Thiagarajar College of Engineering, Madurai-15

Department of Chemistry

Environmental Information System - ENVIS

TCE ENVIS RP - Centre for Plastic Waste Management

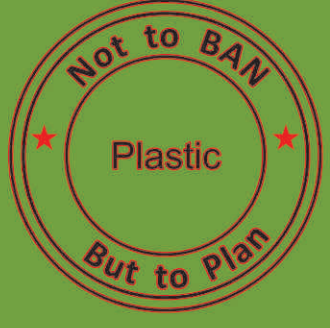
NEWS LETTER

Volume I - Issue 2nd & 3rd : July - Sep & Oct - Dec 2018

Plastic Waste Management

"SINGLE USE PLASTIC"
- A problem ???
to be addressed.

E N V I S



Visit: www.tceenvis.in
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Funded by:

Ministry of Environment, Forest & Climate Change, Govt. of India

TCE ENVIS Handouts

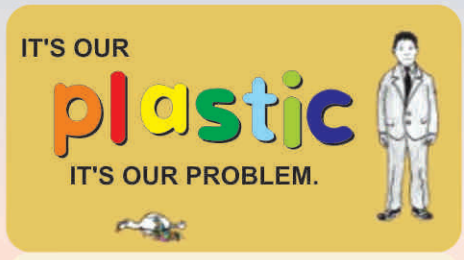
Rethink, Refuse, Reduce, Reuse and Recycle

Rethink	Think about whether you need something before buying it.	
Refuse	Refuse things you will only use once (e.g. straws, plastics bags and bottled water).	
Reduse	Reduce the amount of energy you use by doing things such as walking or turning off lights when you leave the room.	
Reuse	Reuse items instead of throwing then away. For example, when drawing a picture, use both sides of a piece of paper or you could pass on clothing that no longer fits to someone else.	
Recycle	Always recycle paper and plastics where possible.	

THIAGARAJAR COLLEGE OF ENGINEERING
DEPARTMENT OF CHEMISTRY
ENVIRONMENTAL INFORMATION SYSTEM (ENVIS)
PLASTIC WASTE MANAGEMENT-THEMATIC CENTRE
(Funded by - Ministry of Environment, Forest & Climate Change, Govt of Inida, New Delhi.)

TCE
ENVIS

Not to Ban
Plastic
But to Plan



Ministry of Environment, Forest & Climate Change, Govt. of India.

Ministry of Environment, Forest & Climate Change

Thiagarajar College of Engineering
Environmental Information System
Plastic Waste Management

Plastic Ban - Is it a Solution ?

Editorial Message

Dear Readers,

We are very happy to release the 2nd and 3rd issues of our News Letter on "Plastic Waste Management". We wish to inform our readers that, under the auspicious guidance of Dr. Anandi Subramanian, Principal Advisor, MoEF & CC and her ENVIS Secretariat Team, We have successfully completed the 1st batch of Green Skill Development Program Course on ''Waste Management'. A brief perspective related to this course is given in the News Letter. The present issue is mainly focused on the move of our Government for Banning Single Use Plastics. We have presented details about Single Use Plastics and its contribution both in Polymer Industry and also in environmental pollution. The message of our present issue is ''Not to Ban but to Plan" - the Single Use Plastics. Two Research articles are also found its pages in the present issue, which focuses on the use of Waste Plastics in different areas. Activities are the back bone of ENVIS, a detailed presentations of the activities carried out is also given in the News Letter.

On the whole the present News Letter will make the readers to get awareness about the Single Use Plastics and its role in Economy as well as in Environment.

We wish you all the best

"JAI HIND ''

- EDITOR

PLASTIC WASTE MANAGEMENT

TCE ENVIS

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Table of Contents

Waste Segregation Chart

Wet Waste

Vegetable & Fruit Peel, Food Remains, Expired Food item, Meat, Bone, Egg Shell, Flower, Tea Bag & Coffee Powder, Coconut Shell & Fibre etc.

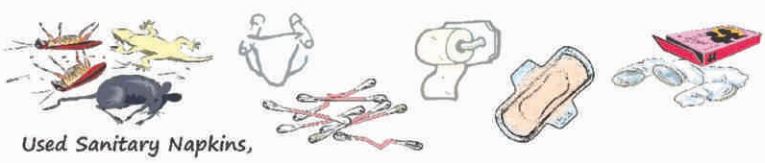
Do not Put in Plastic Cover
They can be composted

Dry Waste

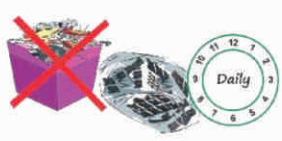
Plastic, Paper, Wood,
Glass, Rubber, etc items not having medical or sanitary residues.

Clean and Store.
Give it to Recyclers

Sanitary Waste



Used Sanitary Napkins,
Diaper, Dead Pest, Ear Buds, Dental Floss, Bandage



Do not throw as is. Wrap in Newspaper.
Mark it with red cross (X) before disposal

Garden Waste

Large Quantity of Leaves, Branches, Dried Plants

Handover Separately to
BBMP Collection Trucks

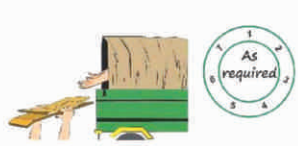
Hazardous Household Waste

Medicines, Pesticides, Old Paints, Hair Colour
Mosquito Repellent, Syringes, Cosmetics

DO Not Mix with other Waste.
Store Carefully.
Hand it over to specific Recyclers

Debris/ Rubbish

Construction Debris, Demolition Waste, Broken Glass, Broken Furniture



Call BBMP or
Other Agencies for Pickup

E-Waste

Tube lights, CD's, Batteries,
Computers, Televisions, Mobile phones,
Laptops, Printer Cartridges, Cables

DO Not Mix with other Waste.
Store Carefully.
Hand it over to specific Recyclers

Single Use Plastic - A Look

Single-use plastics, often also referred to as disposable plastics, are commonly used for plastic packaging and include items intended to be used only once before they are thrown away or recycled.

These include, among other items, grocery bags, food packaging, bottles, straws, containers, cups and cutlery. Figure introduces the main polymers used to manufacture single- use plastic items and indicates their most common applications.

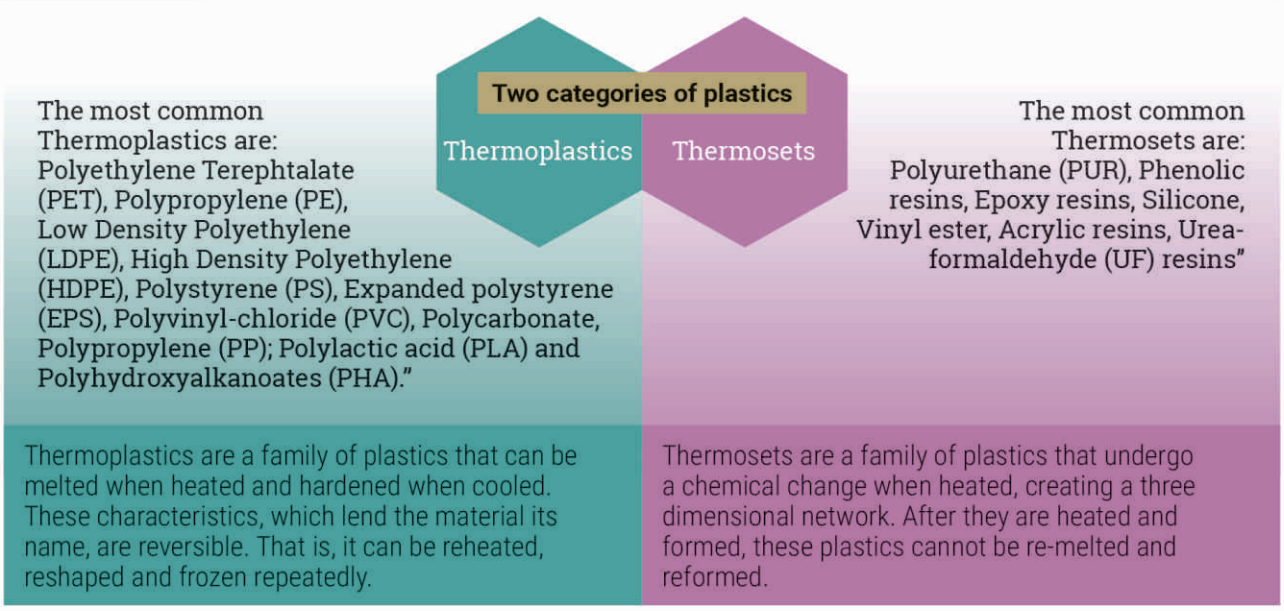
Since the 1950s, growth in the production of plastic has largely outpaced that of any other material, with a global shift from the production of durable plastics to single-use plastics (including packaging), as shown in Figure.

The production of plastic is largely reliant on fossil hydrocarbons, which are non-renewable resources.9 If the growth in plastic production continues at the current rate, by 2050 the plastic industry may account for 20% of the world's total oil consumption.

More than one-fourth of the resins globally used in the production of single-use plastics11 are manufactured in Northeast Asia (China, Hong Kong, Japan, Republic of Korea and Taiwan). This is followed by North America, the Middle East and Europe. Global consumption of plastic can be estimated by observing the amount of plastic waste produced. Plastic packaging is mostly single-use, especially in business-to-consumer applications, and a majority of it is discarded the same year it is produced.

Source: United Nation Environment Programme,2018

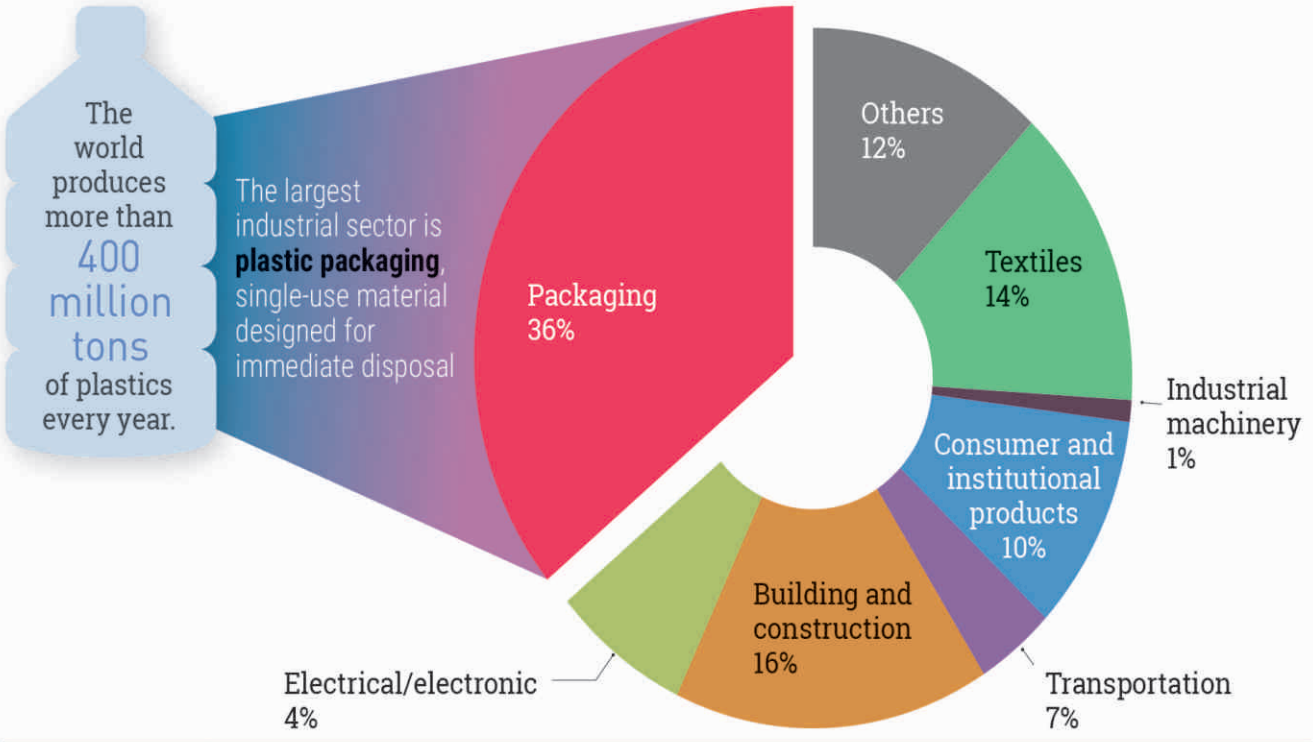
The two main categories of plastics and their single-use applications



