ICPE Envis Eco-Echoes

INDIAN CENTRE FOR PLASTICS IN THE ENVIRONMENT

Management of Plastics, Polymer wastes and Biopolymers and impact of Plastics on the Eco-system

Sponsored by

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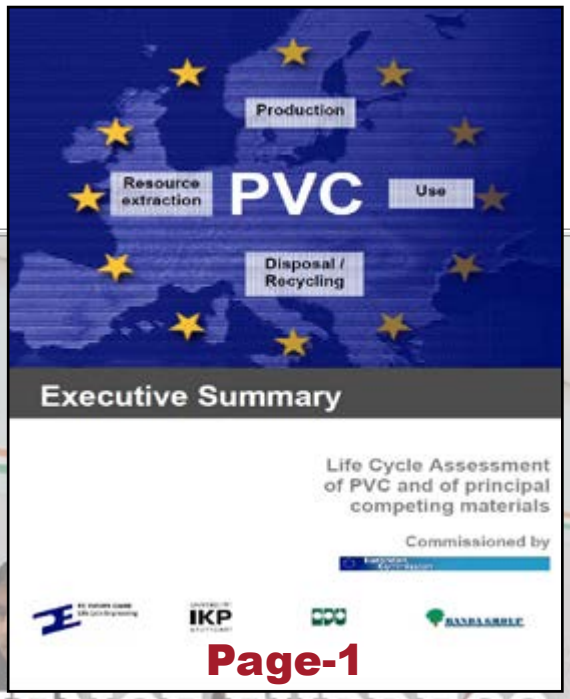

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Envis Eco-Echoes

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Editorial

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INDIAN CENTRE FOR PLASTICS IN THE ENVIRONMENT

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Capacity Enhancement Programme on Management of Plastics, Polymer Waste and Bio-Polymers, Impact of Plastics on Eco-System

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Since Alexander Parkes displayed the process of preparation of cellulose nitrate in an exhibition in London in 1862, which ultimately led to the commercial production of celluloid, recognized as the first man made plastics material, research work on synthetic plastics took momentum after the 1920s which saw the invention and commercialization of thermosetting plastics. More discoveries and inventions of synthetic plastics had started in the 1930s. After discovery of polyethylene at ICI in 1933, first commercial production of the material started in 1939. During this period commercial production of poly(methyl methacrylate) (PMMA) and polystyrene also started followed closely by the production of PVC (1940), polyacrylonitrile (1940), patent of polyethylene terephthalate (PET) followed by production of polyester fiber (Terylene) (1941), polytetrafluoroethylene (PTFE) (1945), acrylonitrile butadiene styrene (ABS) (1948). 1955 saw the first production of high density polyethylene (HDPE) closely followed by the production of polypropylene (PP) in 1957. From few million tons in the 1950s, production of plastics has reached about 250 Mn Tons in 2015. The cause of phenomenal increase in the usage of plastics is attributed to the various benefits provided by plastics.

These discoveries / inventions in the field of polymer science and technology changed the face of the world. Prof. (Dr.) M. M. Sharma, Padma Vibhushan and Prof. (Dr.) R. A. Mashelkar – Padma Vibhushan wrote) in the Compendium – 'Plastics for Environment and Sustainable Development' compiled by ICPE & CIPET(2003): "Plastics have moulded the modern world and transformed the quality of life. There is no human activity where plastics do not play a key role, from clothing to shelter, from transportation to communication and from entertainment to health care. Plastics, because of its many attractive properties, such as lightweight, high strength and ease of processing, meet a large share of the materials needs of human. From practically zero in the fifties, human kind today consumes greater than one hundred and fifty million tons of plastics. We truly live in a 'Plastics Age'. They also wrote: "The overall eco-friendliness of plastics become apparent when one evaluates the total 'life cycle' namely, an analysis of raw materials, energy, effluents, methods of disposal etc. of a material from its origin to its final disposal."

LCA Studies by various internationally acclaimed Institutes have shown that plastics reduce emissions compared to the alternatives thus helping in reducing climate change phenomenon, the most environmental concern the world is facing today. Apart from environmental benefits, plastics meet the stringent safety requirements laid down by various International Standardisation Authorities including the Bureau of Indian Standards for its safe use in direct contact with foodstuffs, pharmaceuticals and drinking water. Despite all these positive attributes, plastics attract severe criticisms for allegedly polluting the land and water in its physical form, an allegation which needs serious attention of all – the authorities as well as the general mass. Waste Management is the main challenge. Rules have been framed by GoI on PWM. However due to inadequate infrastructure and lack of monitoring of the rules coupled with littering habits of the general mass, the whole issue remains unresolved. All concerned are required to abide by the law for keeping our environment clean and safe.

