NATIONAL SOLID WASTE ASSOCIATION OF INDIA

Waste MONITOR

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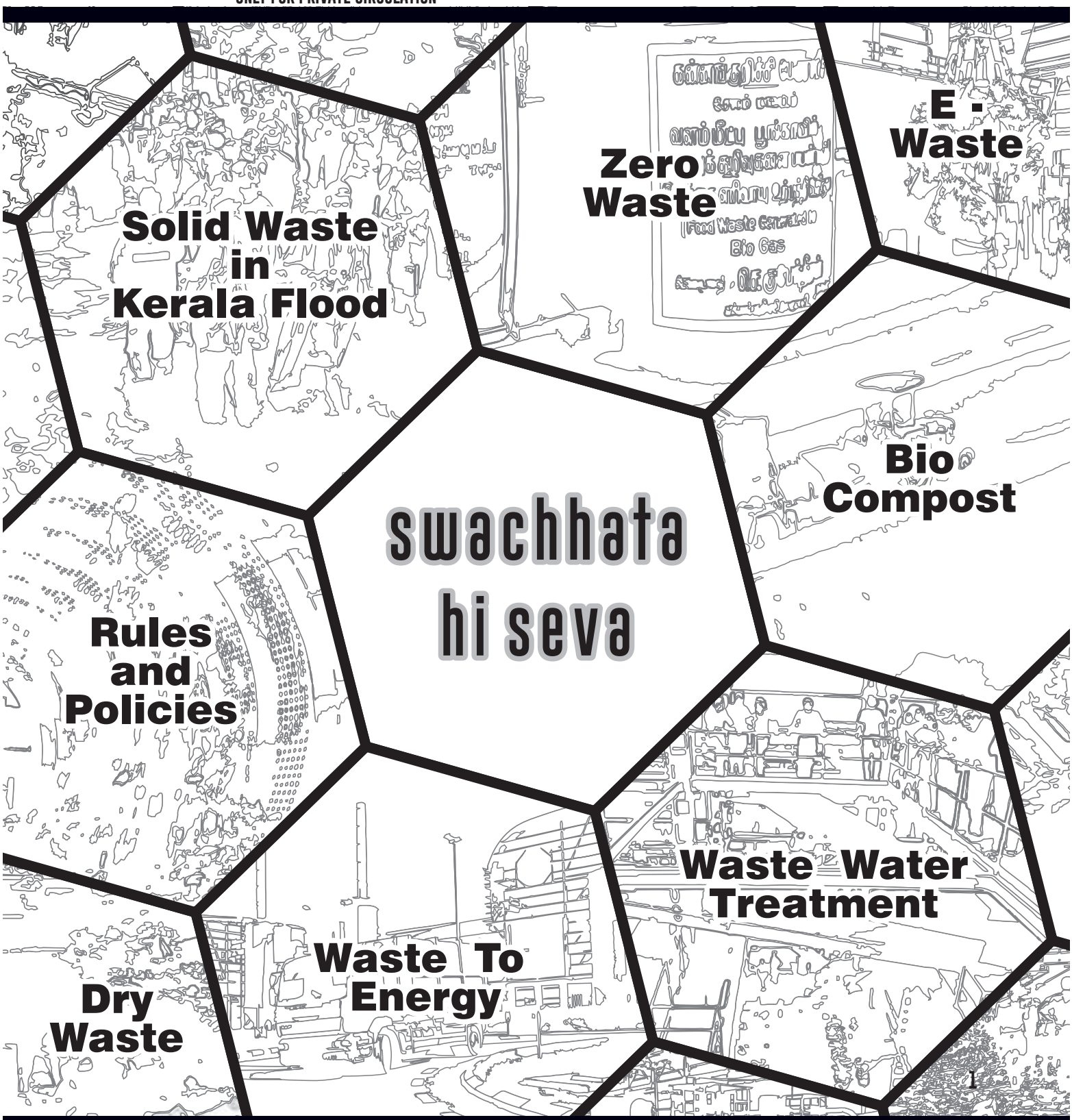

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President's Note

Rampant urbanization and increase in per capita income have a proportional effect on the consumer behavior which leads to high rate of municipal solid waste generation. Many countries including India are actively working towards addressing the issues arising out of municipal solid waste. The country is in the process of implementing an effective and infallible mechanism to handle the solid waste management at various levels including policy, technology, research etc. His Excellency Hon'ble Prime Minister of India Shri Narendra Modi launched Swachh Bharat Mission on 2nd October 2014, a national campaign by Govt. of India, covering 4041 statutory towns, to clean the streets, roads and infrastructure of the country. However there is still a noticeable gap in the awareness levels about the ideal modus operandi of 'how to handle waste' at various rungs of the waste management ladder.

