




## IN THIS ISSUE




### Plastics Waste In Road Construction

Vidyasagar Street - Kalyani, West Bengal

**Improves Quality of Asphalt Road**  
**Reduce Cost of Construction**  
**Addresses Disposal Issue of Plastics Waste**



Indian Centre for Plastics in the Environment

### Page-1

**USE OF PLASTICS WASTE  
IS A DEFAULT MODE IN  
CONSTRUCTION OF  
ASPHALT ROAD IN INDIA NOW**



### Role of Women IN Swachh Bharat Abhiyan

1st OCTOBER 2015

**Supporters:** Department of Resource Management, Mini Theatre SNT Women's University

**Co-Sponsored by:** Meri Saheli, New Woman, Sanjivani

**Organized by:** NSWM, Envis Centre

**Venue:** Mini Theatre SNT Women's University, Juhu, Mumbai

### Page-5

**ROLE OF WOMEN IN SWACHH  
BHARAT ABHIYAN  
SEMINAR AT  
SNT WOMEN'S UNIVERSITY,  
JUHU, MUMBAI**

### NAME OF THE ENVIS CENTRE



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#### Area of Activity

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

#### Head of Institution

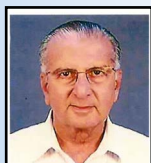
**Mr. K. G. Ramanathan**  
President - GC



#### Other Office Bearers



**Mr. S. K. Ray**  
*Hon. Secretary /  
Member - EC*



**Mr. P. P. Kharas**  
*Hon. Treasurer /  
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**Mr. Vijay Merchant**  
*NGO - Project  
Member - GC*

**ICPE-ENVIS Co-ordinator**  
**Mr. T. K. Bandopadhyay**  
Technical Director



#### Designed By

**Mr. Sudheer Khurana**  
Sr. Programme Officer



In a significant policy decision Government of India, Ministry of Road Transport and Highways has made it mandatory to use plastics waste for the construction of bituminised roads in the entire country. In a Government Circular, the Ministry has directed all State Governments and Union Territories that "Bituminous mix with waste plastics shall be the default mode for periodic renewal with hot mixes within 50 kms periphery of urban area with population more than 5 lakhs." The Circular continues to direct that "Any relaxation on ground of non-availability of waste plastics, cost etc shall involve approval of the Ministry". Primary reason for issuance of such direction is due to the fact that waste plastics improves the desirable properties of bituminous mixes leading to improved longevity of roads. The Ministry also realized that this practice would resolve the plastics waste management problems to a great extent

Before this decision of the Ministry, Indian Road Congress (IRC), the highest technical body in the country in the matters of Standardizations of specifications on roads, had published "Guidelines for the use of plastic in hot bituminous mixes (dry process) in wearing coats". On the basis of this IRC Guidelines, Union Government has taken such bold policy decision.

Indian plastics industry could not expect a better policy decision by the Union Government; a decision which is based on science. This has not happened easily. Three to four organizations / Institutes, including ICPE worked relentlessly for the last more than a decade to establish this scientific phenomenon by field demonstrations. A brief on these efforts have been published in this edition of ENVIS Eco-Echoes.

All plastics waste, mixed and commingled can be used for this application. Thus the major issue of plastics waste management could be resolved to a great extent in the country. Now it is the responsibility of the plastics industry and the users of plastics to ensure the availability of plastics waste as per the specifications of IRC so that any Government Road Department need not approach the Ministry for waiver of the rule on ground of non-availability of plastic waste.

Organising Awareness Programmes is an important activity to spread the correct information to masses. ICPE has been doing this activity from its inception in 1999 propagating the idea of two bin culture of waste collection at the source of waste generation for facilitating the waste management system. Government Authorities had come out with Notifications covering this aspect. It is now seen that Courts also pass Orders to Civic Bodies to adhere to such directions included in the Rules. One such Order of Karnataka High Court as published in a Newspaper has been reproduced in this Edition.

In the Data Sheet, the formulae and CAS numbers of different types of 'Phthalates', a chemical used for plastics, paints/ adhesives etc industries for formulating the products. The details of the status on their safe use in food contact applications would be covered in future Editions, for ready reference.

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#### 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.