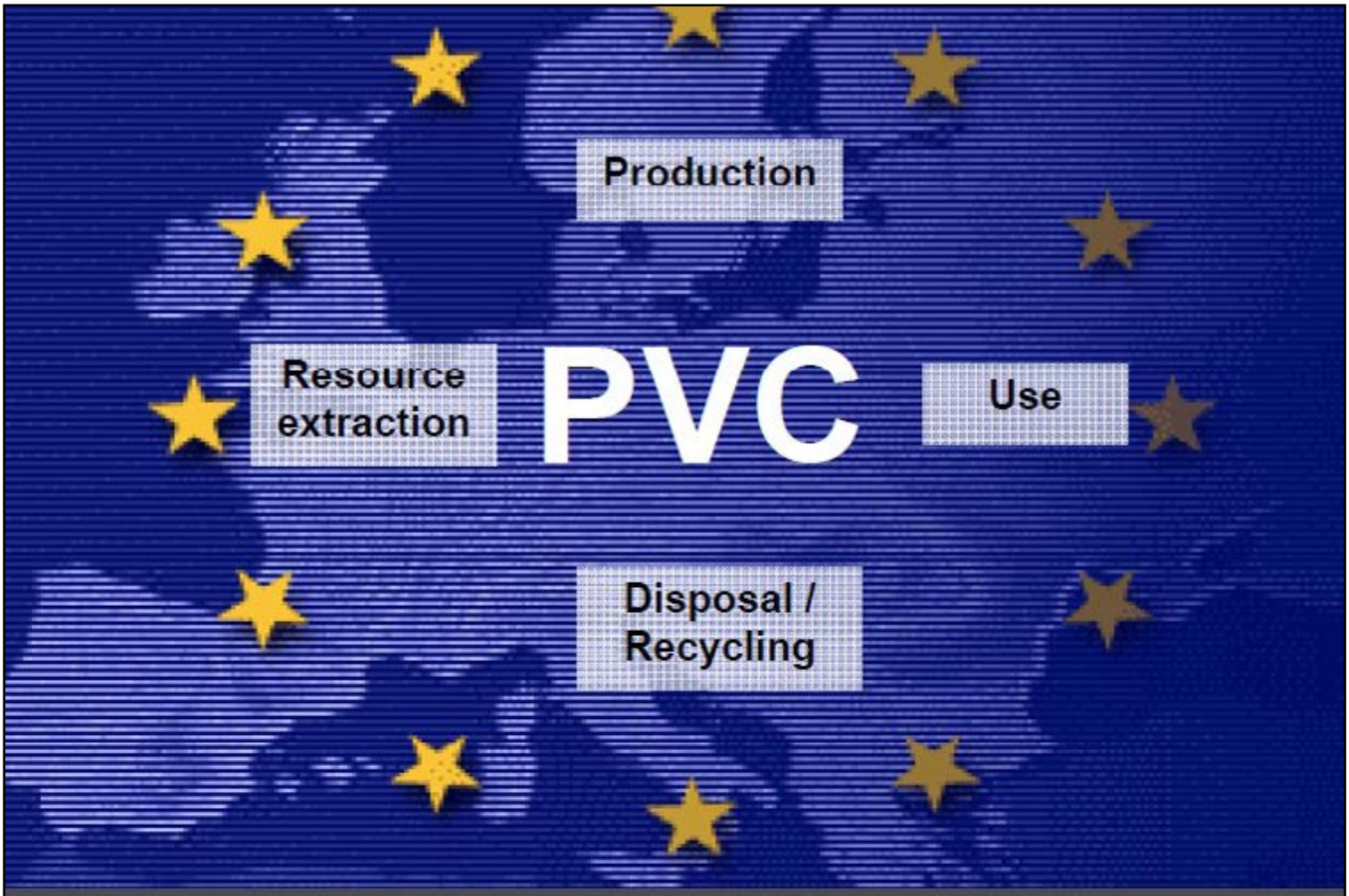
Subscription Information:

ENVIS is sent free of cost to all those interested in the information on Plastics and Environment.

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

Editor : Mr. T. K. Bandopadhyay

Life Cycle Assessment of PVC & of Principal Competing Materials
Commissioned By : European Commission



Executive Summary

Life Cycle Assessment of PVC and of principal competing materials

Commissioned by

European Commission

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Life Cycle Engineering

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Life Cycle Assessment of PVC & of Principal Competing Materials
Commissioned By : European Commission

Continued....

Executive Summary

The overall goal of the study was to compile an overview of the publicly available information on Life Cycle Assessments (LCA) on PVC and competing materials, for a variety of applications, in order to assess existing information and to identify information gaps.