Waste Monitor intends to spread awareness about right practices by bridging the critical information gap in the waste management sector and assist industries, municipalities, NGOs and others by providing professional guidance from experts.

While it is a fact that we are currently inundated with information from various forms of media, Waste Monitor will attempt to bring in relevant information and meaningful intelligence on the sector for the stakeholders.

We will include news, analyses of current events, and success stories not just from India but also from across the globe that could be of interest to our readers. In this way, the bi-annual magazine will have an International outlook but with its concerns focusing on Indian reality. ■

Dr Amiya K Sahu
President

Editorial

Municipal Solid Waste (MSW) management & disposal has been a perennial problem in India. Efforts of environmental activists like Almitra Patel first brought forth widespread awareness about this problem. Later MSW Rules 2000 were promulgated in Sept 2000 in compliance with Hon Supreme Court's directive.

However the problem did not result into substantial results even till 2016. Launching of Clean India Mission (Swacch Bharat Abhiyan) in 2014 by Prime Minister of India, His Excellency Hon. Mr. Narendra Modiji, combined with modification into a stricter version of these Rules to MSW Rules 2016, together have seen significant activities in MSW management. However it is far from the actual desired level.

National Solid Waste Association of India (NSWAI) has been active since 1996 in promoting MSW management, with blessings from Ministry of Environment, Forest & Climate Change, Govt. of India. In order to create awareness, a magazine like Waste Monitor was being published till 2014. Though it was discontinued for some administrative reasons, the same is being revived this year & the same is being presented here to readers.

In this issue we are privileged to present successful efforts of Govt. of Tamil Nadu, in MSW management highlighted by Mr. Ratnoo (IAS). Dr. Kurup, has presented problems in waste management in Kerala, after the state was struck by torrential rain & flooding. Mr. Sandeep Patel highlights significance of material recovery from MSW for its ultimate disposal. Dr. Modak has pointed out practical difficulties faced by entrepreneurs in setting up Waste to Energy facility. Disposal of most problematic liquid waste is not left out & Mr. Vinayak Anawalikar presents a success story of the same, done through composting. Avoidance of air pollution through burning Agro Waste are presented by Mr. Santosh Gondhalekar in terms successful conversion into Bio-CNG. Dr. Joshi brings forth status report on biomedical management & disposal. Mr. Sampath endorses in his article importance of segregation & conversion of MSW into MRF. Mr. B. K. Soni points out some naked facts prevailing in waste management matters & suggests improvement. Mr. Vijay Marchant highlights problems in plastic waste management in India. Mr. Rahul Chhabra presents importance of Biological Filters in management of liquid effluents. Mr. Vishwesh Pavnaskar presents his practical experience in improvement of MSW management in Pune City. We are privileged to have practical views of Almitra Patel & Isher Judge Ahaluwalia on scientific & safe closure of existing waste dumps in India, which occupy huge amount of land & are hotspots affecting people's health. The regulatory framework, which controls the waste management in India is presented by Dr. Patil.

Waste Management examples in Israel are illustrated by Mr. Leh Libiya & stakeholders in waste management in India has many things to learn from it.

Importance of worldwide event like IFAT & its significance from waste management perspective are illustrated by Mr. Bhupendra's interview.

I am sure the readers of Waste Monitor will like this revived incarnation in terms of its knowledge & contents. Happy Reading.....■

Dr. Harshvardhan Modak
Editor-in-Chief

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Zero-waste Townships

- A case of zero waste management practice implemented in 78 townships of Tamil Nadu.

> ***The waste management practices in Town Panchayats are generally dominated by Not in My Backyard (NIMBY) Syndrome where people, council as well as waste managers wanted their town to be clean; but were hardly bothered as to what was happening to the waste that is taken away from their areas.***
>
> **Mr. Rajendra Ratnoo,** IAS, Commissioner of Disaster Management, Chennai

INTRODUCTION : The earth is warming up and there is now overwhelming scientific consensus that it is human-induced. Irresponsible disposal by way of dumping the waste in name of 'waste management' is causing a huge challenge to the sensitive ecology.

Sight of burning of waste in the streets and the dump site was not uncommon in Towns of Tamil Nadu. The waste management practices in Town Panchayats are generally dominated by Not in My Backyard (NIMBY) Syndrome where people, council as well as waste managers wanted their town to be clean; but were hardly bothered as to what was happening to the waste that is taken away from their areas. People had a tendency to dump the waste in the storm water drains creating hot spots for mosquito-menace!