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#### Editor

Mr. T. K. Bandopadhyay



# Use of Plastic Wastes in the Construction of Bituminised Road

## India Makes it Mandatory: Aims for Quality Roads and Cleaner Environment

Road engineers have been experimenting with use of certain synthetic polymers to improve the binding property of asphalt roads. Polymer blended bitumen shows higher softening point, lower penetration value, and better ductility. Polymer coated aggregates blended with bitumen gives higher Marshall Stability value – a key property in asphalt road. All these aspects improve the performance criteria of asphalt road. However, the high cost of virgin synthetic polymers limited their use only in higher cost application area.

It was while looking for a cheaper and viable alternative to virgin synthetic polymers that Indian scientists stumbled across plastic waste as an effective substance. Simultaneously, it was also proved to be a scientific and environment-friendly method of disposal of low-end plastics waste, especially the thrown away carry bags and some varieties of one-time used flexible plastics packaging waste materials. Though plastics waste are recyclable and are collected for appropriate recycling process for conversion into various products of non-critical and secondary applications, these low-end plastics waste are generally abandoned by the waste pickers due to difficulty in cleaning and segregation. Collection process of these light weight plastics waste become an unviable proposition. On the other hand, these low-end plastics waste can be used for road construction without elaborate cleaning and segregation. By simple conventional techniques, these are shredded into small sizes and are mixed with hot bitumen and / or hot aggregate.

In the batch process, the aggregates are heated to a range of 170 – 180 degree Celsius in a hot mix plant and the shredded plastics waste is added to it. The plastics become softened and get coated over the aggregate. The hot bitumen mixed or without mixed with plastics waste is then added to the plastic coated aggregates and mixed well. This mixer in hot condition is then transferred on to the road for laying. In the continuous plant, the shredded plastics waste is spread over the aggregate with the help of automatic dosing machine. The aggregate with shredded plastic enters the hot rotor, where the plastics get molten and is deposited on the surface of the aggregate in the first half of the rotor. Molten bitumen is then sprayed on the plastics coated aggregates, which is still under rotation inside the rotor. Such mix is then taken out and used for laying the road. In another technology, waste plastics are mixed only with hot and molten bitumen and this molten bitumen-plastics waste blend is then mixed with the aggregates and laid on the road.

Experiments have proved that use of waste plastics increases the life of roads and at the same time the cost of construction of such roads also comes down due to the fact that cost of plastics waste after proper shredding is less than that of bitumen. 10 to 15% replacement of bitumen by plastics waste is possible, beyond which the Marshall Stability values decrease and hence is not recommended. Even 10% replacement of bitumen by plastics waste reduces the overall cost substantially.

For 1 KM long road of 14 feet width, 2 MTs of bitumen can be replaced with equal quantity of plastics waste and the cost saving is approximately Rs 40, 000/. Life of the road also is extended. Lesser use of bitumen also implies that CO2 emission during its heating process is reduced to that extent. India is considered a pioneer in using plastics waste for the construction of asphalt roads. Central Road Research Institute (CRRI), Delhi – a CSRI Institute under Government of India, had developed the Wet Process and had obtained a Patent on the Technology. A private sector entrepreneur of Bangalore, with the arrangement with CRRI, Delhi, worked for popularizing the concept in Karnataka State and elsewhere. Almost simultaneously, Thiagarajar College of Engineering, Madurai had developed the Dry Process and the Institution too obtained a Patent on the process. All these happened in the early 2000. Hundreds of miles of roads have been constructed in the States of Tamil Nadu using the technology developed by Thiagarajar College of Madurai.

Initially ICPE encouraged the development and popularization of concept of using plastics waste for construction of asphalt roads by using both Wet and Dry process developed by in the country. ICPE and CRRI had jointly constructed a trial road in the Bawana area in Delhi. ICPE also had conducted trial using the other process. Dry Process being capable of utilizing more quantity of plastics waste, ICPE focused its interest in popularizing the technology. However due to the Patent Rights holding by the original developer, ICPE researched to innovate another Technology for utilizing the plastics waste for the construction of Asphalt Roads, so that there is no hindrance in using the process without any obligation of paying any royalty / fee to anyone. This process was first applied in constructing asphalt road at Mumbai. ICPE had worked with the Road Engineering Department of Municipal Corporation of Greater Mumbai – MCGM and applied this technology in constructing a very busy road near Dadar Railway Station – Prof. V. S. Agashe Road, in the early 2008. The condition of the road remained good even after five rainy seasons.