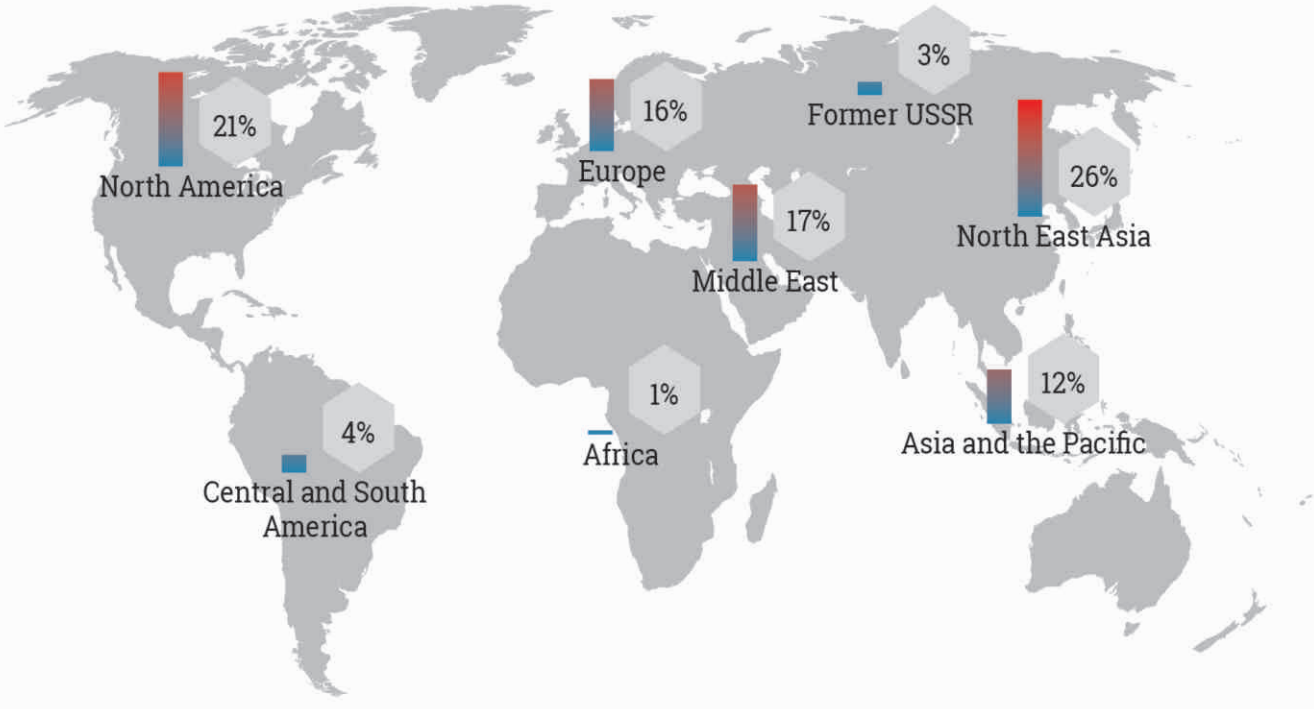
Main polymers used in the production of single-use plastics

Source: United Nation Environment Programme,2018

Global plastic production by industrial sector, 2015

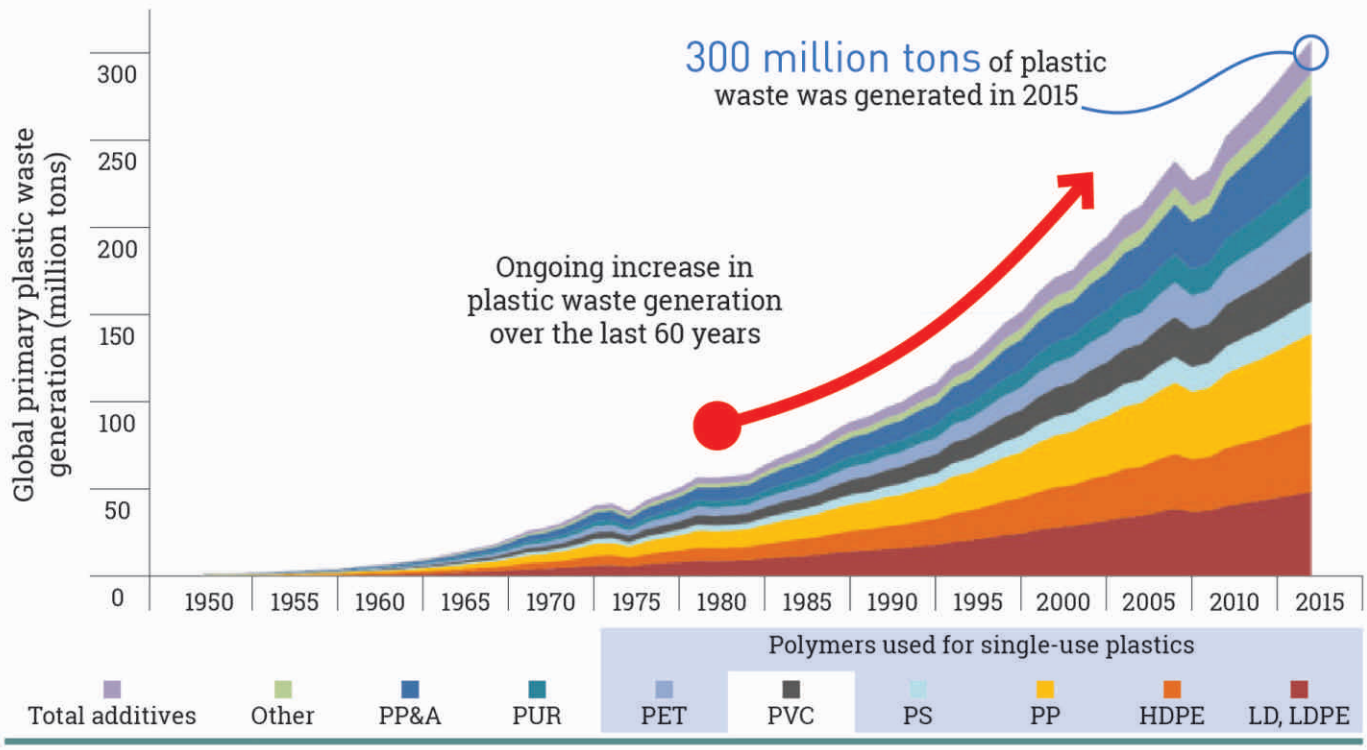


Distribution of single-use plastic[12] production by region (2014)

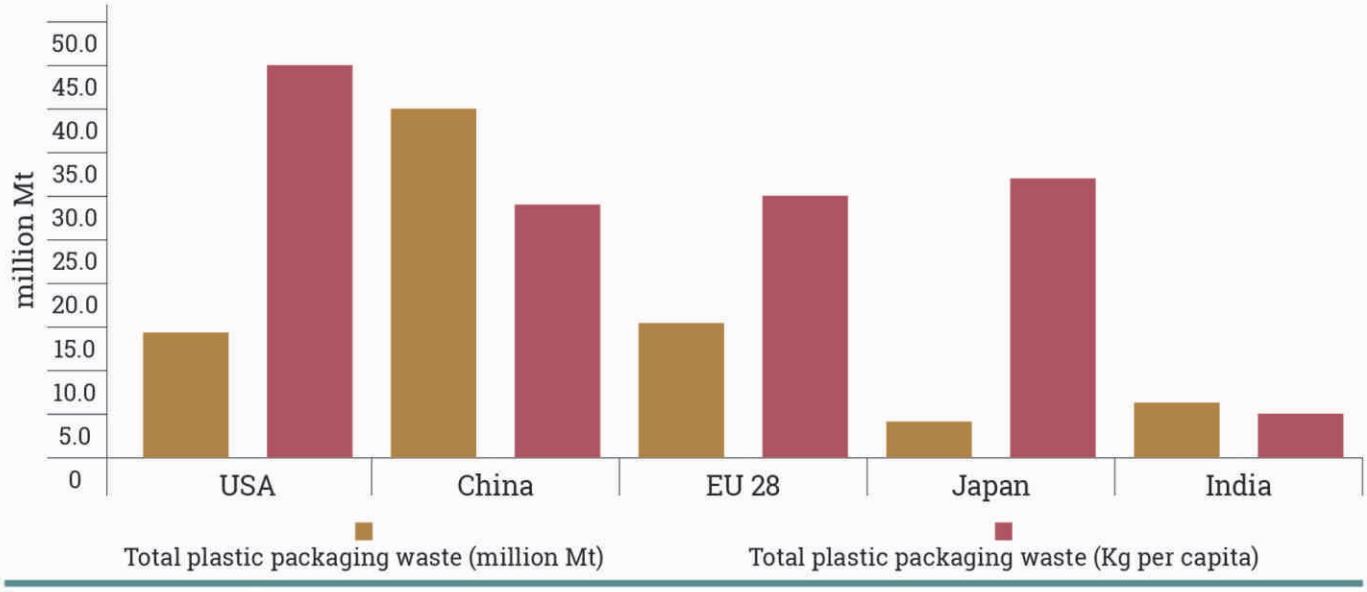


Source: United Nation Environment Programme,2018

Global primary plastics waste generation, 1950 - 2015[16]



Plastic packaging waste generation, 2014 (million Mt)[17]



Plastic Ban - A look On International Status

Source: United Nation Environment Programme,2018

Area	Country	Year	Action	Type	Features
Asia	Indonesia	2017	Government commitment	Memorandum of understanding	**Type:** Because of a four - year organized by citizens to get plastic bags banned in Bali, the governor signed a memorandum of understanding to phase out plastic bags by January 2018 (Prisco,2017). **Impact:** Information not available
	Thailand	2009	Public-Private Campaign	Discount to consumers	**Type:** Local authorities initiated a 45-day campaign in Bangkok to reduce the consumption of plastic bags. Many supermarket chains, local markets and other stores took part in the campaign and offered a one-baht (around) $0.03) discount for every THB 100 (nearly $3.00) purchase if they brought their own cloth bags. In 2009, the campaign targeted a cutback of 4.4 million plastic bags (Corporal,2010) **Impact:** Information not available
Europe	Austria	2016	Public-Private agreement	Levy	**Type:** Levy on plastic bags in major supermarkets. Agreement signed by Ministry (BMLFUW) and major trade companies and environmental protection organizations. Its target surpasses that of the EU-Directive (United Nations,2017a) **Impact:** Drop in consumption of plastic carrier bags per person per year from 54.3 very light weight and 3.1 light-weight (15.50 microns) in 2015 to 44 very lightweight and 4.3 lightweight in 2016 (Ministerium fur ein lebenswertes Osterreich, 2017).
	Finland	2016	Public-Private agreement	Levy	**Type:** Voluntary agreement between the Ministry of Agriculture and Environment and the Federation of Finnish Commerce to undertake measures to reduce the consumption of plastic bags. The measures include: advice and information to reduce consumption and prevent litter, a fee on shopping bags >15µ and <50µ and no self- service of thin plastic carrier bags (Plastic Carrier Bag Agreement, 2016) **Impact:** Information not available
	Germany	2016	Public-Private agreement	Ban or levy	**Type:** Voluntary ban or levy on plastics bags (retailers can decide whether to phase out plastic bags or to apply a fee of 0.05 to 0.50 (about $0.06 to $0.60. The agreement was made by the Ministry, the German Retails Federation and participating companies to curb the use of plastic bags. Many more companies participate without having signed the agreement.), (German government,2016,Surfrider, 2017 **Impact:** Information not available

Plastic Ban - A look On International Status

Source: United Nation Environment Programme,2018

Area	Country	Year	Action	Type	Features
Europe	Luxembourg	2004	Public-private agreement	Levy	**Type:** 85 brands (including all big distributors) participate in the "Eco-sac" ("Oko-Tut") initiative, a cooperative project between the Ministry of the Environment, the Luxembourgian Trade Confederation and the non-profit association Valorlux to reduce the consumption of lightweight plastic bags by replacing them with the so-called "Oko-Tut" (a reusable bag) **Impact:** Plastic bag consumption dropped by 85% in nine years and the "Oke-Tut" has replaced most free plastic bags at supermarkets across the country (Luxembourger leads way. 2013; Bansh-Baltruschat et al,2017)
	Spain	2008	Public-private agreement	Levy	**Type:** Voluntary agreement since at least 2008 between main retail associations and regional authorities to promote prevention and reduce the consumption of plastic carrier bags. Some charge a fee for the bags, others grant a small pay-back if plastic carrier bags are not used. **Impact:** Pacto por la Bolsa in Catalonia, signed in 2009. Its target was a reduction of consumption of "single-use" bags by 50% by 2012. By 2010, a reduction of 40% had been achieved (European Commission, 2013).
	Sweden	1970	Private initiative	Levy	**Type:** Levy on consumer Since the 1970s, grocery stores started to charge consumers for plastic and paper carrier bags (around SEK2; about $0.24) (Surfrider Foundation Europe,2017; Radio Sweden,2007) **Impact:** The charge on plastic bags has led to "better quality plastic carrier bags" and reduced use of plastic bags in the first years after implementation. Demand increased again thereafter (Radio Sweden,2007)
	Switzerlanc	2016	Public-private agreement	Levy	**Type:** Switzerland's largest supermarket chains introduced a plastic bag levy based on a voluntary agreement, which was approved by the parliament as an alternative to a total ban (Swiss supermarkets, 2016) **Impact:** Demand for plastic bags dropped by 80-85% (Price tag, 2017)
North America	Canada	2016	Private initiative	Levy	**Type:** A big supermarket chain announced that it will start charging consumers CAD 0.05 (around $0.04) per single-use plastic bag and CAD 0.25 per reusable bag (The Canadian Press, 2016). **Impact:** Information not available
Oceania	Australia	2017	Private initiative	Ban or Levy	**Type:** Some major supermarkets announced that they will phase out lightweight plastic bags or provide bags but charge AUD 0.15 ($0.12) per bag (Pearlman, 2018) **Impact:** Information not available