LCA comparisons should be undertaken at application level rather than at material level. Depending on the kind of product, the environmental impact during use or after end-of-life can be even more important than the environmental impact of material production (e.g. fuel saving light-weight parts in automotive applications or use phase effects of the cleaning of flooring materials). Approximately 100 LCAs related to PVC have been identified, with only 30 making comparisons at the application level.

Many of the reviewed LCAs do not fulfil all requirements outlined by ISO 14040 ff.

LCAs are strongly goal and scope dependant. Therefore, two studies on the same product system may give different conclusions. LCAs do not aim to evaluate the effects of exposure and hazard related data in the way Risk Assessments do. LCAs identify the important environmental aspects and stages over the life cycle and Risk Assessments analyse exposure and hazard related information. However, they can both be used within one tool-box.

The following general conclusions on PVC and its life cycle can be drawn:

- **Within the PVC life cycle chain, the production of intermediates**, particularly the processes from the extraction of crude oil and rock salt up to VCM production, **plays a major rol**e for the environmental impacts.
- From a PVC life cycle perspective, the production of stabilisers and plasticizers plays a significant role, whereas the production of pigments offers a comparatively low optimisation potential, because of the small volumes used.
- Some **new technologies** exist, e.g. mechanical recycling based on selective dissolution, **for recycling PVC** in an **economically feasible** way. However, currently only a small amount of PVC post consumer waste is being recycled. Incineration, in conjunction with municipal waste disposal, is a simple option that allows for the partial recovery of energy and substances, if state-of-the-art technology is applied.
- Regarding the **positive effects of increasing recycling rates, mechanical recycling** (or material recycling), which loops the material back directly into new life cycles, substitutes, to a certain extent, the processes of resource extraction, intermediate production and granulation/ polymerisation during the production of virgin material. **Chemical recycling** (feedstock recycling) is another option of recycling PVC into another life cycle.
- In contrast to some metals, the recycling market of plastics, and therefore the demand in secondary material, is not yet established in an adequate way. Nevertheless, today and in the near future we see a mix of mechanical and chemical recycling pathways and state-of-the-art disposal routes as the most favourable way to optimise the environmental impacts of PVC and competing materials.
- The **user will not accept recycled products with lower optical or aesthetic quality** (colour, surface quality), even if the technical quality (mechanical properties, durability) is the same. This is especially true for building, electronic and automotive products.

The most important applications of PVC are in the building and construction sector (windows/ shutters, sheets, flooring and pipes), the electric and electronic equipment sector (predominantly cables), the transport sector (plastisols, artificial leather, dashboards, structural parts) and the packaging sector (non-beverage packaging). A remarkable amount of LCA information is available for building materials and products, but a strong dependence on the specific results and the goal and scope of the studies case-by-case remains.

The main findings concerning sector- and application-specific LCAs of PVC and its competitors are:

- For **windows**, one of the most important PVC applications, the **available studies** conclude that there is no "winner" in terms of a preferable material since most of the studies conclude that none of the materials has an overall advantage for the standard impact categories. The **most promising potential** for lowering environmental impacts **of windows** is expected through the **optimisation of the design**. Therefore the choice of material is of rather minor importance, as long as the material can provide the required system quality of the window.
- Most **flooring application** studies conclude that linoleum has comparable or slightly fewer environmental impacts compared to PVC flooring of equivalent quality in the production phase. One study (IPU 0013) states that wooden flooring tends to have lower impacts than PVC and linoleum, but is more demanding in the use and maintenance phase. There is little LCA information about carpeting, a main competitor for flooring applications.
- For **roofing applications** the available study concludes that a higher quality of the systems (thermal conductivity per thickness of roofing sheet layers) as well as the accuracy of the laying and maintenance processes has a large influence on the reduction of environmental impacts. The study reports that some polymer solutions tend to have lower environmental impacts than competitive systems.

Life Cycle Assessment of PVC & of Principal Competing Materials
Commissioned By : European Commission

Continued....

- The **results on pipes are very heterogeneous**. Some studies see clear advantages for concrete and fibre cement pipes, some report clear advantages for polymer pipes such as PVC and PE, some conclude that the material plays no role as long as no cast iron is chosen.
- The only **toy applications** requiring significant amounts of PVC are applications such as inflatable toys, paddling pools and rubber boats/ rafts. The potential risks associated with the misuse of toys (e.g. ingestion, sucking or chewing) are of particular concern. However, an LCA cannot analyse these risks properly, therefore, these concerns should be addressed using other tools, such as risk assessment.
- **Few comparative LCA studies** pertaining to **consumer goods** are available. No useful general conclusions on material comparisons could be drawn.
- The **relevance of PVC in packaging is decreasing.** PVC bottles tend to have comparable impacts to those of PET bottles; however, the market share of PVC bottles in Europe is now minor.
- In the **transport sector** (incl. automotive) many comparative LCA studies including PVC alternatives have been performed. However, these studies are confidential and were not available for analysis in this study.
- **PVC cable** does not seem to have significant competitors in many cable applications, therefore few PVC cable LCA studies exist. Recycling processes have been in place for some time, due to the high economic value of the recovered copper and aluminium. Economically feasible options exist for the recycling of recovered PVC.