### Construction of Asphalt Road with Plastics Waste Near Dadar Railway Station, Mumbai



*Shredded plastics being prepared*



*Shredded plastics being added from dosing device over the Aggregates on conveyer belt*



*Aggregates with plastics waste enter the hot rotor*



# Use of Plastic Wastes in the Construction of Bituminised Road

## India Makes it Mandatory: Aims for Quality Roads and Cleaner Environment

*Continued....*



**Plastic Coated Aggregates blended with bitumen being loaded on the transporting vehicle**



**Road being Constructed**



**Prof. V.S. Agashe Road after construction: April 2008**



**Road after 6 months**



**Roads after one season : June 2009**



**Road after two rainy seasons: July 2010**

### Construction of Asphalt Road with Plastics Waste at Kalyani near Kolkata

After the construction of road in Mumbai, ICPE in collaboration with Indian Plastic Federation (IPF), Kolkata had taken up the projects to construct such roads in three locations near Kolkata in 2009 and 2010. ICPE provided the technology for constructing about 1.25 KM stretch Bidyasagar Street in the busy Kalyani city area, near Kolkata in 2009. In the following year two more roads were constructed in Chandan Nagar and Ashokgar Municipality area of the adjoining districts. Quality of the roads remains good even after five years.



**Discussion with Engineer and Contractors of Kalyani Civic Body**



**Plastic Waste**



**Shredded plastic waste being mixed with aggregates: Batch Process**



**Mixing With Bitumen**



**Batch Mixing Plant**



**Bidyasagar Street made with Plastics waste in 2009**

**No damage in road condition after 3 years**



# Use of Plastic Wastes in the Construction of Bituminised Road

## India Makes it Mandatory: Aims for Quality Roads and Cleaner Environment

*Continued....*

### Construction of Asphalt Road with Plastics Waste at Chandan Nagar and Ashok Nagar near Kolkata

Construction of road at Kalyani Municipality in April 2009 and its good performance report encouraged other Municipality authorities to take decision to replicate the same in their areas too. People of Ashok Nagar, having 100% literacy rate (it has 100 primary schools) and Chandan Nagar Municipality – a former French Colony, basically do not indulge in littering in general. IPF team's persuasion helped the civic authorities to take decision of disposing of the plastics waste in a scientific way by using those for constructing road. ICPE had provided all technical assistance before and during the road construction. The great enthusiasm showed by the Heads of the Civic Authorities and the conviction of the Executive Engineers of both the Municipalities helped in undertaking the trial constructions.

At Ashok Nagar Kalyangarh Municipality, total length of about 1 KM was selected by the Municipality authority for the trial construction of asphalt road with plastics waste. Municipality Chairperson, Mayor, Mayor-in Council, Chief Engineer, Leader of the opposition party – all attended and witnessed the trial. The Municipality Chairperson informed that after observing the performance of the road in the coming monsoon, all roads of the municipality would be constructed using waste plastics in future. They also informed that they were encouraged by the good performance of the road constructed at Kalyani municipality in the previous year. Formulation was similar to the one conducted at Chandan Nagar. Seal coat was used on the top layer.

It is hoped that the awareness programmes would help spread the message to other areas as well facilitating disposal of waste plastics in an environment friendly manner and at the same time enhancing the life of the Asphalt Roads at a lower cost.



**Road workers are mixing plastics waste with aggregates**



**Blend is discharged at right temperature condition**



**Chairperson of Municipality carries the blend for laying**



**Completed road with seal coat. Ashok Nagar - Kalyangarh Municipality takes initiatives in this road construction using waste plastics for environment protection**