Source: United Nation Environment Programme,2018

Asia	India	Besides the national law, several states and cities have introduced bans on plastic carrier bags and other plastic materials. A selection of them can be found in the India.			
		2016	National	Ban - entered into force	**Type:** Ban on non-compostable plastic bags<50µ [73] (Notification on Plastic Waste Management Rules, 2016) **Impact:** Information not available
		2004	Local Himachal Pradesh	Ban - entered into force	**Type:** Ban on the production, storage, use, sale and distribution of non-biodegradable plastic bags <70µ in the Indian state of Himachal Pradesh. (The Himachal Pradesh Non-Biodegrdable Garbage (Control) Act, 1995). In 2011 a ban on disposable plastic products, such as plastic cups, drinking glasses and plates was introduced (Duboise, 2012). Impact: Significant decrease in plastic pollution (IANS, 2009)
		2016	Local - Karnataka	Ban - entered into force	**Type:** Ban on manufacturing and sale of plastic bags in the Indian state of Karnataka (DHNS,2017).
		2016	Local - Punjab	Ban - entered into force	**Type:** Ban on manufacture, stocking, distribution, sale or use of single-use plastic carry bags and containers in the state of Punjab[74] (The Punjab Plastic Carry Bags (Manufacture, Usage, and Disposal) Control (Amendment) Act, 2016) **Impact:** Information not available
		2010	Local - Haryana	Ban - entered into force	**Type:** Ban on manufacture, stocking, distribution, sale or use of plastic of carry bags in the state of Haryana (NDTV,2010). **Impact:** Limited because of poor enforcement. (PTI,2016b).
		2016	Local - Kerala	Ban - entered into force	**Type:** Ban on plastic bags <50µ in the Indian state of Kerala (Deccan Chronicle, 2016). **Impact:** Information not available.
		2001	Local - West Bengal	Ban - entered into force	**Type:** Several regulations from 2001 onwards. Ban on plastic bags <40µ and blanket ban in certain areas in West Bengal (Mahesh et al., 2015 West Bengal Pollution Control Board) **Impact:** Plastic bags are still commonly used. Implementation is limited (Mahesh et al., 2015).
		1998	Local - Sikkim	Ban - entered into force	**Type:** Ban on delivery or purchasing of goods and materials in plastic wrappers or plastic bags in the state of Sikkim. **Impact:** Although plastic bags are still common (used by 34% of shops) the majority switched to paper bags or newspaper (66%) (Bari, 2018).
		2016	Local - Sikkim	Ban - entered into force	**Type:** Ban on sale and use of disposable Styrofoam in Sikkim [75] (Styrofoam ban, 2016). **Impact:** Information not available
Asia		2017	Local - New Delhi	Ban - entered into force	**Type:** Ban on all kinds of disposable plastics in New Delhi [76] (Naik,2017a). **Impact:** Limited because of poor enforcement. (Bari,2018)
		2018	Local - Maharashtra	Ban - entered into force	**Type:** Ban on plastic bags <50µ in the state of Maharashtra [77] (Naik, 2017b). **Impact:** Information not available

Article 1: Plastic - Not to Ban But to Plan

Plastics entered the 20th century with a bang. Plastics, a byproduct of petroleum, spread its wings in various fields like domestic appliance, machine parts, electrical and electronic gadgets and so on. It has displaced wood, cloth, paper, metals and other engineering materials. The concept of adhesives changed and varieties of adhesives have taken important place in construction. A revolution has taken place in the paint industry. Above all, plastic products have become common man's friend and poor man's need. If you visit into the huts of villagers, you will see plastic chairs, plastic buckets, plastic cups, and plates and so on. Plastic products have given them a better standard of living. They have become part and parcel of their life. Small scale vendors, whose business capacity is around few hundred, can afford to use the cheap plastic bags for their day business. Living without it is a problem.

Plastics are not a villain. It is only the wrong mindset of some that makes all the difference. Of course plastics do no undergo bio-decomposition. Yet there are many non-biodegradable materials, which are in use.

People are classifying plastics as single-use-plastics, non-recyclable plastics and so on. It only shows the wrong understanding of the law makers.

Image Source: https://www.teacherspayteachers.com

What are Single-Use Plastics?

Most of them are from PE, PP and PS. They are referred as safe plastics. They can be easily recycled and they do not contain any toxic chemicals like B.P. Just because the plastic materials are disposed improperly, can we call them as non-recyclable?

Moreover, if you go through the non-recyclable list of plastic materials, it looks strange. Milk pouch, bin liners, plastic bags used for agriculture, raincoats, wrappers, biscuit covers and other eatable wrappers, all fall in the same category of single time used plastics. Then why are they exempted? In fact, if you visit any petty shop, you see readymade food packets of different sizes hanging as strips. Are they disposed properly? They also contribute to pollution. What about e-plastics? The technology advancement is moving with e-plastics usage. So, one can understand that the problem is not plastics; it is only improper disposal of single time used plastics, which causes water clogging, problems of MSW management, rain harvesting etc.

If, this being the problem, then we need to ban cigarette, which not only causes human health problems, but also it is the maximum content in sea debris, as cigarette buds.

Why not cigarette be banned?
How about alcohol addicts?
They are the causes of social problems?
Why not it be banned, if banning is the solution for any problems.

Enough Opportunities to Use Waste:

Let us think differently. Rethinking is a process to get solution. Our slogan is Recycle, Reduce & Reuse; single time used plastics can be very well recycled. The carry bags are more used to carry fruits, flowers, vegetable and so on. The weight carrying capacity needed is only 1 kg. A bag with the film thickness of 10 mm is more than sufficient for this purpose. Then why should one use 50 mm film bag. It consumes 5 times the raw material. Moreover the thin film bag can be easily recycled also. Using of thinner films account for reduction in the consumption of raw materials. The fear is only about the disposal, more due to cost factor. One could easily prevent this, provided there is value addition to the waste plastics.

"The artist's Brush is made up of Plastic fiber. He brought his brushes in a plastic bag. He writes 'ban plastics' on a plastic Board"
- This is reality!

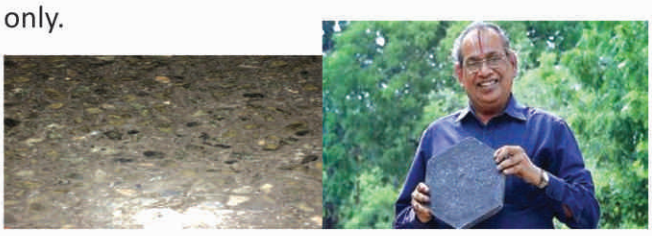
Article 1: Plastic - Not to Ban But to Plan...

Today newer technologies are available to reuse waste plastics which have proved successful. Today waste plastics is a resource for making better roads. This has added value addition to the waste plastics. Today, a kilo of shredded plastics cost around Rs. 30.

Plastic tar road is a strong road without forming any post holes, even after 10 years of usage. Here, plastic coated stone aggregate mixed with bitumen and used for Road Construction. The plastic material used are carry bags, chocolate covers, biscuit covers, food packing material both - single layer and multi layers (size 2 mm to 4 mm). The shredded plastics is added over hot stone (170°C) which gets melted (not decomposed – no gas evolution) and coated over stone. This is mixed with bitumen (160°C) and the mixture is used for road laying. Here, plastics is added to the tune not less than 10% of the bitumen required. Equal amount of bitumen is saved. For ex. 1 km and single lane with 20 mm thick – tar road needs 1 tonne Plastics, (10,00,000 carry bags) and 9 tonnes bitumen only. The roads are doubly strong (MSV-2500 kg) and there is no pot hole formation even after 10 years. There is no maintenance expenditure too. The roads are good; we use waste plastics and save bitumen. India has not less than 46 lakhs Km Road of multi lanes. To convey into plastic tar road not less than 100 lakh tonnes of Plastics is needed. In India around 30 lakhs tones is only available. On one side, the technology is very useful and on the other hand, the waste plastics find total use.

Another technology development is the innovation of structural materials called plastone (a synthetic granite). This has been developed using waste plastics and solid waste like stone granite, ceramics, limestone, concrete debris and other industrial solid waste. It is made available as tiles, table tops, hallow blocks and so on.

A 1'×1'×1" block needs not less than ½ kg waste plastics, with about 15 Pet Bottles. This block can be used as paver blocks, for lawns for cannel lining, portable speed breaker and so on. Using these tiles, low cost toilet can be constructed in just 2 hrs. The cost comes around RS. 12,000 only.



This year's central budget includes construction of 2 crore toilets and if the plastone is used, we need 1 crore tonnes of waste plastics.

Indian roads need 100 lakh tonnes of waste plastics and the toilets need another 100 lakh tonnes. Oh God !. Where is the plastics. All the plastics available can be made to use.

This reuse of plastics waste has revolutionized the road technology world over. One country offered 300 M for transferring the technology to them. I refused and dedicated it to our country. Over 7 countries are ready to take my plastone technology.

In India more than 1 lakh km roads have been laid by PMGSY & MEF & CC and they continue to lay plastic tar road.

Waste plastics is also used to develop corrosion-resistant iron roads, leak proof roofing sheets, e- waste modified bitumen and others. Hence, reuse technologies have been established well.

Now, Where is the Problem?

On one side, plastic material finds various uses in all walks of life and the waste plastics have become a great resource for Road Construction and for structural materials.

The problem is nothing but our garbage culture and careless and cared less of an attitude towards environment. It is due to weak planning of solid waste management of the administrators.

Article 1: Plastic - Not to Ban But to Plan...

Domestic people should be asked to follow double bin system and to collect plastics separately. Similarly, hotels and community halls should flow proper garbage culture. The administrators and the Govt. should issue orders accordingly. They too should collect the waste and deposit it to the reuse centres. Strict measures are to be taken. The industries, who are the manufacture of plastic materials, are interested in marketing it only and forget it. They too have the responsibility to collect the waste and help the administration properly. This should be insisted by the Govt. The school students can be educated by creating awareness and they can be requested to bring their waste to the school. This will be collected by the user group. The house is cleaned and the waste will not reach the municipal solid waste centre too. The younger generation is made to know about the future problem. The hotels and community halls should be compelled to join in the move. Industries should be compelled to work under pay-back system. It is their bounden duty to collect use waste and help for reuse and to keep the environment clean. To help them, there is CSR Scheme.

The government body should sit sincerely to develop proper system of collection of waste and deposit them to the reuses centres.

The government can use unemployed graduates, NRIs and other groups to make the system effective. As in Tamil Nadu, self help group (ladies) can be used for this purpose effectively. They may be helped financially to set up centre for waste plastics and they will supply the shredded plastics to the reuse centres.

Banning the plastics is not the solution. By developing proper system for reusing and by proper planning, we can solve the problem of plastics which is only man -made.

So, **'No Ban, But to Plan'** should be one slogan or watch word.

The problem is nothing, but our garbage culture and careless and care less of an attitude towards the environment.

Plastic products have become common man's friend and poor man's need. They have given them a better standard of living and have become a part and parcel of their life. Living without plastics is a problem.

- - Mostly these poor people houses are gaurded by plastic sheets only - -

We are honored to share that our Coordinator Dr. R. Vasudevan, (Padma Shri Awardee), Dean ECA, TCE, Madurai was selected as a Expert Committee member by the Ministry of Chemicals & Fertilizers, Department of Chemicals & Petrochemicals, Govt. of India, to define the "Single use of Plastics" and other related issues.

General Survey on Plastic Ban

Your Name : _____ Qualification : _____

Organization : _____ Gender : _____ Age : _____

1. Which plastic products do you use excessively?
   A. Plastic bags B. Plastic liquid containers (bottles) C. Plastic buckets, bins and barrels
   D. Plastic shoes E. Others (Please, specify)

   Answer: _____

2. Why do you prefer to use the plastic product(s) especially plastic bags?
   A. They are cheap B. They are light in weight C. They are easily available
   D. Lack of alternative materials E. Others (Please, specify)

   Answer: _____

3. Do you think that plastic bag wastes cause problems?
   A. Yes B. No C. No idea

   Answer: _____

4. How you do dispose the plastic bag waste of the plastic materials?
   A. Open dumping B. Burying C. Burning
   D. Others (Please, specify)

   Answer: _____

5. What are the problems?
   A. Animal death B. Human health problem C. Blockage of sewage(drain) systems
   D. Deterioration of natural beauty of environment

   Answer: _____

6. Which parts of city are seriously polluted by plastic bag wastes?
   A. Parks B. Waste dumping sites C. Market places D. Crowded residential areas
   E. Roadsides F. any open places in the city G. sewage lines

   Answer: _____

7. Is the trend of utilization of plastic bags increasing or decreasing?
   A. Increasing B. Decreasing C. Others (Please, specify)

   Answer: _____

8. Plastic is “Increasing”, what are the possible reasons?
   A. Cheapness low cost B. Durability C. Availability wherever and whenever required
   D. Lack of awareness of the community E. Others (Please, specify)

   Answer: _____

9. Plastic is “Decreasing”, what are the possible reasons?
   A. Availability of alternative materials B. Awareness of the community
   C. Increasing prices of plastic-made materials D. Others (Please, specify)

   Answer: _____

10. According to your opinion, should the utilization of plastic bags be continued or discontinued?
    A. Should be continued B. Should be discontinued

    Answer: _____

11. Plastic is "should be discontinued", who is responsible to do so?
    A. Municipality B. NGOs C. Government D. Environmental agencies
    E. The community itself F. Others (Please, specify)

    Answer: _____

12. If you say plastic bags should not be used, what alternatives can be used?
    A. Paper bags B. Fiber bags C. Cloth bags D. Others

    Answer: _____

13. Do you take your own bags when you go to the GROCERY STORE?
    A. Always B. Not, but usually more than 75% of time
    C. Not, but about HALF to 75% of time D. Not, but LESS THAN HALF the time E. Never

    Answer: _____

14. Do you take your own bags when you go to stores OTHER THAN THE GROCERY STORE?
    A. Always B. Not, but usually more than 75% of time
    C. Not, but about HALF to 75% of time D. Not, but LESS THAN HALF the time E. Never

    Answer: _____

15. When you bring home plastic bags, what happens to them?
    A. I reuse some once (e.g., for animal waste, wet trash, etc.) and then throw them in the trash.
    B. I re-use some of them more than one time before discarding them.
    C. I discard only the ones that are soiled, in the regular trash
    D. I save the clean ones in a separate container for disposal
    E. I just throw each individual bag in the regular trash

    Answer: _____

16. Use the below slider to tell us how strongly do you feel that the elimination of single use plastic bags will have a positive effect on the environment?
    A. Little or No Effect B. Significant Effect

    Answer: _____

17. Do you support a ban on single use plastic bags?
    A. Yes B. No C. Unsure

    Answer: _____

18. Plastic would a ban/fee influence your behavior?
    A. Would use reusable B. No effect, already use reusable C. Less use of bags
    D. Pay the fee E. would shop elsewhere

    Answer: _____

19. What do you do with plastic bags after you receive them from a store?
    A. Reuse them B. Throw them C. away Recycle them

    Answer: _____

20. If your municipality banned single-use plastic bags, how would you feel?
    A. Support B. Oppose C. Unsure

    Answer: _____

Suggestion / Comments: _____

POLYMER MODIFIED BITUMEN PREPARED USING ABS POLYMER-CHARACTERIZATION AND APPLICATION IN FLEXIBLE PAVEMENT.