No comparative LCA studies exist for materials used in medical applications, and little environmental optimisation in medical products has taken place thus far. Taking this into consideration, together with the large amount of waste produced by hospitals as a result of waste medical products, the potential of comparative LCA studies identifying methods for environmental improvement is expected to be high.

Background, Goal and Scope

In July 2000, the Commission adopted a Green Paper on the Environmental Issues of PVC. This was followed by a commitment to assess the impact of PVC on the environment using an integrated approach.

Apart from an approach based on PVC and additives in waste management, the question of potential substitution for certain PVC applications was raised.

Comparisons at material production level are insufficient as significant environmental impacts or benefits of materials may occur during the use and recycling stages. Hence only a comparison considering the entire life cycle of a material can show the full picture. LCA is a powerful tool for the analysis and optimisation of a product over its life cycle and is effective in broadly implementing life cycle thinking. The EU Commission concludes for Integrated Product Policy (IPP):

LCAs provide the best framework for assessing the potential environmental impacts of products currently available. They are therefore an important support tool for IPP. [IPP 2003]

Therefore, Life Cycle Assessments, preferably according to ISO 14040 ff (which is the International Standard on LCA and therefore guarantees a certain quality of results),are of primary interest.

Additionally, the level of current optimisation of a material should be considered. A material, which has been optimised continually over time, may show a lower potential for further improvement than a less optimised material.

Furthermore, it is recognised that potential substitutes or alternatives have to be compared at an application level, because important effects are related to the specific application of a material (e.g. weight reduction, reduction of energy consumption in mobile applications, maintenance), and are not limited to the production of the material.

Therefore, application of an adequate Goal and Scope in the Life Cycle Assessments must be verified.

Source:http://ec.europa.eu/DocsRoom/documents/12175/attachments/1/translations/en/renditions/native

DISCLAIMER: The statements and conclusions expressed are those of the project consortium and should not necessarily be regarded as stating an official position of the European Commission.

PVC Industry Position on RoHS

Brussels, 08 June 2010

ENVI Committee's proposal for restrictions on PVC in EEE not backed by facts

The European PVC Industry views the recast of the RoHS Directive positively, sharing its objective to reduce environmental impacts of products placed on the European market.

However, our industry is extremely concerned by the ENVI Committee's proposal to include PVC in the Priority List for potential substitution in electric and electronic equipment (EEE) (Annex III).

We are very disappointed that, yet again, we face proposals without sound scientific basis, nor care for appropriate methodology.

In order to ensure decision-makers have all the facts, we draw attention to the following:

- The European Commission Green Paper[1] states, *"at the current levels of chlorine in municipal waste, there does not seem to be a direct quantitative relationship between chlorine content and dioxin formation"*.
- The Green Paper on PVC was discussed in the European Parliament in April 2001. The Parliament called for the Commission to ensure the lifecycle impact on health and the environment for alternative products is assessed with at least the same degree of precision and objectivity as that used to assess PVC remains relevant.
- The *Life Cycle Assessment of PVC and of Principal Competing Materials study*[2], resulting from the Horizontal Initiative of the Commission on PVC, makes it clear there is no reason to discriminate against PVC in any application. The Horizontal Initiative on PVC (2000-2006) was focused on individual studies on end-of-life PVC, precisely the same issues now under consideration within the RoHS recast.
- The PVC industry responded in a concerted and practical way to the various concerns raised within the Green Paper. Most significantly, the Voluntary Commitment of the PVC Industry, "Vinyl 2010", provides the most effective way of delivering real improvements faster than any other approach,. The PVC industry's response is effective and measurable, governed by review dates, commitments on consultation and external verification.
- The PVC producing and transforming industry in Western Europe comprises more than 21.000 companies with more than 530.000 jobs and a turnover of more than 72 billion €. At a time of uncertain economic growth, listing PVC in Annex III would result in market uncertainty and de-selection of PVC by downstream industries in sectors well beyond E&E, We are particularly concerned by the unintended consequences this would have. It would pose a serious threat to the industry in the EU, with serious potential impacts on both the chemical and E&E sectors.
- Calling now for the restriction of PVC is inconsistent with existing regulation and an example of scaremongering. This would not only have a significant and unjustified negative impact on the PVC industry but would also undermine REACH.
- PVC and PVC waste are not classified as hazardous and are fully suitable for recycling and recovery, as proven by Vinyl 2010. Since the beginning of the program in 2000, nearly 700.000 tons of post-consumer PVC waste have been safely recycled.
- In addition, E&E waste is also and more and more generated locally in developing countries. Open-burning does unfortunately exist but is not general practice. Our industry believes it should be strictly forbidden, with local laws strictly applied. PVC recyclers in developingcountries have NO interest in open burning which results in lost income from plastic materials and has a very negative effect on the quality and value of metals (in particular copper) recovered. Introducing environmentally sound waste management practices is the ONLY way to prevent negative health and environmental issues in these countries.