More and more civic authorities in India took initiatives to utilise the technology for triple benefits – improvement of quality and life of the road, reduction of cost and scientific disposal of low-end plastics waste. Indirect benefit includes engagement of the waste pickers for earning livelihood. Industry Major – Reliance Industries Ltd has taken keen interest in the technology and has arranged to construct such roads within its own complexes in Hajira and Vadodara. Many other organizations and Institutes like CIPET, Shriram Institute for Industrial Research (SIIR) also used this technology. Road Department of Gujarat Government has approved construction of trial roads in Vadodara and Surat. Plastics that normally do not get recycled due to economic and other reasons would no longer go to the landfills. In this scientific method, plastics waste mainly flexible packaging waste, which remains uncollected by the waste pickers due to low demand by the recyclers due to difficulty in conventional recycling process, can be disposed of in an environment friendly manner and the same time improving the quality of the bitumen roads. All these efforts in popularizing use of plastics waste for road construction by CRRI, Delhi, Thiagarajar College of Engineering, Madurai and M/s K.K. Polyflex, Bangalore, ICPE and some other Institutions ultimately resulted in Government of India's taking decision for use of waste plastics for the construction of bituminized roads mandatory. This would pave the way for collection of abandoned plastics waste for road construction activity. This is considered as a BOLD STEPS BY GOVERNMENT OF INDIA.

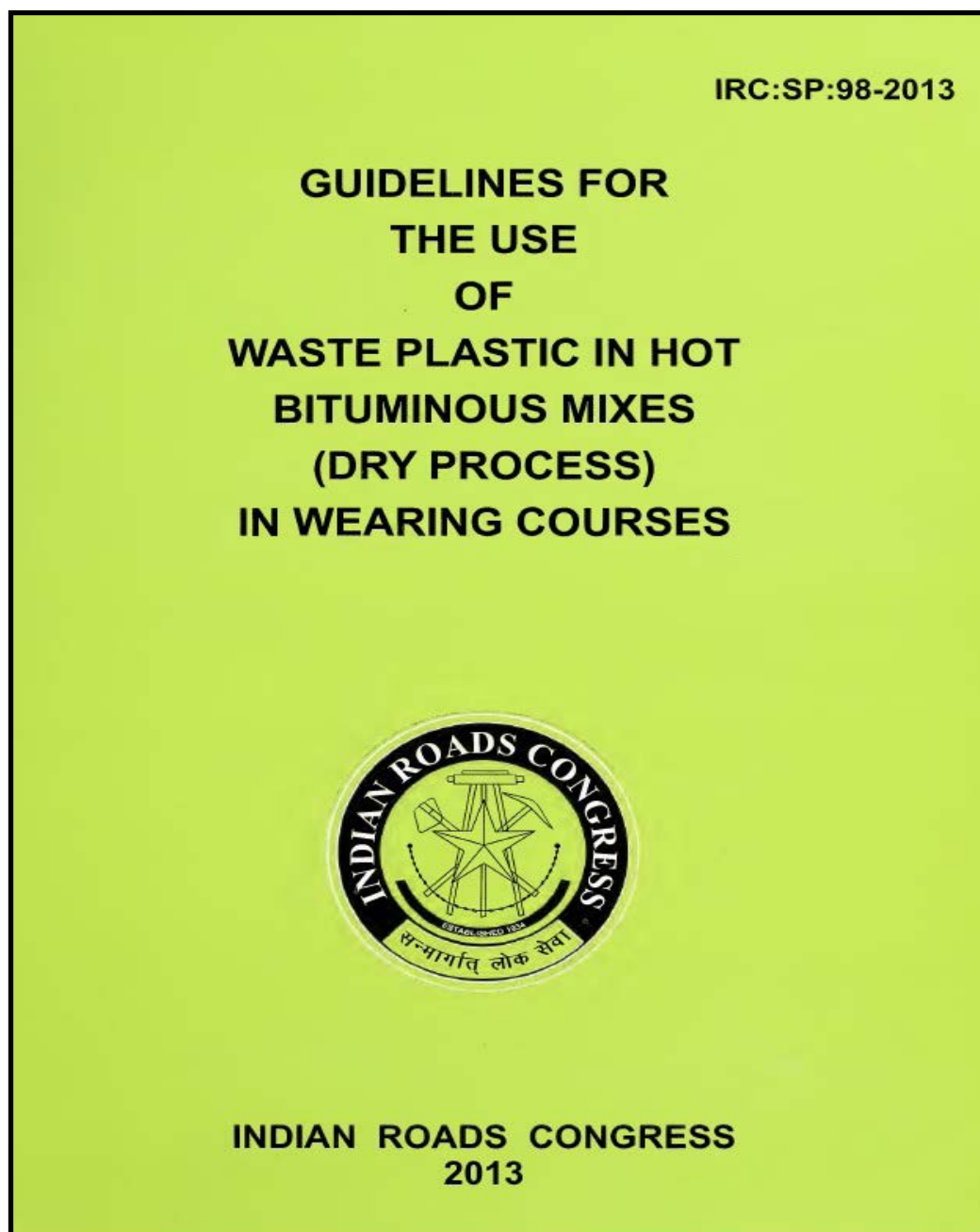
Excerpts from the Circular dated 9th November, 2015 issued by the Ministry of Road Transport & Highways, Government of India:

#### QUOTE

The Ministry has decided to encourage use of plastic waste in the hot mix bituminous wearing coat. Accordingly it is decided that:

- Bituminous mix with waste plastic shall be the default mode for periodic renewal with hot mixes within 50 kms periphery of urban area having population more than 5 lakhs. Any relaxation on ground of non-availability of waste plastic, cost etc. shall involve approval of the Ministry.
- All the agencies responsible for preparation of project reports / estimates for the National Highways and Centrally sponsored works are expected to analyse and clearly bring out reasons of inclusion or otherwise of provision of use of waste plastic in wearing coats in the proposal.

#### UNQUOTE





# ROLE OF WOMEN IN SWACHH BHARAT ABHIYAN SEMINAR AT SNDT WOMEN'S UNIVERSITY, JUHU, MUMBAI

On 1st October, 2015 ENVIS Centres of ICPE and NSWAI jointly organised a Workshop on the theme – “Role of Women in Swachh Bharat Abhiyan” with the support of Department of Resource Management, SNDT Women's University, Mumbai and with the Co-sponsorship of well known Woman Magazines – Meri Saheli, New Women and Sanjivani at the Mini Theatre of SNDT Women's University, Mumbai. Smt. Seema Redkar, Ex- OSD, Solid Waste Management Cell of Brihanmumbai Municipal Corporation (BMC), as a Guest speaker, recollected the contributions made by the women workers in keeping the city clean. Smt. Mrinal, a veteran woman worker of an NGO, who made significant contributions in BMC's cleaning work, was felicitated in the Workshop.

Prof. Jayant Joshi explained the easy process of Home Composting of Organic Waste generated at homes of common people. Dr. Amiya Kumar Sahu, President, NSWAI talked on Management of MSW and Shri Tushar K Bandopadhyay, Technical Director, ICPE explained how all types of plastics could be recycled by one process or other. Prof. Manjit Singh Kaur, of SNDT Women's University informed the gathering about the special training imparted among the women students so that they remain sensitive about the responsibility of keeping the environment clean and safe. Special thanks were given to the women magazine company for their assistance.





# AWARENESS PROGRAMME AT ANJUM-I-ISLAM JR. COLLEGE, MUMBAI

As a part of its important agenda, ICPE Mumbai office had organised School Awareness programme at ANJUM-I-ISLAM JR. COLLEGE, MUMBAI 14th December, 2015. About 80 students of Class XI of different streams had attended the programme along with their teachers. From ICPE, Shri Tushar Bandopadhyay, Shri Sudheer Khurana and Smt Sangeeta participated. The programme included screening of awareness films followed by deliberations on the subject. Students interacted during the deliberation on how they could contribute in the waste management and clean-up activities. This question was raised by the coordinating teacher of the School also. ICPE had explained that, if the school authority could allocate a specific store room where the students could bring all the dry waste from their homes and neighboring area in clean conditions and accumulate it to a sufficient volume then ICPE would be happy to organise, through appropriate NGO, collection of such accumulated dry waste including plastics waste from the school itself. It was also assured that the waste collector would make suitable payment for collection of such waste which is generally range between Rs. 5 to 15 per kg or more, depending upon the quality of the collected waste. The teacher was encouraged and assured that the school management would be approached for creating such a storage space. The students also declared that they were willing to join such an activity. ICPE promised to visit the school again after some period.





# AWARENESS PORGRAMME AT MAHATAMA GANDHI, VIDYAMANDIR, MUMBAI

Waste Management issue in general and plastics waste management in particular has been crippling the whole system of maintaining our cities and towns clean and healthy. Thin plastic bags and flexible packaging materials add to the woes as most of these materials remain uncollected by the volunteer groups of waste pickers due to several reasons mainly due to the economic non-viability of such exercise. Our poor civic sense of littering coupled with fragile waste collection infrastructure has added to the cause. Nevertheless Government has issued Notifications banning plastic bags less than 40 microns throughout the country including some other actions.