Dr. R. Vasudevan, Dr. A. Ramalinga Chandra Sekar and Mr B. Sundarakannan,
Thiagarajar College of Engineering, Madurai.

ABSTRACT:

The modification of bitumen using polymers in road paving applications is gaining momentum day to day over the past few years. The need for the modification is raised due to the need in the improved performance of the flexible pavements. Developing countries like India whose transportation mainly depends upon the road, need a vast research in this field. Presently the commonly used modifier for the modification of bitumen is the styrene butadiene styrene polymer which is elastomeric in nature. Polymers like styrene butadiene rubber, natural rubber and CRMB are also used for the modification of bitumen. Many scientists are experimenting on the use of waste polymers for the bitumen modification. The present paper is to study the modification of the bitumen using an elastomeric polymer Acrylo Nitrile Butadiene Styrene. Samples of ABS modified bitumen were prepared by mixing different percentages of ABS with neat bitumen of PG 80/100.

The prepared PMB was subjected to various studies starting from empirical tests, Infra Red Spectroscopy and the thermal analysis. The results of IR investigations indicate that the mixed ABS modifies the chemical nature of the bitumen chain with some increased butadiene concentration in the mix. The nitrile group present in ABS also alters the structure of the bitumen mix. The thermal investigation indicates the various distinct decomposition stages of the modified bitumen and it shows an increase in the thermal stability of the polymer modified bitumen. The ageing characteristics of the modified bitumen were also studied and theresults obtained are discussed in this research paper.

The polymer modified bitumen aggregate mix was also prepared to study the mix properties. Properties like stripping test and extraction test was carried to study the binding nature of ABS PMB with the aggregate. The stability nature of the mix was carried using the Marshal Stability test and the voids parameters were also measured. The results obtained shows improved characteristics of the mix properties. With the results obtained for the ABS PMB and its mix shows that the prepared sample can be very well used for flexible pavement applications.

INTRODUCTION:

The Development of polymer modified bitumen composites gain momentum due to its vast application in the field of flexible pavements (Airey GD., 2002). The performance of asphalt concrete pavement depends on the bitumen properties, asphalt concrete mixtures volumetric properties and external factors such as traffic volume and environment. Bitumen is a visco-elastic material where temperature and rate of load application have a great influence on its behavior. Conventional flexible pavement is exposed to a wide range of loading and weather conditions; it is soft in a hot environment and brittle under low temperature. Higher traffic volume produces high stress within pavement layer, which is one of the main causes for pavement distress. Fatigue cracking and permanent deformation are considered as most serious distresses associated with flexible pavements. These distresses reduce the service life of the pavement and increase the maintenance cost. To reduce the pavement distresses there are different solutions suchas by adopting new mix design or by using asphalt additives. Using of asphalt additives in highway construction is known to give the conventional bitumen better engineering properties as well as it is helpful to extend the life span of asphalt concrete pavement.

Considerable research in recent years is going on in the polymer modified bitumen to improve the performance of the bitumen in the flexible pavements. Modified bitumen provides the diversified properties needed to build better performing roads.

Addition of polymer to asphalt cement is the most important form of modification due to its wide range of application and potential for use.

Nowadays, polymer technology is considered as a permanent part of the highway construction (Topal A., 2010; González V et al., 2010; Pena JJ., 2002; Airey GD., 2003). On the other hand, using crumb rubber from scrap tiers, waste plastics, e waste and other waste related to polymers as asphalt modifier helps to solve serious environmental problems too and to improve the pavement performance. The main advantage of using polymer technology is to improve the adhesion properties between the binder and aggregate. The properties of modified bitumen depend on the modifier type with respect to modifier content and bitumen type. The main advantage of elastomers such as (SBR) and (SBS) (Feng Zhang et al., 2011) is that they can provide a higher strength to the modified bitumen or mixtures (King et al., 1999). The use of ABS is a recent research in the field of polymer modified bitumen. The ABS is also a tri block copolymer (elastomer) which contains styrene molecule and nitrile compound at both the ends and co blocked with diene compound. It is believed that the use of ABS will result in some physical change with the asphaltenes present in the bitumen. ABS polymer is used to modify the bitumen and the modified bitumen is subjected to various studies and the results are discussed in detail in this paper.

EXPERIMENTAL PROGRAM:

Materials:

Base bitumen is collected from Indian Oil Corporation an Indian bitumen manufacturing company. The basic properties of the bitumen was tested and reported in Table-1. The ABS polymer was supplied by RANBAXY chemicals. The polymer size was measured and found to be >600microns

Sample preparation:

The bitumen was heated to 165.deg.C and it was stirred at a speed of 3000 rpm and then the ABS polymer was added to it. The stirring was continued for six hours. Two bitumen samples were prepared using different percentages of ABS. The polymer content of ABS PMB was ranged as 5% and 7%. All these PMBS were prepared in a mechanical shear mixer, the modified bitumen was named as ABS5 and ABS7 and the plain bitumen was named as Plain B. The polymer modified bitumen were prepared using a shear mechanical stirrer REMI Model

METHODS OF TESTING:

Empirical tests:

The plain bitumen and the ABS PMB were subjected to the following conventional binder tests: Penetration tests to study the penetration value of the bitumen at 250C; Ductility test to study the ductile/elastic recovery of the bitumen at 250C; Softening point test to study the softening temperature range of the bitumen; separation test to find the homogeneity of the PMBs formed under this process. All the tests were carried out under the procedure adopted by ASTM standards.

Ageing characteristics:

The Ageing is the process of inducing /simulating the field performance of the binder in the laboratory (Durrieu F et al., 2007; Mouillet V et al., 2008). Ageing study on the ABS PMB was done using RTFOT. The process of ageing is to make the bitumen harder by thermally oxidizing the bitumen in the presence of hot air. The standard procedure was heating the bitumen to 1600C and maintaining the bitumen at that temperature for 75min.

THERMAL STUDIES:

TGA- Thermal decomposition:

The thermal decomposition studies of the Plain B and ABS PMB was done. The study was carried by taking 5mg of the sample in an aluminum holder and heating the sample from 300C to 6000C at a standard heating rate of 100C per minute. The samples were run in air atmosphere. The study was done to find out the thermal stability of the bitumen (Feng Zhang et al., 2011). The DTG is also obtained using the TGA curve. The study was carried out using Shimadzu TGA- 50 instrument.

FTIR studies:

The FTIR spectra of the ABS PMB and the base bitumen were measured using Shimadzu IR Prestige-21. The spectra were analyzed by dissolving bitumen in decaline and then the

solution is placed over a KBR discs and subsequently dried using an IR lamp. The study was done to observe the structural modification made by the polymer. All the samples were analyzed in the wavelength range from 400 cm-1 to 4600cm-1

Stripping studies:

It is the process of studying the binding nature of the bitumen with the aggregate. The study was carried as per the ASTM standard D3625. A known amount of aggregate is coated with calculated amount of PMB and the mix is then immersed in a container with water. The container is then placed over a water bath at 60.deg.C for 8 hrs. The container is then removed from the water bath and the peeling out of bitumen layer from the aggregate is observed visually and the percentage of stripping is noted.

Extraction test ASTM D2172:

The polymer modified bitumen coated aggregate mix was also submitted to bitumen extraction using trichloroethylene. The mixture is immersed in trichloroethylene for 3hrs and then it is placed in a centrifugate extractor and the binder is extracted. The difference in weight from the mix and the extracted aggregate will give us the percentage of binder. Here in the extraction test, different percentage of PMB was prepared and it was subjected to extraction and the extraction ability was noted. The extraction with time dependent is noted for the mix

Marshall stability ASTM: D 1559 - 1979:

Marshall Stability value is the basic study on the stability of the mix with application of load. The standard mixture was prepared as per the IRC specification. The aggregate mix was coated with Polymer modified bitumen as described above. The mixture was then transferred to the mould. It was compacted with 75 blows on either side. The specimens (64 mm height and 10.2 mm diameter) were prepared by 1. Varying the percentage of plastics waste and 2. by varying bitumen quantity. These specimens were tested. The voids present in the mix also play an important role in deciding the performance of the mix as pavement. The Marshall Mix block is subjected to different types of tests to find out the following properties,

A) Voids filled with mineral aggregate
B) Air voids
C) Voids filled with bitumen
D) Bulk density
E) Specific gravity
F) Voids in mix

The results of the Marshall stability value is shown.

Marshal Stability Value is indicative of load with standing property of the flexible pavement. The minimum value is fixed as 1000Kg by IRC with 5% of bitumen and 95% of stone aggregate.

DISCUSSIONS OF RESULTS:

Empirical tests:

Table-1 gives the comparison results of the empirical values of the Plain B and ABS PMB. The softening point of the modified bitumen increases with increase in polymer content. The increase in softening point of the ABS PMB is a favorable result; it is observed that as higher the softening point of the bitumen better the resistant to permanent deformation properties like stripping, bleeding and rutting.

Table-1. Empirical test results.

Name of the modifier	% of Additive	Ductility	Penetration	Softening
	0	**75**	**67**	**41**
ABS	3%	68	64	58
	5%	64	59	62
	7%	60	51	68

The ductility value is responsible for the elasticity of the bitumen samples at low temperature range (250C), It is observed that the ABS PMB has a low difference in ductility value when compared with the Plain B. This decrease in ductility value of the PMBs is due to the chemical chain alteration inside the asphaltene compounds of the Plain B. The ABS polymer added to the bitumen interacts with the asphaltene molecules and may form a chemical bond, resulting in restricting the change in elasticity of the bitumen at low temperature. The advantage that was found with this property is that the modified bitumen

can perform very well in low temperature and high temperature areas and it may also with stand the fatigue cracking.

Penetration point is another important parameter which indicates the temperature susceptibility of the bitumen. From the softening point results, it was found that the polymer modification of bitumen will reduce the temperature related deformation of the binder. The decrease in the penetration point of the PMB shows that it can withstand high temperature environments and by this property deformation of the binder mixture at higher temperature can be avoided.

Thermal analysis:

The thermal studies TG/DTG of the base binder and the ABS PMB binder (Chen JH., 1985) were studied Table-2. Figure-1 shows the thermal curves of the Plain B, suggesting a decomposition stage starts from 2850C and it ends on 5150C and also shows a weight loss of 65. The Figure-2 shows the TG of 5% and 7% ABS PMB respectively. The thermal curves show three stages of decomposition as mention in the Table-2, these three stagse shows a maximum decomposition temperature at 3820C, 4620C and 5240C for 5% modified bitumen and 3820C, 4630C and 5200C for the 7% modified bitumen. From the above values the initial decomposition temperature and the final temperature of the modified bitumen are higher than the Plain B. The rate of decomposition of the modified bitumen is also slow due to its three stages when compared with plain B. When analyzing the percentage of decomposition of the modified bitumen, the graph values show that there is a difference in the percentage of loss between the modified bitumen. This is due to the strong bonding of the nitrile and the diene molecules from the polymer over the bitumen. The above results are the confirmation of the increase in the thermal stability of the modified bitumen. The three stage decomposition we have obtained from the TG of PMB also validates that the mixed polymer had formed a chemical bonding with the asphaltene compounds present in the bitumen. Thus it changes the thermal stability of the PMB (Wen-qian Luo et al., 2011).

Table-2. TGA Results of plain and ABS modified bitumen.

S. No.	Modifier	Stage	Onset Tem (°C)	Maximum temp (°C)	End temp (°C)	% of Weight loss
1	Plain Bitumen	I	285	460	550	67%
2	5% ABS	I	294	382	416	24%
		II	416	462	516	37%
		III	516	524	550	13%
3	7% ABS	I	296	382	410	23%
		II	410	463	490	32%
		III	490	520	550	20%

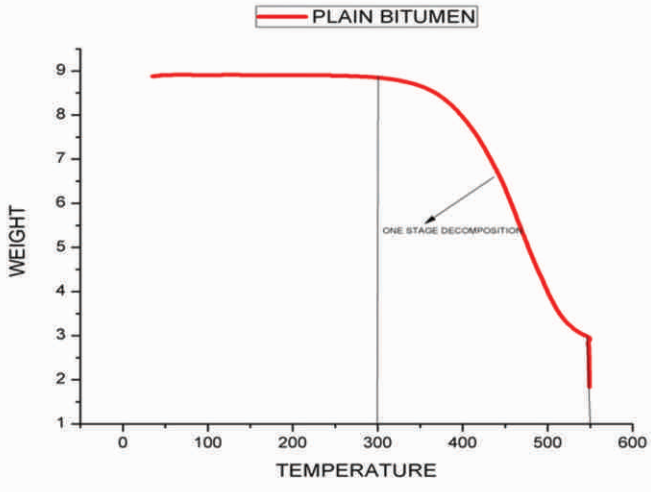


Figure-1. Thermo gravimetric of plain bitumen.

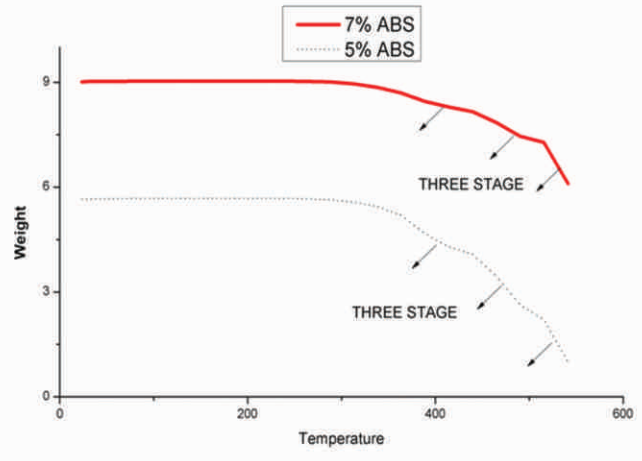


Figure-2. Thermo gravimetry of 5% and 7% ABS modified bitumen.