We call on decision-makers to stick to sound science.

Helmuth Leitner
General Manager ECVM

Jean-Pierre De Grève
General Manager Vinyl 2010

Alexandre Dangis
Managing Director EuPC

[1] For more information on the comprehensive investigation made by the European Commission on PVC issues in the period 2000-2006 (PVC Horizontal Initiative), please visit: http://ec.europa.eu/environment/waste/pvc/index.htm and http://ec.europa.eu/environment/waste/pvc/pdf/en.pdf

[2] See http://ec.europa.eu/enterprise/sectors/chemicals/files/sustdev/pvc-final_report_lca_en.pdf

ICPE ENVIS Centre Awareness Campaign at (Valsad Station) From 20th to 22nd April 2016

Science Express Climate Action Special (SECAS) was flagged off on 15 October 2015 from Delhi Safdarjung Railway Station by Dr. Harsh Vardhan, Hon'ble Minister of Science & Technology and Earth Sciences; Shri Suresh Prabhakar Prabhu, Hon'ble Minister of Railways; Shri Prakash Javadekar, Hon'ble Minister of Environment, Forest and Climate Change; Shri Y. S. Chowdary, Hon'ble Minister of State for Science & Technology and Shri Manoj Sinha, Hon'ble Minister of State for Railways in presence of several other dignitaries and guests.

SECAS is an innovative mobile science exhibition mounted on a 16 coach AC train which has been custom-built for Department of Science & Technology (DST) by Indian Railway. The state-of-the-art exhibition aboard the 'Science Express Climate Action Special (SECAS)' aims to create awareness among various sections of society, especially students, as to how Climate Change can be combated through mitigation and adaptation.

The SECAS was scheduled to travel across the country for about seven months, halting at 64 locations in 20 States, covering 19,800 km.

SECAS arrived at Valsad station on 20th April, 2016. ICPE ENVIS Centre did Awareness Programme at Valsad Station during the scheduled visit of Science Express organised jointly by DST and MoEF CC in collaboration with Indian Railways, has been highly successful.

More than 12, 000 students of Class V to Class XII from more than 20 Schools in and around Valsad including one which is 60 km away from Valsad, visited the Science Express and most of them had seen ICPE Display Panels and many of them had interacted with ICPE team during the visit.

Number of teachers including principals of many schools were more than 100. ICPE awareness leaflets were distributed among all the schools through the teachers / principals.

Inside the train, image of plastics has been shown incorrectly. We contacted the accompanying staffs of DST and expressed our concern. ICPE Envis Team gave leaflets & other useful study material to the staff to make them understand better about plastics. At last they understood that Plastics are Environment friendly and assured that they would not advise the visiting students and members of public any ill of plastics.

MoEF & CC ENVIS Secretariat is glad that so many students had gathered and ICPE could establish contacts with the teachers of all the visiting schools.

Some of the pics from the awareness campaign at Valsad Station are given below

Celebration of Swachh Bharat Pakhwadas along with World Environment Day on 5th June, 9th and 13th June, 2016

ICPE ENVIS Centre on Management of Plastic, Polymer Wastes and Biopolymers and Impact of Plastics on the Eco System – Mumbai

ICPE Envis Centre started the celebration of Swachh Bharat Pakhwadas on The World Environment Day-2016 by launching two posters on the theme of "Save Environment". ICPE released two posters which urge all to save environment by taking a pledge on the following.

1. Save Trees
2. Save Electricity
3. Save Water
4. Carry your own Bags
5. Do not Litter

ICPE ENVIS Centre organised an Awareness programme along with SIES – Indian Institute of Environment Management & SIES – School of Packaging, Packaging Technology Centre on 9th June, 2016 at SIES premises, Nerul, Navi Mumbai.