However, a section of NGOs indulging in creating a myth regarding the suitability of using plastic bags in contact with food items and organizing programmes in schools propagating such myths among the young students and making arrangements to get those programmes published in print media. One such report in the local media reads:

## Quote

Be prepared to collect the parcels from the hotel counters in cardboard or similar containers. The ban on plastic bags in Mumbai after the flood situation of 26th July 2005 is likely to get more stringent. Research has shown that the food products packed in these plastic bags get affected and consumption of such food may lead to cancer, heart trouble. Hence Corporation is likely to take some serious steps in this regards.

## Unquote

In this context ICPE along with Industry Members had organized Awareness Programmes in the same schools viz. Mahatma Gandhi Vidyamandir, Bandra, Mumbai to clear the myths created earlier. Dr.Shrikant Diwan from the Industry and Shri T.K. Bandopadhyay from ICPE with the permission of the school had interacted with the students and the teachers. At the end of the session all in the school had realized that the myths regarding plastics and appreciated that we all have to contribute towards keeping our environment clean by adhering to 2-bin culture and by not indulging in littering. The School authorities have requested ICPE for visiting the school again to conduct such programmes in future.



## ICPE STALL AT INDIA PACK-2015, MUMBAI

ICPE had participated in the 6th International Packaging Exhibition, 2015 held during October 08 – 11, 2015 at Bombay Exhibition Centre, Goregaon, Mumbai. ICPE had focused on creating Awareness on the Environmental Benefits of Plastics, Issues related to the waste generated after the use of plastics – mainly from the packaging sector and the scientific solutions thereof with the help of Case Studies put up in Display Panels and by screening of short films.

It was observed that many of the facts about plastics – especially the fact that plastics emit least Green House Gas to the atmosphere and consume least energy for production compared to the alternate packaging materials like glass, aluminium, paper etc, are not known to general mass.

Different types of plastics recycling systems including Co-processing of plastics waste in Cement Kilns, Pyrolysis to fuel and Use of Plastics Waste for construction of Bitumen Roads were explained by way of display panels. Case study on ICPE and NGO work on segregation projects on Dry Waste from the source of waste generation was also displayed. Visitors, including students who visited ICPE Pavilion had said that they had learned the realities about plastics.



## NEWS

### HIGH COURT DIRECTS BENGALURU TO USE TWO BIN-ONE BAG SYSTEM FOR WASTE COLLECTION

#### NOW, IT WILL BE 'TWO BINS AND ONE BAG' SYSTEM FOR WASTE COLLECTION AND DISPOSAL FOR BENGALUREANS.

In a series of directions for effective municipal solid waste (MSW) management, the Karnataka High Court on Thursday directed using 'two bins and one bag' system while prohibiting citizens from using plastic bags or covers to dispose wet and hazardous wastes. A Division Bench comprising Justice N. Kumar and Justice B.V. Nagarathna said that it would be mandatory for all categories of waste generators — residential, non-residential and government offices — to segregate waste into wet, hazardous and dry at source. While biodegradable or wet waste should be handed over to collectors in a green-coloured bin or container, hazardous waste should be given in a red-coloured bin, the Bench said, while asking citizens to use reusable bags for handing over dry waste to collectors. The court also said that plastic liners or plastic bags should not be used inside the bins while storing wet waste. Instead, recyclable papers or old newspapers could be used. The Bench prohibited citizens from throwing or dumping any waste in public or open spaces, including roadsides, drains or water bodies. Pointing out that the Bruhat Bengaluru Mahanagara Palike (BBMP) alone cannot handle the enormous amount of garbage generated in the city, the court said cooperation is needed from citizens, who are entrusted with the fundamental duty of protecting and improving the natural environment under Article 51A of the Constitution. The Bench directed the BBMP to identify violators and impose penalty as per provisions of the Karnataka Municipal Corporations Act after publicising the changed system of waste collection and disposal.