TIR studies:

The ABS PMB was subjected to the FTIR spectroscopic studies. The FTIR spectrums of the samples are shown in Fig. 3-5. From the graphs obtained, the modified bitumen shows the following properties.

a) The presence of the ABS in the bitumen structure is confirmed by the appearance of the Nitrile group in the spectra at a wavelength of 2200 - 2300cm-1. This was found by comparing the spectra of plain B and the modified binder. The strength of the peak also differs from 5% and 7% which also shows the increment in the amount of modifier used.

b) The butadiene peak is observed at the wavelength range 1000 - 960 cm-1

c) The peaks at 2853 and 2920 cm-1 are the peak of the aliphatic C-H stretching of the itumen polymer mix respectively.

d) The carbonyl c=o peak was observed in the wavelength 1683cm-1

e) The Main chain of the bitumen is modified with the polymer added- this needs further studies.

The spectroscopic study suggests that the modifier namely ABS used has a good tendency to mix with the bitumen. This also confirms the uniform mixing of the modifier with bitumen.

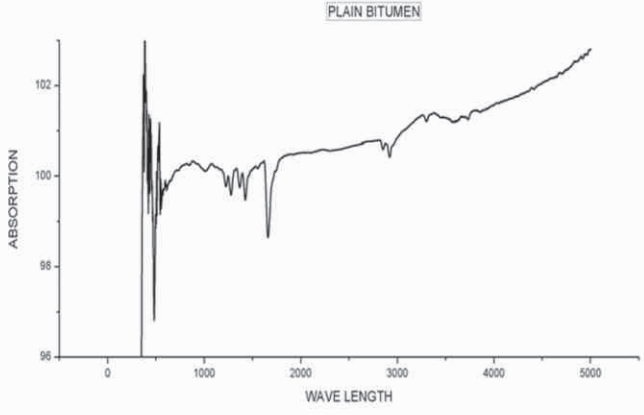


Figure-3. FTIR of plain bitumen.

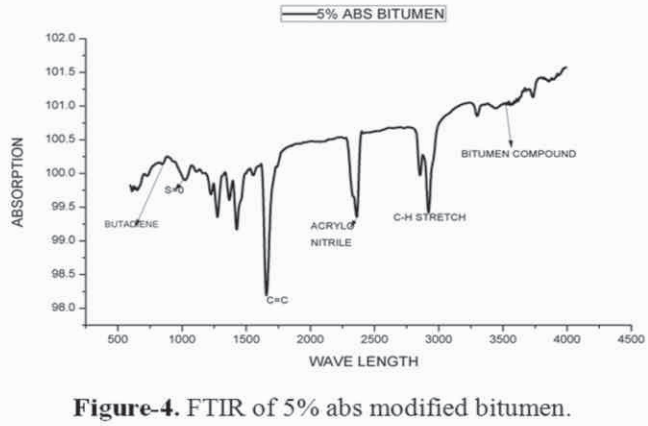


Figure-4. FTIR of 5% abs modified bitumen.

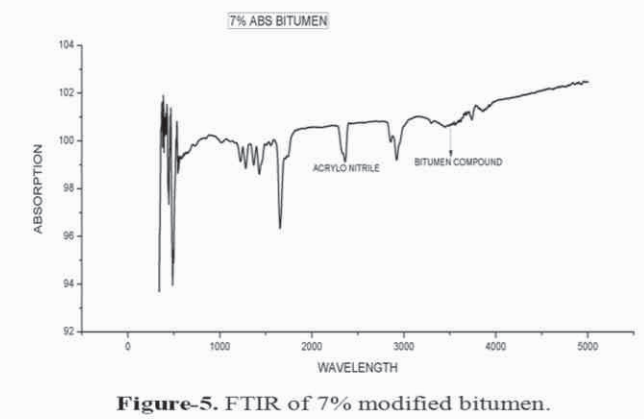


Figure-5. FTIR of 7% modified bitumen.

Stripping studies:

The stripping study was carried out to study the nature of the binding capacity of the PMB over the aggregate. As per the IRC coding a minimum of 5% stripping is allowed for flexible pavements. The study on the ABS PMB with aggregate mix shows that there is no stripping even after 72hrs at 40.deg.c Table-3. The peeling out of the bitumen from the aggregate is called as the stripping value. When bitumen coated aggregate is immersed in water, the water penetrates in between the stone and bitumen resulting in the peeling of the bitumen. This in turn results in the loosening of the aggregate and forms potholes. It shows that if pores and voids are present in aggregate it results in the poor binding of the aggregate with the bitumen. In the case of polymer modified bitumen coated aggregates, there is no pore. So it shows poor stripping value. The PMB binds very well with the aggregate due to the reason that both polymer and bitumen are hydrocarbons, they mix very well to form a newer visco elastic material which can resist the flow of water from the surface to the aggregate. Hence peeling out of bitumen from the aggregate is very low. The striping of bitumen from the aggregate will results in the formation of pothole and cracks which is permanent deformation problem for a pavement, but in the use of ABS PMB the stripping is nil and it shows that there will be no pothole formations and crack formation during stagnation water over the road surface. This is an important finding, since this property improves the performance of the pavement by reducing the permanent deformations caused due to peeling out of bitumen layer from the aggregate.

Table-3. Results of stripping tests for plan and ABS modified bitumen

S.No.	Percentage of ABS polymer	Percentage of stripping
1.	NIL	7%
2.	5%	NIL
3.	7%	NIL

Extraction test:

The extraction tests is the process of removal bonded bitumen from the aggregate using a solvent. The mix prepared using ABS PMB was

subjected to extraction tests and the results are shown in Table-4. The extraction results show that the removal of bitumen from the ABS PMB mix was very difficult when compared with plain bitumen mix. This was due to the reason that the ABS PMB has a tendency to form a strong bonding with aggregate due to its improvement in the sticking / binding nature after the addition of the polymer. The ABS which is mixed with the bitumen strongly interacts with the bitumen and form a new binder with improved binding capability. This results in the difficult removal of bitumen from the mix. This result also suggests that the pavement mix formed with the ABS PMB shows better binding and no permanent deformations.

Table-4. Results of extraction studies for plain and ABS modified bitumen.

ABS content (%by weight)	Bitumen extracted after 5 min %	Bitumen extracted after 10 min %	Bitumen extracted after 15 min %
0	96.0	98.0	100.0
5	63.5	88.7	92.3
7	63.2	86.7	90.7

Marshall stability test:

The old test to study the stability nature of a bituminous mixes is the Marshal Stability test. The test provides results about the stability (load withstanding capacity) of the mix, voids present, flow property and to determine the mix ratio for pavement construction. The ABS PMB mix was subjected to the MSV test and the results obtained is fairly high when compared with plain bitumen mix Table-5. The other properties also show good results. This improvement is due to the following reasons; both polymer and bitumen are similar in chemical nature. The polymer molecule interact with the constituents of bitumen namely asphaltene and other similar compounds and results in a three-dimensional internal cross-linked network.

The cross-linking results in strong bonding with improved elastic structure. This will also add its suitability as a blend for asphalt pavement. This is supported by the high Marshall Stability values. Thus the ABS PMB mix helps in increasing the stability of the mix and makes the mix to perform well even at higher load movements over the road surface.

Table-5. Results of Marshall Stability Value for plain and ABS modified bitumen.

Percentage of Bitumen	Percentage of ABS with respect to total weight	M.V (Kg)	F.V (x.0.25mm)	Void percentage	M.Q Kg/mm
4.5	0	1100	3.3	62	515
4.5	5	1800	3.4	66	529
4.5	7	1700	3.5	62	486

CONCLUSIONS:

The basic empirical tests namely softening point, ductility and penetration point are within the tolerance limit for the ABS PMB used for flexible pavement. This results help us is concluding that the PMB shows higher temperature susceptibility and lower deformation due to cracking.

It is observed from our thermal studies that ABS PMB has better temperature withstanding property with an increased binding property. The ABS PMB shows lower thermal deformation. This will help to reduce rutting and fatigue cracking during performance.

The FTIR studies throw more light on the interaction between the polymer and bitumen as it suggests a change in chemical structure, a unique observation. Further studies on the structural characterization will throw more light on the interaction of the ABS polymer with the bitumen constituents namely asphaltenes and maltenes.

The studies on the mix properties like stripping and extraction shows improved results, indicating the performance of the ABS PMB mix is good with increased binding property and it concludes that the mix may perform better in all condition without any deformations. This can be confirmed by conducting further performance studies on the prepared samples.

The MSV studies concludes that the mix prepared using ABS PMB can perform in heavy load moving areas and can be used in pavement surfaces where different load vehicle move.

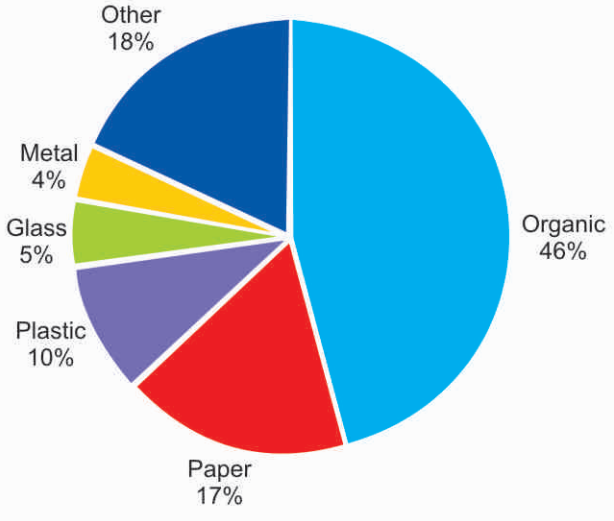
In our findings the ageing due to oxidative heating is also shows a small influence in the modified bitumen.

The ABS PMB prepared can be very well used for flexible pavement application.

Whenever we cross a solid waste dumpsite, the first thing we do is stop inhaling the pungent smell but the disheartening fact is that, have we ever thought of a reason for it or solution for it. The answer from most of us will definitely be a big "NO". And now it's definitely time for a change.

CURRENT SCENARIO OF SOLID WASTE LANDFILLS:

Many cities in developing Asian countries face serious problems in managing solid wastes. The annual waste generation increases in proportion to the rise in population and urbanization. Asian countries with greater rural populations produce more organic waste, such as kitchen wastes, and fewer recyclable items, such as paper, metals, and plastics. Land filling is one of the most common ways of municipal solid waste (MSW) disposal in developing countries. Landfill holds the least position in the hierarchy of integrated solid waste management.

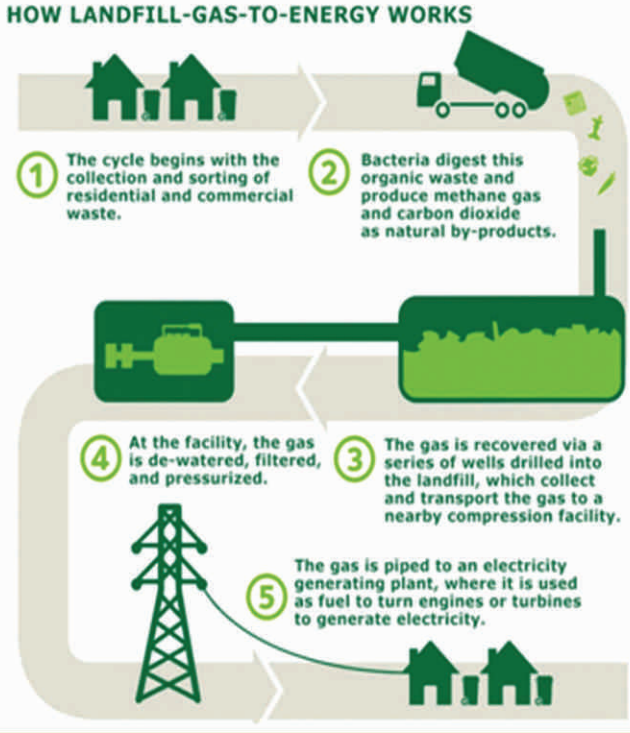


Air pollutants emitted from landfills contributes to the emission in the atmosphere of greenhouse gases and cause serious problems to the human health.

Methane emission from landfill is serious environmental global concern as it accounts for approximately 15% of current greenhouse gas emissions. There are two life stages in a landfill, its operating stage, where municipal solid waste (MSW) is being disposed of, and its closed stage, where storage capacity is reached. Operating landfills emits more CH4 than closed landfills since the major part of degradation occurs in the first few years following disposal with decreasing emission rates with time after closure. Various waste-to-energy (WTE) conversion technologies can generate energy products from municipal solid waste (MSW) but as far as dumpsite is concerned, Land fill Gas Recovery (LFGR) tops the list.

WHAT IS LANDFILL GAS RECOVERY???

Capturing LFG and using it as an energy source can produce significant energy, environmental, economic, and other benefits. LFG generated from landfills can be captured by gas collection and control systems that typically burn the gas in flares. Alternatively, the collected LFG can be used as fuel in energy recovery facilities, such as internal combustion engines, gas turbines, micro turbines, steam boilers, or other facilities that use the gas for electricity generation thereby reducing GHG emissions. However before installation of such systems it is important to predict the methane generation from the landfill site. Estimation of landfill methane emissions are based on models. Several models to predict methane emissions originating from landfills have been proposed or are recommended by national governments. The most common type of models uses single-phase or multi-phase first-order kinetics that describes the decay of biodegradable waste and the production of methane.