In view of the above, Solid Waste Management assumed a greater significance in the Town Panchayats. The remedial initiative implemented in phased manner are described.

STUDY AREA AND OBJECTIVE :

The Zero-Waste townships project has been piloted in 78 Town Panchayats of Tamil Nadu State under Integrated Solid Waste Management System for the year 2013-14 (implemented in the year 2014-15), to achieve Zero Waste Towns.

STRATEGIES ADOPTED / MODE OF TRANSFORMATION WITH DETAILS OF ROLE OF VARIOUS STAKEHOLDERS :

Following strategies have been used to bring a change in the waste management practices among various stake-holders in Town Panchayats and gradually take them towards Zero Waste:

A) Waste Reduction by adoption of 5 R principles

1. **Refuse :**
2. **Reduce:**
3. **Reuse**
4. **Recycle:**
5. **Resource recovery**

The 5Rs are being achieved through a community based behaviour change communication campaign. A logo of the campaign has been created and approved by the govt and being used by all Tps.

Decentralized Waste Management: As a logical consequence of 5Rs, it is ensured that people are encouraged for decentralised waste management to create **Zero Waste Locality.**

B) Though emphasis is on decentralised waste management, however in the balance waste generators it is ensured to make door to door collection.

1. **Collection:** It has been ensured that for every 150 households, a **push-cart** is provided for ensuring 100% door to door primary collection.

2. **Transportation:** It has been ensured that the door to door segregated collection in a separate trip to the **Resource Recovery Park (RRP)**

C) **Processing :** It involves windrow composting, vermin-composting and Bio-methanization, use of ducks for fish waste & segregation shed.

D) **Research inputs for problematic waste:** Certain Categories of waste that are neither reusable nor recyclable (e.g. multilayered packaging, Sanitary napkins, diapers etc.) are constantly audited to create innovative solutions.

E) **Extended Producer Responsibility Campaign**: Sending back the non-recyclable and non-reusable dry waste (such as multi layered food packaging) to the respective companies.

F) **Training and Capacity Building:** This is a key strategy to ensure that an institutional mechanism for training is put into place so that capacity of various stake-holders can be built after training needs analysis.

G) **Welfare of Workers and Worker Motivation:** Regular health checkups, provision of workers safety equipments, **incentivising performance,** and fare wages is ensured to keep workers motivation level high.

H) Communication Strategy for Community based Campaign: Information, Education and Communication (IEC) brought about a lasting change. Use of Social media helped.

I) **Regulatory framework and Enforcement:** The local bodies passed appropriate resolutions and enforced in a phased manner on lines of various statutory Acts.

UNIQUE FEATURES AND OUTCOMES

Several outcomes and benefits of the project can be listed not only in the 78 town Panchayats of first phase but in all other Town Panchayats. The positive outcomes of the project initiative are very much visible in the following

A. Increased coverage of waste collection has **reduced no. of hotspots** in Town Panchayats that could have lead to outbreak of diseases.

B. **Reduction in the prevalence of communicable diseases,** particularly, vector borne diseases including dengue fever has been noticed as a result of the project implementation. The no of cases have dropped down to meagre 122. Similarly no of dengue fever cases in TPs in 2013 were 1344 while in 2014 no of cases came down to 533.

C. **Reduction in the incidence of cattle ingesting plastic carry-bags** It is reported by the field functionaries that due to elimination of littering and removal of hot-spots as well as increase in door to door coverage has substantially reduced incidences of cattle ingesting plastics.

D. **Increase in coverage of door to door collection** of waste has increased to 5442 wards out of 8288 wards in Tamil Nadu.

E. **Decreased amount of Waste generated:** Continuous campaign for waste reduction has helped in reduction of waste to a significant level and thereby reduction of load on environment.

F. **Increase in waste Processing :** The waste processing has increased to **725.11**

MTs of waste going for windrow composting, 241.70 MTs going for vermin-composting perday. In a few TPs Biomethanization has also being taken up. The recycling of waste has also increased both directly from house-hold level as well as TP level due to setting up of required infrastructure. The **processing of waste has increased to 65% of the waste collected.**

G. **Reduction in dumping of waste :** The waste going to dump sites has decreased by nearly 30-35 % in last one year in overall town Panchayats and reduced by more than 65 % in 78 Town Panchayats where infrastructure is provided in the first phase.