The Awareness programme has been attended by Shri P.V Naraynan, Chairman SIES – School of Packaging, Dr. Saumya Singh, SIES, Dr. C.Srinivas of SIES-IIEM, Dr. Devayane Savant – SIES IIEM, Dr. Sneha Mishra- SIES IIEM, Shri N.Sethu – SIES, Ms. Anjali Kapoor-SIES, Shri T.K.Bandopadhyay, Technical Director ICPE & ICPE ENVIS Centre Coordinator, Shri T.V. Srinivasan, Accounts cum Adm. Executive, ICPE, Shri Sudheer Khurana, Sr. Programme Officer, ICPE ENVIS Centre. 100 Students and their respective Professors of SIES – Indian Institute of Environment Management & SIES – School of Packaging, Packaging Technology Centre also attended the programme.

Shri P.V Naraynan, Chairman SIES – School of Packaging started the programme by deliberating the students & professors about ICPE ENVIS Centre & its activities. He also briefed the audience about the facts about plastics and the value of waste management. After that ICPE ENVIS Centre showed two Films named "Listen Plastics have something to Say" & "Meri Marzi- A Film on Waste Management" followed by a Presentation By Dr. C.Srinivas of SIES-IIEM on the subject "Plastics: BOON OR BANE?" & Presentation by Shri T.K.Bandopadhyay on the Subject "Impact of Plastics on the Eco Systems – Benefits, Issues & Solutions."

After the presentations the students have been asked to give their ideas & solutions on the issues of plastics & waste management. Students presented their views & gave innovative solutions to the current waste management problems. ICPE ENVIS Centre has given one First prize & 3 Consolation prizes to the Participants who actively gave suggestions. Shri Narayan ended the programme by giving a Vote of thanks to ICPE ENVIS Centre Team & all the participants. He also assures ICPE ENVIS Centre to have more awareness programmes in the coming years.

ICPE ENVIS Centre also organised an Awareness programme along with Kerala Plastics Manufacturers Association (KPMA), NSS Unit 183 on 13th June, 2016 at Sreenarayan Higher Secondary School, Kochi. Mr. Joseph Sander, President, KPMA, Mr. Bava Vice President KPMA & Mr. Pranoj Prabhakar, Executive Member of KPMA along with Mrs. Geetha Murli of ICPE were present during the programme along with the officials. 400 Students of Class 12th and their teachers attended the Programme. Awareness pamphlets and ICPE ENVIS Newsletter were distributed among students and teachers.

POSTERS LAUNCHED ON ENVIRONMENT DAY....09th June, 2016

Pictures of all the Celebrations of Swachh Bharat Pakhwadas along with World Environment Day on 5th, 9th and 13th June, 2016

Sree Narayana Higher Secondary School, Cochin, Ernakulum Dist.

Guinness World Record: Bisleri, John Abraham Felicitate Schools for Helping them

The idea behind the record was to propagate the Swachh Bharat campaign, initiated by Prime Minister Narendra Modi, by launching a school contact programme. To reach out to maximum students and spread awareness, the world record attempt was taken up. To mark the success of the Bisleri Swachh Bharat Plastic Bottle Recycling Initiative, Bisleri International felicitated schools who had helped Bisleri in winning The Guinness World Record for collecting the **Highest Number of used Plastic Bottles for Recycling**. These schools were rewarded with participation certificates from Guinness World Records, Limca book of records and gifts & certificates from Bisleri.

The earlier Guinness World Record was 13,408 kgs which was achieved by a school in Florida. Bisleri surpassed that record by collecting 23,538.9 kgs of PET bottles i.e.1.1 million bottles, and entered Limca Book of Records as well as Guinness Records. 105 prestigious schools in Mumbai and over 2 lakh students had participated in this collection activity to help the beverage company achieve this milestone of winning Guinness World record. To honour and motivate the students Bollywood Actor, John Abraham, Vijay Merchant, one of the founder members of Indian Centre for Plastics in the Environment (ICPE) and Sameer Unhale, State Mission Director, Swachh Maharashtra Mission directorate, Govt. of Maharashtra were also present. Bisleri promotes the idea of collection of bottles to avoid environmental nuisance. The company believes in recycling the plastic bottles to non-food items only.

Speaking on the school felicitation, Ramesh Chauhan, Chairman, Bisleri International, said, "The message to Indian consumers is that plastic bottles are valuable resources even after they've been used. The simple act of recycling helps generate local revenue, supports recycling jobs, and enables us to continue to benefit from these useful resources. It is a matter of pride for us as a company that we have been able to gather more than 1.1 million PET bottles for recycling with the help from all these kids who are going to be the future of the country. This initiative has helped change the mindset of the people towards plastic bottles and has inculcated good values in the children and made them believe that they can make a big difference by taking a small step." The bottles collected during the activity will get a second lease of life as eco-friendly products and will be recycled into non-food items like T-shirts, bags, sheets, carpets, etc. To encourage the use of such products Bisleri handed goodies made from recycled bottles to the students. PET is the acronym for Polyethylene Teraphthalates - a kind of plastic among the several types available and used for different purposes on a day-to-day basis. Bisleri's bottled mineral water too is manufactured by making use of PET plastic. Over decades, Bisleri has been successfully supporting the recycling of tonnes of PET every year, leading to fruitful 'asset management'.

