme of ICPE stall was Plastics Waste Management and Recycling of Plastics – same as in Plastindia '09 Exhibition in Delhi during February 04-09. Awareness message was disseminated by display of panels, screening of short films, distribution of awareness booklets, leaflets and personal discussions.

Two-day Workshop on

'Solid Waste Management with Emphasis on Plastics Waste Management'

– Chennai, 2nd & 3rd September, 2009

A two-day workshop on Solid Waste Management was jointly organized by ICPE in association with Central Institute of Plastics Engineering and Technology (CIPET) on September 2nd & 3rd, 2009 at CIPET Auditorium, Chennai. The workshop was supported by Ministry of Environment and Forests.

Mr. Rajesh Lakhani, I.A.S., Commissioner, Municipal Corporation of Chennai, Mrs. Neelkamal Darbari, Joint Secretary, Govt. of India, Department of Chemicals & Petrochemicals and Mr. K. G. Ramanathan - President, ICPE, were the prominent guests, who spoke during the workshop. The workshop was attended by around 50 delegates who included government officials, officials from Tamilnadu Pollution Control Board (TNPCB), CIPET, Chennai Corporation, Town Panchayat, NGO's, Recyclers, Waste management companies – municipal authorities; officials from educational institutes, consultants, industry members, etc.

Prominents among the participants were - Dr. T. Swaminathan, Professor, IIT, Chennai, Mr. Mohan Naidu & Dr. Rajasekar – District Environmental Engineer, (TNPCB), Mr. R. Regunathan, Chief Engineer, Directorate of Municipal Administration; Mr. K. Balasundaram, Chief Engineer, Chennai Corporation, Mr. P. V. Narayanan & Dr. Sundar Balakrishnan, Harita NTI. Prominent companies participated were – ITC, ILFS Ecosmart Ltd., Acme Impex, NAUE GmbH & Co., Gorantla Geosynthetics Pvt. Ltd., Neel Metal Fanalca.

Important recommendations made at the end of the workshop were:

1. Single Agency to evolve Legislations/Regulations, Implement and Monitor Policies / Legal Action and to hold Judicial Powers with respect of Solid Waste Management.
2. This Agency to also raise funds through an 'environment cess' which should go to Authority as development fund besides equal contribution from State and Centre.
3. Promote the concept in education by incorporating in the school syllabus , Workshop and knowledge sharing with stakeholders, industry, industry, NGOs, students, bureaucrats, corporations, state pollution control boards etc. on regular basis.
4. Involve rag pickers with NGOs to handle activities of solid waste management
5. Authority to oversee Extended Producer Responsibilities, Corporate Social Responsibility, Taxation etc. as proactive rather than reactive approach.
6. Authority to be the Single Window Clearance for all issues relating to environment
7. Ban should be the last Option once all other options fail….. Self Regulation should be professed …..

On the mike: Mrs. Neelkamal Darbari. On the dias from right: Dr. D. H. Raiker, Mr. K. G. Ramanathan, Mr. Rajesh Lakhani and Mr. Krish Iyenger

8. Regulation through source segregation using multiple bins and value recovery by promoting technologies of deriving Fuel from waste plastics, Incineration, Use of plastics waste in Road Construction etc.
9. Landfill to be the last priority amongst waste disposal options. Value based options and evaluated periodically.
10. Approach to be 'Proactive' rather than 'Reactive' in terms of standardization of norms.
11. Expert committee to be set-up who would Visit sites, Study Machinery and Success Stories, Link Institutions for projects and also assist Judiciary.

One-day Workshop on
Multi-stakeholder Dialogue
jointly organised by ICPE and IPI on

Creating Collaboration for Sustainable Management of Post-consumer Plastics Packaging Waste

– Bangalore on 28th July, 2009

The aim of the workshop was to identify new directions, develop collaborative actions for managing post-consumer plastics packaging waste by bringing together participants from the whole supply chain – plastics producers, packaging fabricators, brand owners, municipalities, waste collectors and sorters, organizations involved with material separation, recovery, and reprocessing. The workshop focused on specifically on three packaging types that are rapidly growing in India without adequate systems for dealing with their waste. The areas covered were – Multilayer Food and Detergent Packaging, Plastics Bags and Expanded Polystyrene Packaging & Tableware.

The Workshop was conducted by Dr. Brian & Dr. Seetha Coleman-Kammula – the two principles at Simply Sustain, LLC of USA, experienced in sustainability and CSR for support projects.

Local NGOs, Corporate Houses, Local Civic Bodies, Plastics Associations had participated in the Workshop and number of Working Groups have been formed, who are expected to maintain a follow up on the Waste Management Activities as identified.

Plastics Waste in MSW in Mumbai

In many States of India, plastics waste is blamed as the major cause of Municipal Solid Waste problems. Without underestimating the problem of plastics waste, the reality can be stated that plastics waste form only about 5% of MSW stream in major Indian cities. NEERI report conducted at Mumbai in 2006, confirms this (reported in Eco-Echoes/ April-June, 2009 issue).