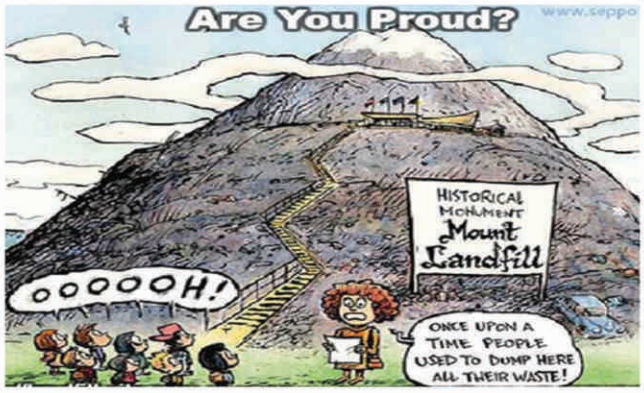
LFG RECOVERY- CURRENT STATUS OF INDIA

The total net GHG emissions from India in 2007 were 1727.71 million tons of CO2e of which methane emissions were 20.56 million tons. GHG emissions from the waste sector constituted 3% of the net CO2e emissions (2.52 million tons of methane). The waste sector emissions were 57.73 million tons of CO2e. It is estimated that MSW generation and disposal resulted in the emissions of 12.69 million tons of CO2e in 2007. The total GHG released from the waste sector in 2007 was 57.73 million tons of CO2e, of which, 2.52 million tons was emitted as methane; that is, 22% of the emissions were from MSW disposal (MoEF, 2010a). MSW landfills are the third largest human caused source of methane. Installation and O&M of such projects obviously will take a huge money investment and definitely will result in the equal or more returns than investment.

GAIL PROJECT- A LEAP FORWARD

GAIL (India) Ltd, a Maharatna company, as a part of its R&D activities has taken up an initiative in this direction and implemented a Pilot project to ascertain the recovery of LFG from an un-scientifically managed open active MSW dumping site at Ghazipur Delhi.

The objective of the Pilot project was to assess the potential of LFG recovery from an active Landfill site (in Phase-1) and study the suitability of its use as an alternate renewable fuel source by purifying it for use as CNG (in Phase-2). GAIL's R&D Pilot project area comprises of 4 Hectares (10 Acres) in the North-Eastern part of the Ghazipur Landfill site. The area can be subdivided into three parts – Slice A, Slice B & slice C.



Waste composition is an important consideration in evaluating a LFG recovery project, in particular the organic content, moisture content, and "degradability" of the various waste fractions.

LFG Pump tests were carried out to estimate the potential for LFG recovery. The capturing of LFG and its utilization as fuel helps mitigate the GHG emissions on 2 counts. While collecting and Flaring, CH4 is destructed to CO2 (as CH4 is 25 times more potent than CO2 for causing Global warming).

Waste is not a waste until it is wasted. Therefore, it's time for the energy revolution. Let's all step forward to generate energy from waste. So, next time when you come across a dumpyard, remember that you are crossing tonnes of energy and not a trash hill. It's better late than never.

"BE PART OF THE SOLUTION NOT PART OF POLLUTION"

Article by: Mrs.S.Sivasangari,
Asst. Prof. - Dept. of Civil Engg., TCE Madurai.

"Share a Survey on Plastic Ban"

Take a Survey (Page No. 13) on plastic ban by individual or group and share your feedback with us. The survey is being carried out in public sectors, schools, colleges. The filled in survey form may be sent to "TCE ENVIS" - "Dr. R. Vasudevan, Coordinator TCE ENVIS, DEAN ECA" – Thiagarajar College of Engineering, Madurai.

GSDP: Batch 01 - Waste Management

Overview:

Course Name	:	Waste Management
Duration	:	300 Hours
Inauguration Date	:	18.07.2018
Course Started	:	19.07.2018
Course Ended	:	01.10.2018
Valedictory Date	:	12.10.2018
No. of Participants	:	14 Persons
Resource Person(Ext)	:	10 Experts
Resource Person(Int)	:	20 Experts
Field Visits	:	08 Areas

The inaugural function of GSDP course on waste management was held on 18th July 2018. The course was inaugurated by Dr. Almitra Patel, a pioneer in solid waste management of our country and who is also one of the member constituted by supreme court of India for framing rules on solid waste management. In her inauguration speech she applauded the entire ENVIS team for their effort in conducting skill development program for un employed youth of our country and she also pointed out the role of youths in solid waste management in our country. The function is presided by Mr. Hari Thiagarajan, Trustee, TCE. Principal, Head and Deans are the other dignitaries on the stage. The program was attended by the GSDP participants and the civil engineering students.

GSDP: Batch 01 - Waste Management

GSDP 1st Batch Waste Management Certified Trainees:

Sl.No.	Candidate Name	Qualification	Email ID
1.	NIVETHA R	M.Sc., Zoology	kaniye.smp@gmail.com
2.	LOGESH KUMAR P	B.E., Civil Engg	logeshramya1796@gmail.com
3.	GAYATHRI AP	B.E., Civil Engg	gayathriap3@gmail.com
4.	KARUPPASAMY B	M.Sc., Physics	bkaruppas88@gmail.com
5.	SARAVANAKUMAR R	M.Sc., Chemistry	saravanakumaran22@gmail.com
6.	SARUHASHINI S	M.Sc., Zoology	sarugaselvam@gmail.com
7.	MANOJ PRABAKAR R	M.Tech., Envi. Engg.	manojprabakar94@gmail.com
8.	SUBHASHINI C	B.E., ECE	subhashinibe1991@gmail.com
9.	BALAMURUGAN A	M.Tech., Envi. Engg.	mbala7383@gmail.com
10.	GIMNA MARIA GEORGE	M.Sc., Botany	gimnamg@gmail.com
11.	THIRUCHELVE S R	M.Tech., Envi. Engg.	thiruselvikrithika@gmail.com
12.	MARUDHUSUBASH B	B.E., Civil Engg	marudhusubash@gmail.com
13.	KAPISH BHAGNANI	BMS	kapishbhagnani23@gmail.com
14.	SANGEETHA P	MSW	sangikathir2000@gmail.com

The course formally started on 19/07/2018 with an introduction given by Padma Shree Dr. R. Vasudevan, coordinator TCE ENVIS.

The session was followed by the lecture delivered by Ar. Balaji, Associate Professor department of architecture, TCE. He discussed about the introduction on solid waste management and it importance.

The course continued with various resource persons and experts in the field of waste management including Lecture class, Lab Demo, Field Visits, Projects, Video Sessions, Group Discussions and So on.,

Especially Chief Health Officer, Madurai Corporation, Madurai, Dr. V. Satish Ragavan., MBBS., MD., trained our participants in the field of Bio Degradable, non-bio degradable and hazard waste management.

GSDP 1st Batch Lecture Details:

Sl. No.	Date	Topic Covered	Resource Person
1.	19.07.2018	INTRODUCTION	DR. R. VASUDEVAN, ENVIS COORDINATOR, TCE.
2.	19.07.2018	INTRODUCTION TO SWM	AR. G. BALAJI, ASSO. PROF, DEPT. OF ARCH, TCE.
3.	19.07.2018	LAB VISIT	TEAM, TCE ENVIS, MADURAI.
4.	20.07.2018	PHOTOS OF DUSTBINS	TEAM, TCE ENVIS, MADURAI.
5.	20.07.2018	SOLID WASTE MANAGEMENT	DR. V. RAVISHANKAR, ASSO PROF, CIVIL ENGG, TCE.
6.	20.07.2018	SUCCESSFUL VIDEOS IN SWM	DR. A. RAMALINGACHANDRASEKAR, PO, TCE ENVIS.
7.	23.07.2018	CHARACTERISTICS OF SOLID WASTE	DR. T. VELRAJAN, PROF. & HEAD, CIVIL ENGG, TCE.
8.	23.07.2018	REUSE OF BUILDING WASTE	DR. R. VELKENNEDY, ASSO. PROF, CIVIL ENGG, TCE.
9.	23.07.2018	LAB VISIT	TEAM, TCE ENVIS, MADURAI.
10.	24.07.2018	COLLECTION TRANSFER & TRANSPORT OF SW to MSW	DR. RKC. JEYA KUMAR, ASST, PROF, CIVIL ENGG, TCE.
11.	24.07.2018	ENTREPRENEUR IN SWM COMPOSTING	DR. S. BALAJI, ASST. PROF, DEPT. OF CHEMISTRY, TCE.
12.	24.07.2018	COLLECTION, TRANSFER & TRANSPORT OF SW TO MSW	DR. D. KANNAN, PROF & HOD - INCHARGE, DEPT. OF BOTANY, THIAGARAJAR COLLEGE, MADURAI.
13.	25.07.2018	BIO DEGRADABLE & HAZARD WASTE	DR. V. SATHISHRAGAVAN, C.H.O., MADURAI DISTRICT.
14.	25.07.2018	ENTREPRENEUR IN SWM	DR. S. BALAJI, ASST. PROF, DEPT. OF CHEMISTRY, TCE.
15.	26.07.2018	WASTE TO WEALTH SOLUTION	DR. M. KOTTAISAMY, HOD, DEPT. OF CHEMISTRY, TCE.
16.	26.07.2018	MUNICIPAL SOLID WASTE, MANAGEMENT	DR. S. RAJENDRAN, PROF, BOTANY, S N COLLEGE, MDU.
17.	30.07.2018	ENVIRONMENT ISSUES & IMPACT	DR. D. KANNAN, PROF & HOD - INCHARGE, DEPT. OF BOTANY, THIAGARAJAR COLLEGE, MADURAI.
18.	30.07.2018	SANITARY LAND FILLING IN SWM	DR. V. RAVISHANKAR, ASSO PROF, CIVIL ENGG, TCE.
19.	31.07.2018	E-WASTE	MS. K. KEERTHY, ASST. PROF, CIVIL ENGG, TCE.
20.	31.07.2018	ZERO WASTE MANAGEMENT	MRS. S. SIVASANKARI, ASST. PROF, CIVIL ENGG, TCE.
21.	31.07.2018	REUSE OF BUILDING WASTE	DR. R. VELKENNEDY, ASST. PROF, CIVIL ENGG, TCE.
22.	01.08.2018	WASTE WATER RESOURCES	DR. S. CHANDRAN, ASST. PROF, CIVIL ENGG, TCE.
23.	01.08.2018	PROPERTIES OF SOLID WASTE	DR. T. VELRAJAN, PROF. & HEAD, CIVIL ENGG, TCE.
24.	01.08.2018	VIDEO SESSION	TEAM, TCE ENVIS, MADURAI.
25.	02.08.2018	WASTE TO WEALTH	DR. M. KOTTAISAMY, HOD, DEPT. OF CHEMISTRY, TCE.
26.	02.08.2018	WASTE WATER RESOURCES	DR. S. CHANDRAN, ASST. PROF, CIVIL ENGG, TCE.
27.	03.08.2018	SENSORS OF WASTE MANAGEMENT	DR. K. HARIHARAN, ASST. PROF, DEPT. OF ECE, TCE.
28.	06.08.2018	BIO-GASIFICATION OF SOLID WASTE	DR. S. RAJENDRAN, PROF, BOTANY, S N COLLEGE, MDU.
29.	07.08.2018	BIO- MEDICAL WASTE	DR. V. SATHISHRAGAVAN, C.H.O., MADURAI DISTRICT.
30.	07.08.2018	GRIDSS	DR. RA. ALAGURAJA, ASST. PROF, DEPT. OF ECE, TCE.
31.	09.08.2018	RECOVERING ENERGY FROM SW	DR. V. GAYATHRI, ASSO. PROF, DEPT. OF PHYSICS, TCE.
32.	09.08.2018	WASTE WATER RESOURCES	DR. S. CHANDRAN, ASST. PROF, CIVIL ENGG, TCE.
33.	13.08.2018	RECYCLING ON E- WASTE	MS. K. KEERTHY, ASST. PROF, CIVIL ENGG, TCE.
34.	13.08.2018	WONDER WORLD OF NANO	DR. V. GAYATHRI, ASSO. PROF, DEPT. OF PHYSICS, TCE.
35.	14.08.2018	WONDER WORLD OF NANO	DR. V. GAYATHRI, ASSO. PROF, DEPT. OF PHYSICS, TCE.