H. **Reduction in Pollution**

a. **Toxic gases emission :** The community

leaders/ institutional heads were educated to stop the indiscriminate burning of waste/ discard items.

b. TN Pollution Control Board has measured the emission levels and has stated that this year ambient air quality was much better.

c. **Reduction in pollution of ground water:** Reduction in open dumping, Cement platforms for composting, leachate arrest and recycling arrested ground water contamination.

I. **Increased availability of Organic manure:** Windrow composting and vermin-composting in Town Panchayats has increased the availability of organic manure and thereby more inputs available for organic farmers.

WAY FORWARD

- Improve the awareness and education.
- Create desired attitude and the behavioural response among the waste generators to prevent environmental degradation, ground water pollution and potential outbreak of diseases.
- Review investment in cost intensive techno-centric solutions vis-a-vis appropriate technological solutions like decentralised small scale (Upto 10 metric tons) processing of waste or in large scale cluster based processing facilities.
- Improve decentralised segregated collection from door steps.
- Address bridging gaps in infrastructure and appropriate technology. ■

Waste and Sanitation scenario after flood in Kerala

"The recent flood in the state is an eye opener for policy makers, politicians, elected representatives and people from all walks of life to adopt environmental and nature friendly efforts to solve the waste management problems. The mindset of the elected representatives and politicians needs to be changed and they should respect the rule of law governance for addressing locally specific measures."

Dr. K. Balachandra Kurup, Governance and Institutional Expert, Former United Nations Advisor in Sudan and Iraq, and Programme Director, International Institute of Waste Management, Bhopal, Madhya Pradesh, India.

INTRODUCTION : The State of Kerala is known for very high standards of education, but it has been facing significant challenges in solid waste management. Waste management is one of the most challenging issues in the state due to high density of population and water-logged areas. The quantity of wastes has also increased tremendously with improved life style, social status and urbanization. Kerala is a land of baffling contradictions with great achievements in social development in spite of its economic backwardness. The recent flood and landslides have aggravated the waste and sanitation situation across the state. This paper examines the impacts of flood on the waste and sanitation situation and the challenges in the state.

The magnitude of the problem

According to the Indian Metrological Department, after 1924, Kerala got 164% excess rain fall during the month of August 2018, in a spell of rainfall for three continuous weeks. The state recorded 2,346.6 mm rainfall between June 1 and August 19. On August 15, 36 large dams in the state had to be opened as the water level had risen close to overflow level. The incidences of two floods that created havoc in July/August 2018 have accumulated at least 15 years of wastes in several affected areas. Around 7000 villages in 572 Gram panchayats and 1359 wards in 63 urban areas are seriously affected in the 12 districts of the state. 73, 551 toilets in the rural areas and 25, 272 toilets in the urban areas are dysfunctional due to the flood. Nearly 600,000 wells were also contaminated as flood waters covered them.

The rampant stone quarrying and digging of pits are the main reason behind the landslides and landslips, which worsened the situation in the Kerala floods.

Around 100,000 people were displaced in 4000 relief camps. In short lack of political commitment, bureaucratic inefficiency, corruption at various levels, and lack of proper planning has contributed to the present flood and landslides in the state.

The waste scenario

Tackling the issue of post-flood waste management is a massive challenge for Kerala, given that the state administration

has not been able to manage around 10,000 tonnes of waste it usually generates every day. While most existing dumpsites and waste treatment plants are already overflowing with municipal wastes

accumulated over the years, some were washed away by the floods. A mapping around the areas showed heaps of muck and mud everywhere. Besides huge piles of food wastes, utensils, clothes, mattresses, books, damaged furniture and e-waste strewn everywhere. The dilapidated toilets also escalated the environmental degradation in the water-logged areas.

The waste management in flood affected areas is a major challenge and a threat to public health, as bacterial infections like rat fever (leptospirosisis) spreading in many floods affected areas. The government has issued directive to all local self-government bodies to collect biodegradable waste on priority basis and dispose it at the earliest. The local bodies have opened collection centres for solid waste management with the guidance of Suchitwa mission. Apart from household wastes, carcasses of animals and birds killed in the floods were also found lying unburied in several places. It was reported that large quantity of electronic

wastes also dumped along the road sides, rivers and other localities and this is a major threat to health as it contains toxins like zinc, mercury, magnesium and lithium. Some of these also contain radioactive substances, which are very harmful to human health and the ecosystem. It was reported that of the total 35,717 metric tonnes of waste that has been collected in state, 14,297 metric tonnes are biodegradable while 18,541 tonnes are solid waste, including plastic bottles and electronic gadgets. Municipal bodies have been able to dispose of only 13,297 tonnes of waste as of first week of September 2018.