ICPE initiated independent studies on the characteristics of plastics waste in Mumbai through two different NGOs – National Solid Waste Association of India (NSWAI) and Environmental Greenliness. These studies revealed that ultimately less than 0.5% plastics waste as MSW is left in the landfill – most of plastics being picked up for recycling. Brief data is given below.

Study by NSWAI

The results are given in Figure 1. Waste generated at different points was characterised. The calculation of waste at every stage was made prior to any collection activity by the sweepers/rag pickers. The study shows that higher percentage of plastics waste was generated in higher income locality. Vegetable market generated the least plastics waste.

Due to lack of segregation, percentage of plastics waste at the source was found to be higher. But when it comes to community level, a major portion of the plastics waste, mostly the ones which are comparatively clean and more valuable, are segregated and picked up by rag pickers for selling to the waste dealers. By the time it reaches final disposal site, quantity of plastics waste reduces further – from a level of about 14% at source to about 6% at the disposal site.

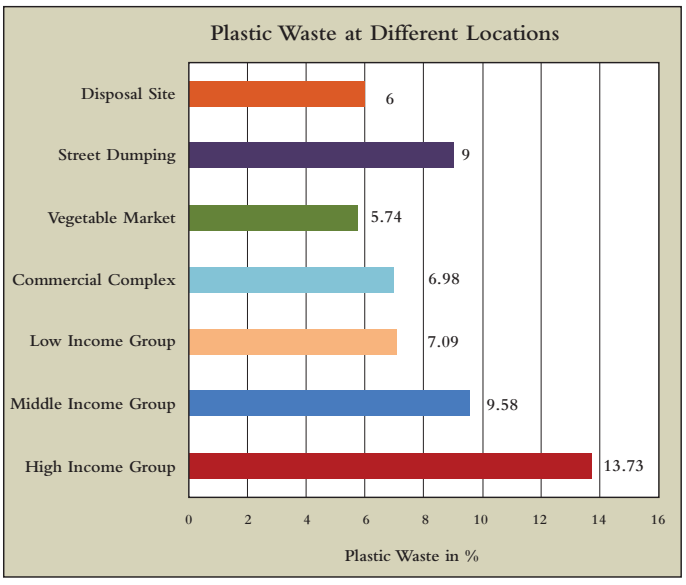


Figure 1

Study by Environmental Greenliness (at Deonar Landfill)

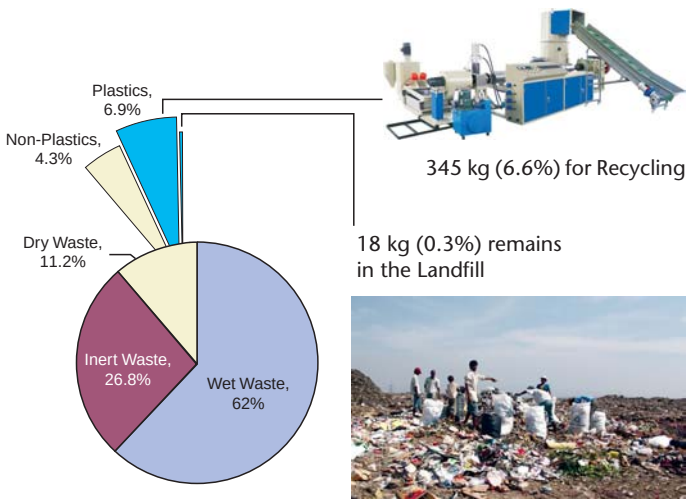
It was observed that the Compactors that bring the city MSW to the landfill contain about 5% plastics waste on an average. The MSW from 'D - Ward' (Higher Income Group area) contained about 7%, while that from – lower income areas contained about 2%.

It was also observed that more than 95% plastics waste brought to the landfill are picked up by the waste pickers and taken out of the landfill for selling to the waste dealers at an average price of about Rs. 3/ per kg. This finally leaves less than 0.5% plastics waste in the landfill area.

This is a clear indication that had waste been segregated at the source, there would have been negligible plastics waste in the MSW dumped in the landfill. Record of one Compactor load of MSW has been given with analysis as below:

Details of Waste in One Compactor		
	kg	**in %**
Dry Waste	586	11.2
Inert Waste	1400	26.8
Wet Waste	3238	62.0
Total Waste	**5224**	
Dry Waste		
Plastics	363	6.9
Non-Plastics	223	4.3
Plastic Waste Removed from the Landfill		
Total Plastics Waste at Landfill	363	6.9
Picked-up & Removed for Recycling	345	6.6
Plastics Waste Remaining in the Landfill	18	0.3

CHARACTERISATION OF TOTAL WASTE



Do Not Litter.
Keep Your Environment Clean.

- **Segregate and Throw Waste Only in Waste Bins.**
- **Use Two Bins – One for Wet Waste, One for Dry Waste.**

Plastics, Metals, Paper …
Can be recycled into useful products.

Waste Food and other Biodegradable Waste.
Can be composted into manure.

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