GSDP 1st Batch Lecture Details:

Sl. No.	Date	Topic Covered	Resource Person
36.	14.08.2018	UTILIZATION OF WASTE PLASTICS IN ROAD	DR. R. VELKENNEDY, ASSO. PROF, CIVIL ENGG, TCE.
37.	16.08.2018	PLASTIC WASTE MANAGEMENT	DR. R. VASUDEVAN, ENVIS COORDINATOR, TCE.
38.	16.08.2018	STRATEGY DEVELOPMENT & PLANNING	MRS. S. SIVASANKARI, ASST. PROF, CIVIL ENGG, TCE.
39.	20.08.2018	E-WASTE ENVIRONMENTAL ISSUES	MS. K. KEERTHY, ASST. PROF, CIVIL ENGG, TCE.
40.	20.08.2018	CONSTRUCTION AND DEMOLITION WASTE	DR. R. VELKENNEDY, ASSO. PROF, CIVIL ENGG, TCE.
41.	23.08.2018	INDUSTRIAL SOLID WASTE MANAGEMENT	MR. R. MANOJPRABAKAR, GSDP PARTICIPANT.
42.	23.08.2018	COLLECTION OF MUNICIPAL SOLID WASTE	DR. T. VELRAJAN, PROF & HEAD., CIVIL ENGG, TCE.
43.	24.08.2018	INDUSTRIAL SOLID WASTE MANAGEMENT	MR. R. MANOJPRABAKAR , GSDP PARTICIPANT.
44.	24.08.2018	ENTREPRENEURSHIP IDEAS	MR. SIVARAJARAMANATHAN, ENTERPRENEUR.
45.	27.08.2018	WATER SOURCE OF INCOME	MR. A. BALAMURUGAN, GSDP PARTICIPANT.
46.	27.08.2018	SOLID WASTE MANAGEMENT IN RED & GREEN OCEAN METHODS	DR. S. BALAJI, ASST. PROF, DEPT. OF CHEMISTRY, TCE.
47.	28.08.2018	PLASTIC WASTE MANAGEMENT	DR. R. VASUDEVAN, ENVIS CO-ORDINATOR, TCE.
48.	29.08.2018	GRIDSS	DR. RA. ALAGURAJA, ASST. PROF, DEPT. OF ECE, TCE.
49.	30.08.2018	METHODS OF SANITARY LAND FILLING	MRS. S. SIVASANKARI, ASST. PROF, CIVIL ENGG, TCE.
50.	30.08.2018	STRATEGY DEVELOPMENT & PLANNING	DR. V. RAVISHANKAR, ASSO. PROF, CIVIL ENGG, TCE.
51.	31.08.2018	BIO – MASS METHOD	DR. R. VASUKI, HOD, DEPT. OF PHYSICS, TCE.
52.	03.09.2018	COMPOSTING USING MICROBES	MR. R. MANOJPRABAKAR, GSDP PARTICIPANT.
53.	03.09.2018	WASTE WATER TREATMENT	MR. R. SARAVANAKUMAR, GSDP PARTICIPANT.
54.	04.09.2018	WATER BASED, SENSOR BASED (GIS)	MS. SR. THIRUCHELVE, GSDP PARTICIPANT.
55.	04.09.2018	PLASTIC WASTE MANAGEMENT	DR. R. VASUDEVAN, ENVIS COORDINATOR, TCE.
56.	05.09.2018	E - WASTE	MR. B. KARUPPASAMY, GSDP PARTICIPANT.
57.	05.09.2018	GRIDSS	DR. RA. ALAGURAJA, ASST. PROF, DEPT. OF ECE, TCE.
58.	06.09.2018	VERMI COMPOSTING	MR. SIVASAMY, SAKHI VERMICOMPOST, VADIPATTI
59.	06.09.2018	SEPARATION & PROCESSING OF SOLID WASTE	DR. T. VELRAJAN, PROF. & HEAD., CIVIL ENGG, TCE.
60.	07.09.2018	CONSTRUCTION & DEMOLITION WASTE	MR. P. LOKESH KUMAR, GSDP PARTICIPANT.
61.	07.09.2018	INTEGRATED SOLID WASTE MANAGEMENT	DR. D. KANNAN, PROF & HOD-INCHARGE, DEPT. OF BOTANY, THIAGARAJAR COLLEGE, MADURAI.
62.	11.09.2018	INTEGRATED SOLID WASTE	MRS. S. SIVASANKARI, ASST. PROF, CIVIL ENGG, TCE.
63.	11.09.2018	PLASTIC WASTE MANAGEMENT	DR. R. VASUDEVAN, ENVIS COORDINATOR, TCE.
64.	12.09.2018	SWM REVISE	MR. MANOJ PRABAR & MR. BALAMURUGAN, GSDP PARTICIPANT
65.	12.09.2018	ENERGY HARVESTING	DR. V. GAYATHRI, ASSO. PROF, DEPT. OF PHYSICS, TCE.
66.	14.09.2018	EARTHWORMS &MICROBOES	DR. R. KANNAN, PROF, AGRI, KALASALINGAM UNIV.
67.	17.09.2018	ENIVORNMENTAL OF ECO LABELS	DR. J. SHANMUGA PRIYA, AP, DEPT OF CHEMISTRY, TCE.
68.	17.09.2018	INCERNATION& ENERGY RECOVERY	DR. S. RAJKUMAR, AP, DEPT OF CHEMISTRY, TCE.
69.	18.09.2018	LIFE OF RACKPICKERS	MR. B. MARUDHUSUBASH, GSDP PARTICIPANT.
70.	18.09.2018	BIO REMEDIATION	MS. GIMNA MARIA GEORGE, GSDP PARTICIPANT.

GSDP 1st Batch Lecture Details:

Sl. No.	Date	Topic Covered	Resource Person
71.	18.09.2018	TPCB RULES	ER. K. RAM MOHAN, M.E, M.B.A, DIST. ENVIS. ENGG.
72.	19.09.2018	LAND FILLING AND DUMP SITES	DR. RAMESH , PROF, NATIONAL INSTITUTE OF TRICHY.
73.	19.09.2018	INTRODUCTION TO VERMI COMPOST	MR. V. VELKANNAN, AP, DEPT. OF CHEMISTRY. TCE.
74.	20.09.2018	CONSOLIDATE ON SWM	MR. KAPISHBHAGNANI, GSDP PARTICIPANT.
75.	20.09.2018	BIO- MEDICAL WASTE	DR. V. SATHISH RAGAVAN, C.H.O, MADURAI DISTRICT.
76.	20.09.2018	COMPARISION OF SWM INDIA - SINGAPORE	MS. A.P. GAYATHRI, GSDP PARTICIPANT.
77.	24.09.2018	WASTE TO WEALTH	MR. BHARATHY, MURUGAPPA GROUPS, KARAIKUDI.
78.	24.09.2018	VERMI COMPOST & RECYCLING	MRS. SARUHASHINI, GSDP PARTICIPANT.
79.	24.09.2018	BIO - MEDICAL WASTE MANAGEMENT	MRS. SUBHASHINI , GSDP PARTICIPANT.
80.	24.09.2018	IMPORTANCE OF CHEMISTRY IN BTM	DR. S. SIVAILANGO, AP, DEPT. OF CHEMISTRY, TCE.
81.	26.09.2018	WASTE & CLIMATE CHANGE	MS. R. NIVETHA, GSDP PARTICIPANT.
82.	26.09.2018	ENVIRONMENT PROTECTION	MRS. P .SANGEETHA , GSDP PARTICIPANT.
83.	26.09.2018	ENERGY HARVESTING	DR.V.GAYATHRI, ASSO. PROF, DEPT. OF PHYSICS, TCE.
84.	28.09.2018	APPLICATION OF LIGNOCELLULOSES WASTE (BANANA LEAFS)	DR. M. KOTTAISAMY, HOD, DEPT. OF CHEMISTRY, TCE.

LECTURE CLASS SNAPS









Vellaikal Dumping Yard - Madurai Corporation

Fungus Based Solid Waste Composting Lab & Bio Gas of Solid Waste Model at Saraswathi Narayanan College, Perungudi, Madurai

Green Exnoura - Composting of Vegetable & Flower Waste.

KT Greens India PVT Ltd - SWM Madurai.

Amma Mess Bio-Gas Plant from Solid Waste from local residents, K-Pudur, Madurai.

Clean & Green Environment - NGO Madurai

GSDP: Batch 01 - Waste Management

Kalasalingam University - Waste Water Treatment Plant & Vermicompost.

GSDP Valedictory:

Our TCE ENVIS Centre for Plastic Waste Management successfully completed the "Waste Management" course 1st batch under Green Skill Development Programme, The 1st batch has 14 participants from various sectors got trained to handle and put their hands towards sustainable development environment.

The Valedictory Function was presided by Madurai District Collector and the Chairman of our College. The District Collector applaused the work of ENVIS on conducting GSDP Course and he promised to help ENVIS in all other activities. The Chairman submitted his gratitude to the ministry for choosing TCE as a ENVIS Centre. He also encouraged the students to take part in environmental related activities.

Thank You

TCE ENVIS Activity Timeline

Date: 23.08.2018 & 24.08.2018

Event: Green Skill Development Programme GSDP

Venue: DZUM, Madras University, Chennai.

Detail: Handled Session on “Plastic Waste Management" in "Waste Management" course conducted by DZUM, University of Madras, ENVIS Centre, Chennai, under Green Skill Development Programme for DZUM ENVIS GSDP 1st batch students.

Date: 27.08.2018

Event: ENVIS Coordinators & PO`s Meeting

Venue: DZUM, Madras University, Chennai.

Detail: ENVIS meeting chaired by Dr.Anandi Subramanian, Principal Advisor, MoEF&CC to discuss all the new initiatives of ENVIS Scheme has been discussed and appraised in the meeting.

Date: 06.09.2018 & 07.09.2018

Event: Waste Plastic - New Technologies Presentation

Venue: NRIDA, Regional Review Meet, Chennai.

Detail: Awareness Presentation by our coordinator Dr. R. Vasudevan on Waste Plastics at National Rural Infrastructure Development Agency (NRIDA) Regional Review meetings held at chennai to make use of technologies that the states can use more such new technologies in future

Date: 14.09.2018

Event: State Level Stake Holders Meet

Venue: Panagal Building, Saidapet, Chennai.

Detail: Attended a state level Stake holders meeting to publicize the new schemes of ENVIS viz., NES (National Environment Survey), GSDP (Green Skill Development Programme)

Date: 20.09.2018

Event: Green Skill Development Programme GSDP

Venue: DESKU, University of Kalyani, Kolkata.

Detail: Handled Session on “Plastic Waste Management" in "Waste Management" course conducted by DESKU, University of Kalyani, ENVIS Centre, Kalyani, under Green Skill Development Programme for DESKU ENVIS GSDP 1st batch students.

Date: 22.09.2018

Event: Green Skill Development Programme GSDP

Venue: NEHU, Shillong, Megalaya.

Detail: Handled Session on “Plastic Waste Management" in "Waste Management" course conducted by NEHU, North East Hill University, ENVIS Centre, Shillong, Megalaya, under Green Skill Development Programme for NEHU ENVIS GSDP 1st batch students

Date: 27.09.2018

Event: Technical Presenation - Innovative Ideas for Plastics Recycling, by ICPE

Venue: Hall of Culture, Nehru Centre, Mumbai.

Detail: Technical Presentation by our coordinator Dr. R. Vasudevan on Innovative Ideas for Plastic Recycling in International Conference on Plastic Recycling & Waste Management Opportunites & Challanges organised by ICPE, Mumbai.

Date: 26.10.2018

Event: Green Skill Development Programme GSDP

Venue: KSCSTE, ENVIS Centre, Kerala.

Detail: Handled Session on “Plastic Waste Management" in "Waste Management" course conducted by KSCSTE, at the Malabar Botanical Garden & Institute for Plant Sciences (MBGIPS), ENVIS Centre, Kozhikode, Kerala, under Green Skill Development Programme for KSCSTE ENVIS GSDP 1st batch students

Date: 02.12.2018

Event: 8th International Exibition on Plastics Seminar - “Waste to Wealth”

Venue: Indplas`18, Kolkata.

Detail: Handled Session on “Plastic Waste Management" in "Waste Management" course conducted by DESKU, University of Kalyani, ENVIS Centre, Kalyani, under Green Skill Development Programme for DZUM ENVIS GSDP 1st batch students.

Date: 13.12.2018 & 14.12.2018

Event: ENVIS REGIONAL EVALUATION & TRAINING WORKSHOP

Venue: ENVIS (Hub & RP) EPTRI, Hyderabad.

Detail: Inventorying, mapping grid selection and monitoring of natural resources in India based on the bio-geographic zones - namely, Himalayan; North-Eastern; Gangetic Plains; Semi-Arid/Desert; Western Ghats, Islands & Coastal; and the Deccan Peninsula – Grid based GIS

TCE ENVIS Activity Timeline

Date: 18.12.2018, 19.12.2018, 20.12.2018

Event: "Reuse of Waste Plastic in Road Laying - Live Demo".

Venue: KILA - Kerala Institute of Local Administration.

Detail: As a another initiative by TCE ENVIS with Clean Kerala Pvt Ltd (JOINTLY PROMOTED BY GOVERNMENT OF KERALA & LOCAL SELF GOVERNMENT INSTITUTIONS) Organised a Training Program on "Reuse of Waste Plastic in Road Laying - Live Demo" for the Engineers of LSGD & PWD, Govt. of Kerala.

Date: 24.12.2018

Event: Plastic Tar Road Laid at Duroflex Industry Premises

Venue: Duroflex Industries, Hosur, Tamilnadu.

Detail: The plastic road laid at the factory premises of Duroflex industries is one such an initiative to reuse the waste plastics in an ecofriendly manner. On behalf of the institute we highly appreciate the company for taking up the project for laying their factory road premises with waste plastics. The company have used more 4 tons of waste plastics for laying the roads. Thus they have reduced the pollution to an extent of 12 tons of carbon di oxide release in the atmosphere. Moreover, the plastic road they have laid will also satisfies the required road performance as per the industries request. We also appreciate the lead taken by M/S Duroflex in showing the care towards the environment by managing the waste plastics. In future the company will spread this initiative to other companies in and around and request them to take part in this Yagna. We wish the company a very great success in promoting this greener technology.

NES - National Environment Survey

NEW DELHI: India's first ever National Environment Survey (NES) will be kicked off from 55 districts across 24 states and three Union Territories in January, 2019.

The earliest the first set of complete green data from the survey will be available is 2020, providing an important tool in the hands of policy-makers for decision making at all levels - district, state and national.

The survey will be done through a grid-based approach, using grids measuring 9x9 km, to collect comprehensive data on various environmental parameters such as air, water, soil quality; emission inventory; solid, hazardous and e-waste; forest & wildlife; flora & fauna; wetlands, lakes, rivers and other water bodies.

It will also assess carbon sequestration potential of all the districts across the country. The NES will rank all the districts on their environmental performance and document their best green practices.

At present, the country has secondary data on most of these parameters. The NES will, however, for the first time provide primary data on all the green heads in the same way that the National Sample Survey (NSS) periodically collects various socio-economic data.

The first set of data will be compiled in one year because we need to cover seasonal cycles in terms of air pollution and flora & fauna.

All 716 districts in the country are expected to be surveyed in a period of three to four years. Currently, all necessary preparatory works and training are being done in all the 55 districts where the NES will be conducted next year.