Top ten Mumbai schools with maximum collection were, Infant Jesus School, Pawar Public School, D. G. Khetan International School, Christ Church School, Ryan International School, St. Xavier's High School, Kudilal Govindram Seksaria Sarvodaya School, Yashodham High School, Bombay Scottish School and Don Bosco High School.

Source : http://www.indiainfoline.com/article/news-business/guinness-world-record-bisleri-john-abraham-felicitate-schools-for-helping-them-116041300703_1.html

Shri Vijay Merchant with the Students →

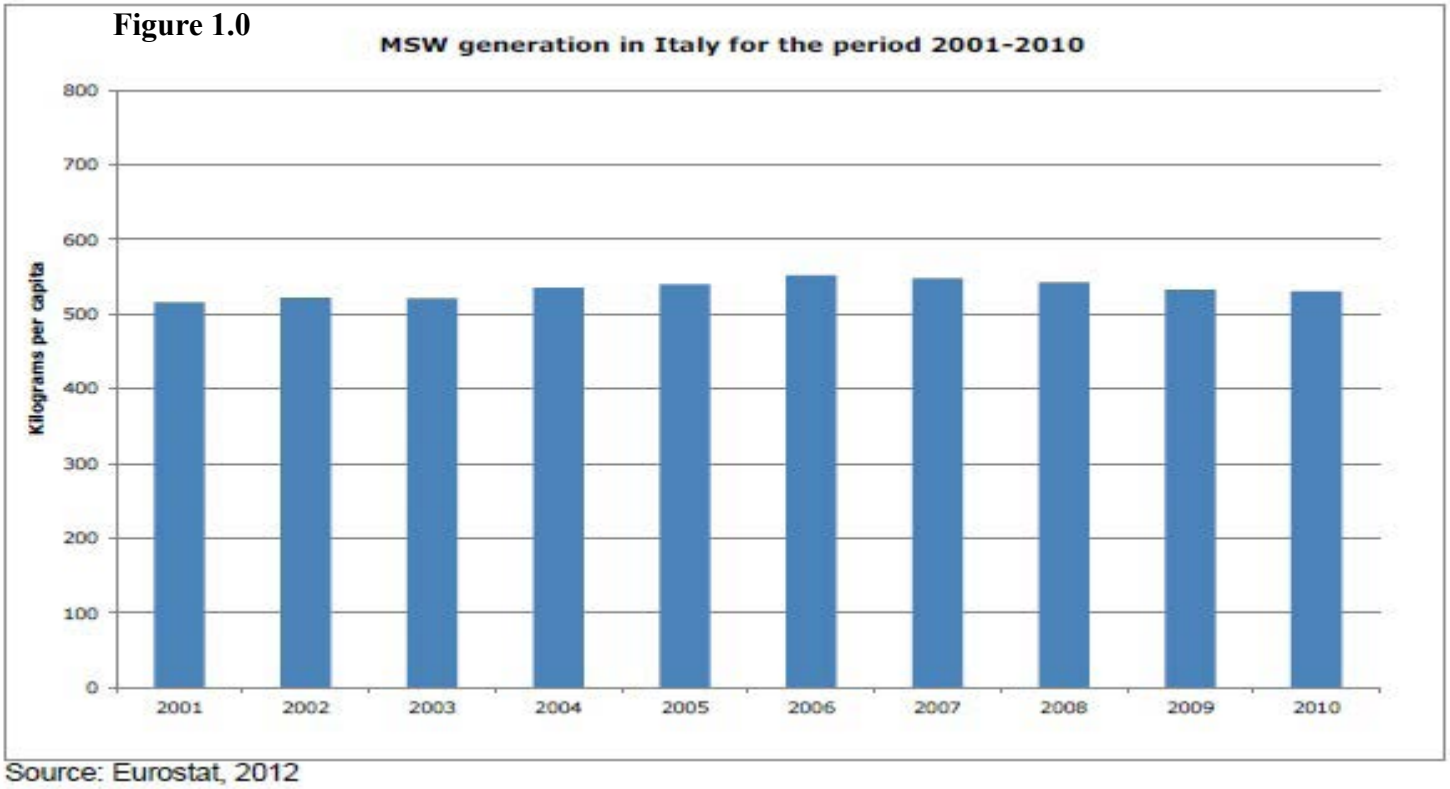
← ***Bollywood Actor, John Abraham & Shri Ramesh Chauhan, Chairman, Bisleri International with the Students & teachers***