Source: <http://www.thehindu.com/news/cities/bangalore/high-court-directs-bengaluru-to-use-two-binone-bag-system-for-waste-collection/article8003221.ece>



ICPE HAS BEEN PROPOGATING THIS MESSAGE SINCE EARLY 2000



# DATA SHEET

Table of the most common phthalates

Name	Abbreviation	Structural formula	Molecular weight (g/mol)	CAS No.
Dimethyl phthalate	DMP	$C_6H_4(COOCH_3)_2$	194.18	131-11-3
Diethyl phthalate	DEP	$C_6H_4(COOC_2H_5)_2$	222.24	84-66-2
Diallyl phthalate	DAP	$C_6H_4(COOCH_2CH=CH_2)_2$	246.26	131-17-9
Di-n-propyl phthalate	DPP	$C_6H_4[COO(CH_2)_2CH_3]_2$	250.29	131-16-8
Di-n-butyl phthalate	DBP	$C_6H_4[COO(CH_2)_3CH_3]_2$	278.34	84-74-2
Diisobutyl phthalate	DIBP	$C_6H_4[COOCH_2CH(CH_3)_2]_2$	278.34	84-69-5
Butyl cyclohexyl phthalate	BCP	$CH_3(CH_2)_3OOC C_6H_4 COOC C_6H_{11}$	304.38	84-64-0
Di-n-pentyl phthalate	DNPP	$C_6H_4[COO(CH_2)_4CH_3]_2$	306.40	131-18-0
Dicyclohexyl phthalate	DCP	$C_6H_4(COOC_6H_{11})_2$	330.42	84-61-7
Butyl benzyl phthalate	BBP	$CH_3(CH_2)_3OOC C_6H_4 COOCH_2C_6H_5$	312.36	85-68-7
Di-n-hexyl phthalate	DNHP	$C_6H_4[COO(CH_2)_5CH_3]_2$	334.45	84-75-3
Diisohexyl phthalate	DIHP	$C_6H_4[COO(CH_2)_3CH(CH_3)_2]_2$	334.45	146-50-9
Diisoheptyl phthalate	DIHP	$C_6H_4[COO(CH_2)_4CH(CH_3)_2]_2$	362.50	41451-28-9
Butyl decyl phthalate	BDP	$CH_3(CH_2)_3OOC C_6H_4 COO(CH_2)_9CH_3$	362.50	89-19-0
Di(2-ethylhexyl) phthalate	DEHP, DOP	$C_6H_4[COOCH_2CH(C_2H_5)(CH_2)_3CH_3]_2$	390.56	117-81-7
Di(n-octyl) phthalate	DNOP	$C_6H_4[COO(CH_2)_7CH_3]_2$	390.56	117-84-0
Diisooctyl phthalate	DIOP	$C_6H_4[COO(CH_2)_5CH(CH_3)_2]_2$	390.56	27554-26-3
n-Octyl n-decyl phthalate	ODP	$CH_3(CH_2)_7OOC C_6H_4 COO(CH_2)_9CH_3$	418.61	119-07-3
Diisononyl phthalate	DINP	$C_6H_4[COO(CH_2)_6CH(CH_3)_2]_2$	418.61	28553-12-0
Di(2-propylheptyl) phthalate	DPHP	$C_6H_4[COOCH_2CH(CH_2CH_2CH_3)(CH_2)_4CH_3]_2$	446.66	53306-54-0
Diisodecyl phthalate	DIDP	$C_6H_4[COO(CH_2)_7CH(CH_3)_2]_2$	446.66	26761-40-0
Diundecyl phthalate	DUP	$C_6H_4[COO(CH_2)_{10}CH_3]_2$	474.72	3648-20-2
Diisoundecyl phthalate	DIUP	$C_6H_4[COO(CH_2)_8CH(CH_3)_2]_2$	474.72	85507-79-5
Ditridecyl phthalate	DTDP	$C_6H_4[COO(CH_2)_{12}CH_3]_2$	530.82	119-06-2
Diisotridecyl phthalate	DIUP	$C_6H_4[COO(CH_2)_{10}CH(CH_3)_2]_2$	530.82	68515-47-9

*As appearing in the Chemical Formula and CAS Number list in Wikipedia*





# WHY PLASTICS ?

## Plastics Waste In Road Construction



Vidyasagar Street - Kalyani, West Bengal

**Improves Quality of Asphalt Road**  
**Reduce Cost of Construction**

**Addresses Disposal Issue of Plastics Waste**



*Indian Centre for Plastics in the Environment*