These 55 districts include south Delhi, Pune and Palghar in Maharashtra, Gurugram and Mewat (Nuh) in Haryana, Kullu in Himachal Pradesh, Nalanda in Bihar, Dhanbad in Jharkhand, Jamnagar and Mehsana in Gujarat, Alwar and Barmer in Rajasthan, Coimbatore and **Madurai in Tamil Nadu,** Shimoga in Karnataka and Hyderabad in Telangana among others.

National Environment Survey
Madurai District

Geographical Area (In Square km.):
3,710
(Ranks 19th in State and 326th in India)

Total Number of Households:
7,97,939

Population:
30,38,252 (Persons)
15,26,475 (Males)
15,11,777 (Females)
(Ranks 9th in State and 119th in India)

Number of Sub Districts/Towns/Villages:
Sub-districts (07)
Towns (39)
Villages (570)

Forest Cover (2015) :
18.10% of Total Geographical Area

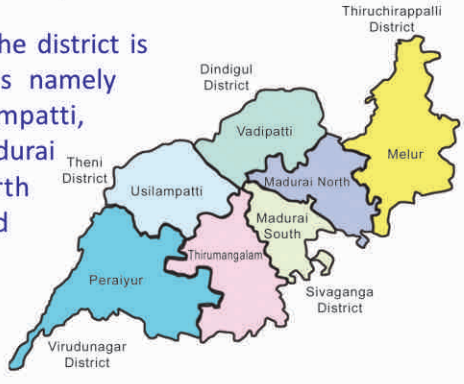
Urban/Rural Population:
60.78(Urban)
39.22 (Rural)

Administrative Language:
Tamil

About Madurai

Madurai district is a district of Tamil Nadu State with its administrative headquarters located at Madurai city. The district got its name from its headquarters city, Madurai. The place, Madurai is also popularly known by various names such as Madurai, Koodal, Malligai Maanagar, Naanmadakoodal and Thirualavai.

Geographically, the district lies at 09°93'N latitude, 78°12'E longitude and 136 m altitude. The district encompasses a geographical area of 3,710 sq km.

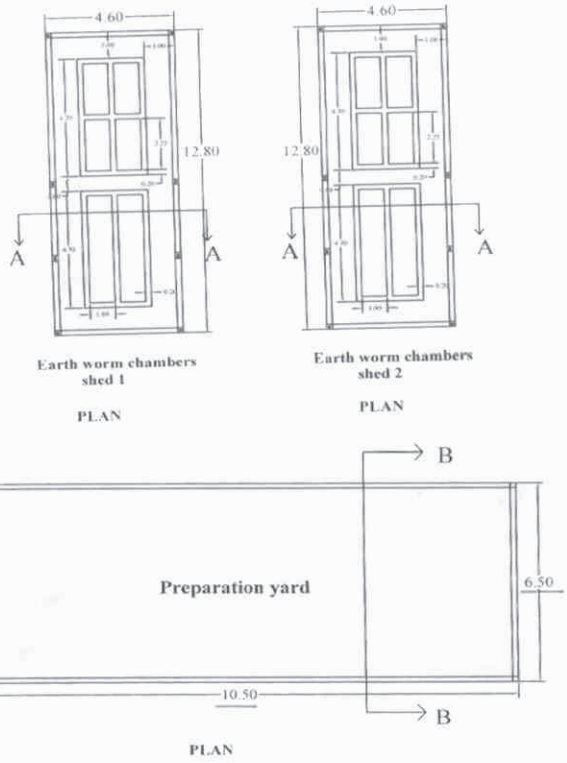


Administration wise, the district is divided into 7 talukas namely Tirumangalam, Usilampatti, Vadipatti, Melur, Madurai South, Madurai North and Peraiyur and moreover, it comprises 39 towns and 570 villages. There are 3 lok sabha seats and 10 Assembly constituencies in the district.

Solid waste management Centre at Department of Chemistry, TCE is carrying out research work on management to cater the needs of the society, industries and to the college. The Centre is established to focus on the existing waste management problems faced by various industries, society and government, providing technologies to the waste management in the following categories.

1. Solid Waste
   - Municipal Solid waste
   - Domestic waste
   - Industrial Waste

2. Liquid Waste
   - Domestic waste
   - Industrial Waste

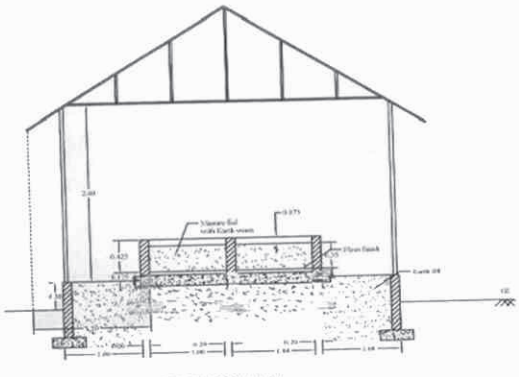


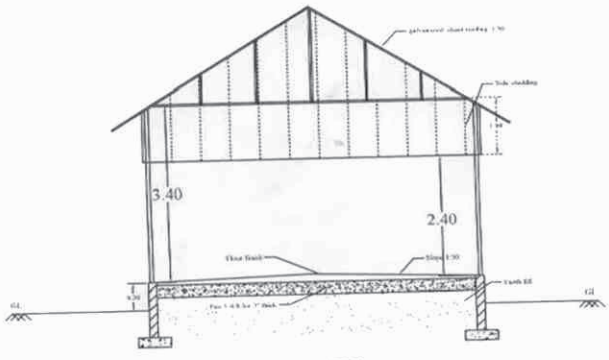
TCE - SOLID WASTE MANAGEMENT - LAYOUT
(Under Construction)

Focused Areas of the Centre: - 4 R's pattern will be followed over all the waste management process

* Reduce
* Reuse
* Recycle
* Rethink

- Municipal Solid Waste management
- Plastic waste management
- Industrial Waste
- Liquid Waste
- All types of Solid Waste
- Environmental Management Systems
- E- Waste
- Sea Weed Waste


SECTION 'AA'



SECTION 'BB'

THIAGARAJAR COLLEGE OF ENGINEERING,
Madurai -15
SOLID WASTE MANAGEMENT
Proposed Earth Worm chamber/shed
and preparation yard

To collect and convert plastic waste to shredded plastic waste as value added product.

- Plastic rejections are considered to be the major contributor towards the irreparable damage caused to the environment due to pollution, world over. Plastic found in different forms are harmful to nature. Inordinate dumping of plastic near water bodies and Indiscriminate burning of plastics are the root cause of exponential increase in the pollution index of many a city in the world.

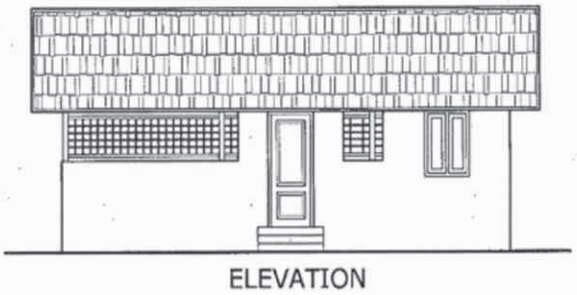
- The project aims to ensure comprehensive management of all harmful rejections in the state, thereby ensuring that the hygiene of the state is never compromised.

- Segregation and collection on plastic waste is the need of the hour.

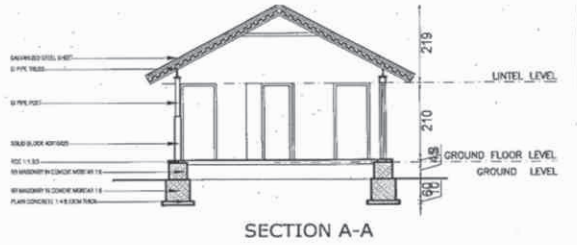
Installation of Plastic Shredding Machine and Baling Machine

- Commission one number shredding machine of processing capacity 100Kg/hr and upto 1 TPD and baling machine based on a supply contract entered into with the Local Self Government Institutions.

- L.S.Gs to ensure that clean and dry plastics rejects are being brought in to the facility through the prevalent collection network of the local body.



ELEVATION



SECTION A-A

- The cost of the machinery, installation, erection and commissioning charges to be borne by Local Institutions. Local Institutions to provide a built up space (Shed) of 1000 square feet and provide all the required infrastructure, like electricity ((3 phase connection and starter switches for machineries), water supply etc.

- The L.S.G to employ self help group, NGO and other plastic waste collectors to process the waste at the facility and convert the waste plastic material, brought into the facility, into shredded plastic suitable for recycling and prepare it for forwarding for further recycling and Tar Road Laying.

- The shredded plastics can be used to P.W.D/L.S.G.D for the construction of polymerized roads.

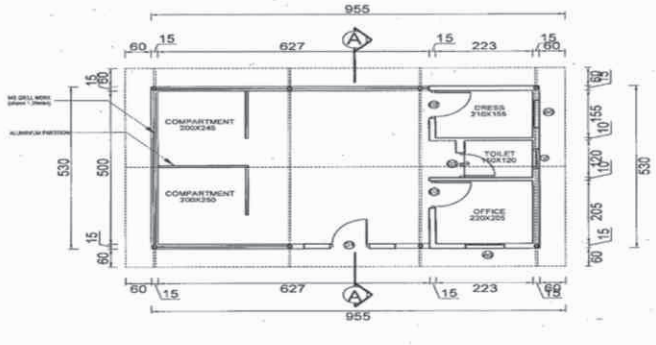
TECHNICAL REQUIREMENTS:

Plastic Shredding Machine-15 HP Motor
Hydraulic Bale Press Machine-7.5HP Motor
Blade Sharpener Machine-2HP Motor
Water Requirement – 1/2 KLD
Shed for machine – 40 ft X 25 ft

QUANTITY OF WASTE INPUT/OUTPUT:

Maximum input quantity of waste which can be processed in the plant-1 tonne per day and Maximum output quantity of plastic per day-800 Kg

Manpower cost: according to the labor department notification , minimum rates for the wages Rs. 470 per day (26 days)



GROUND FLOOR PLAN

1st Year Overview

TCE ENVIS

Plastic Waste Management Madurai

Mar 2018 to Dec 2018

MAR 2018

03 — **Advisory Committee**
Formation of Committee

04 — **Website Launch**
www.tceenvis.in

05 — **Awareness Activity**
Pamphlet Distribution with NSS

JUNE 2018

06 — **Student Ambassador**
Representative for Village

07 — **Started GSDP**
Advertisement, Interview, Inauguration

08 — **GSDP Batch I**
Lectures, Field Visit & Practical's

SEP 2018

09 — **GSDP Batch I**
Completed with 14 Participants

10 — **NEWS LETTER**
1st Newsletter Published

11 — **GRID & GIS**
Madurai District

DEC 2018

Ministry of Environment, Forest & Climate Change

TCE ENVIS – Website Sections

Plastic Waste Management	Dedicated Page for GSDP & GIS	Others
Basic Information's (What is plastic, Types & Etc.,)	Link to Official GSDP Page	NEWSLETTER & Activity
Numerical Data (On Progress to provide search based result)	Complete Info about GSDP 1st Batch	Videos for KIDS
Research Papers (Under Consolidation)	GIS Page (Under Construction)	Gallery, About section for MoEF & CC, ENVIS, TCE & Etc.,
Stats On: 30-12-2018	Total Visit: 4586	Total Visitors: 893

HOME | ABOUT | PLASTIC WASTE MANAGEMENT | GSDP | GRIDSS | QUERY | FEEDBACK

Highlights

- **Live Info** on Plastic Waste Mgmt
  - Programmed for Auto Update
- Online Query Portal
  - Enhanced with Mail Ack.
- Feedback Section
  - Enhanced with Mail Ack.
- •Upcoming – GIS Madurai
  - On Mouse over Info portal

TCE ENVIS Handouts

பிளாஸ்டிக்கை ரோட்டில்
போடாதீர்கள்
பிளாஸ்டிக்கால் ரோடு
போடுங்கள்

TCE ENVIS, Madurai

PLASTIC WASTE MANAGEMENT

TCE ENVIS
MADURAI

Ministry of Environmental, Forest &
Climate Change, GOI

TCE ENVIS, Madurai

Ministry of Environmental, Forest & Climate Change, GOI

Ministry of Environment, Forest
& Climate Change

Thiagarajar College of Engineering
Environmental Information System

Plastic Waste Management

- APPLYING 4 R'S PRINCIPLE
- GOOD GARBAGE CULTURE
- PROPER COLLECTION OF WASTE
- SEGGREGATION OF WASTE SOURCE
- UTILIZATION OF WASTE
- OWN YOUR OWNERSHIP

Success Stories
&
Participants Views

One trainee from Thirunelveli Mr. Subash told that "the course on waste management made me to think of creating a "waste Management Centre" and I am going to spread the knowledge I got from the course by creating awareness on proper disposal of Solid Waste added "The love I have to show to my mother earth lies in keeping her clean and green."- Creating Entrepreneur is one major objective of the course and we have done it.

Two women trainees from a background of Botany & Zoology had even gone out of the box and they have started working on developing a Microbiology Lab to develop Microorganism for the decomposition of Solid Waste as well as Plastic Waste. They have also requested the Host Institution to support them in this regard.

The trainees commented that "The field visits to various Solid Waste Management sites, show many ways of decomposing solid waste but the research on decomposing "Plastic Waste" still lags, so we have decided to work on developing bacteria to decompose "Plastic Waste".

Thiagarajar College of Engineering,
ENVIS Centre,
Plastic Waste Management.
Phone: 0452 2482240 Ext: 903,630
Email: pwm@tceenvis.in
Web: www.tceenvis.in

We had a house wife as a trainee, her story on GSDP course is totally different. "My husband is an entrepreneur, and sometimes I even worried what he is doing with the "Kuppai" (Waste) now after completing the course, my mind set has changed and I myself started working with my husband, Even I have started guiding him Waste Management techniques with the knowledge I have gained through the course. She thanked the ENVIS for conducting the course which changed her mind set on waste and also her life.