Shri Ramesh Chauhan, Chairman, Bisleri International & Bollywood Actor, John Abraham

DATA SHEET

MSW Generation per capita in Italy, 2001-2010

Figure 1.0



Source: Eurostat, 2012

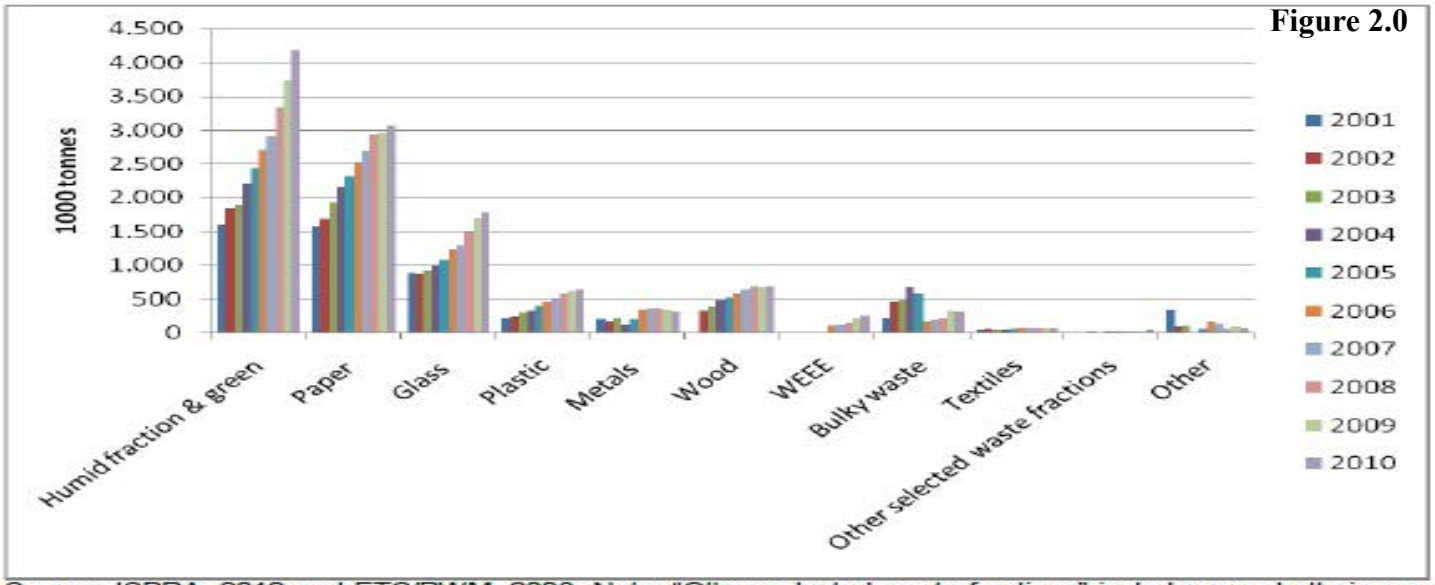
Figure 1.0 shows the development of MSW generation per capita in Italy from 2001 to 2010 (the data for 2010 is a Eurostat estimate). There has been a slight increase in MSW generation per capita from 2001 to 2006 (from 516 kg/ inhabitant to 552 kg/inhabitant), followed by a slight decrease in the second half of the decade (531 kg/inhabitant in 2010).

According to ISPRA (2012), which reports 32.5 million tonnes of MSW generation in 2010 and 532 kg/inhabitant, there are remarkable differences in per capita production across regions; in 2010, e.g., MSW generation ranged from 413 kg/inhabitant per year of Molise to 677 kg/inhabitant per year of Emilia Romagna.

Figure 2.0 illustrates, in absolute terms, the separate collection of different waste fractions at Italian level, between 2001 and 2010 (ETC/RWM, 2008 and ISPRA, 2012)1. It emerges that the separate collection of organic waste has increased by a factor of 2.6 in the 2001-2010 period and separate collection of biodegradable waste as a hole (organic waste, paper, wood, and textiles) represented on average, over the same period, 69 % of the total.

Figure 2.0 Separate collection of different waste fractions at national level, 2001-2010 in Italy

Figure 2.0



Source: ISPRA, 2012 and ETC/RWM, 2008. Note: "Other selected waste fractions" include, e.g., batteries and accumulators, out-of-date medicines, paints, vegetable oils, etc.

PLASTICS

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