Conclusion and Way forward

Considerable effort is required by way of evolving appropriate environmental management plan and its implementation to upgrade the current practices to the environmental regulatory standards.

The recent flood in the state is an eye opener for policy makers, politicians, elected representatives and people from all walks of life to adopt environmental and nature friendly efforts to solve the waste management problems. The mindset of the elected representatives and politicians needs to be changed and they should respect the rule of law governance for addressing locally specific measures.

Existing policies and the institutional framework are required to be examined carefully due to the flood and landslides in the state to ascertain their suitability to cater the needs of the emerging projects in this sector and the gaps need to be addressed. Rules of SWM need to be taken in such a way that these take into account the ground realities and allow time for suitable processes and mechanisms to be developed.

It is crucial to carry out a critical assessment of the quality and quantity of wastes accumulated after the flood and prepare a realistic action plan to address the situation

based on short and long-term measures. This will enable the local bodies, government and people to come out with locally specific waste management plan. There is a need to create dedicated group of officers and skilled staff for local bodies with specialization in multifaceted knowledge and capability for addressing issues connected to all type of wastes. As we all know that effective and efficient management of wastes reduces or eliminate adverse impacts on the environment and human health and supports socio economic development and improved quality of life. In this connection the National Solid Waste Association (NSWAI) can provide technical advice and guidance for undertaking appropriate and locally specific strategies to minimise the waste problem during floods and other natural calamities. ■

Significance Of Material Recovery Facility (MRF) In The Success of Swachh Bharat Abhiyan

> ***Ours is an inclusive model which has been successful in the city of Ahmedabad. The same is best suited for Indian scenario as it integrates at different levels with all the stakeholders. Integration of the waste pickers, BOP and women labors leads to big social impacts that the society needs presently. Creation of a 'Circular Economy', mitigation of carbon-dioxide equivalent emissions and prevention of waste dumping, cost savings and reduced burden on local bodies are amongst the many economic and environmental benefits that it offers.***
>
> **Mr. Sandeep Patel,** Founder and CEO of NEPRA

Material Recovery Facilities are the ones where waste materialscollected from various places are sorted into different types (e.g. plastics, paper, metal) using a mixture of manual and automated methods. After sorting they are sent to re-processors/recyclers to create new products.MRF ensure recycling/sustainable waste disposal in an appropriate and scalable manner.Configuration of a MRF depends upon factors such as types and quantities of material to be processed, quality and quantity of incoming waste, processing rates and desired quality of end products.

It should find a **top spot** while establishing **integrated and scientific municipal waste management systems.** The role of MRF in success of **Swachh Bharat Abhiyan(SBA)** that aims for a clean India by 2019 is immense. Having said this, it is significant to understand that zero waste facilities and scientific waste disposal technologies shall co-exist. One of the major impediment to the success of waste to energy or pyrolysis plant is improper supply of good quality raw materials. One of the reasons in slow growth of recycling industry vs. waste generation can be attributed to unpromising supply of recyclable waste.

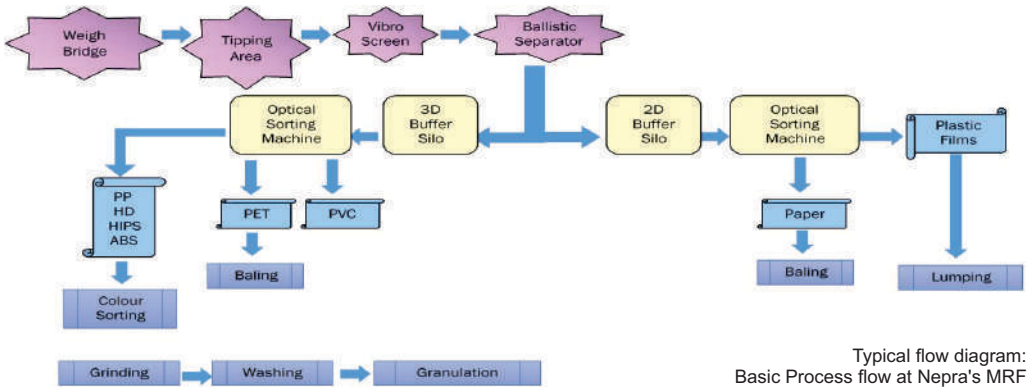
Nepra'sMRF with annual capacity of handling 36,500 tons of waste most appropriately points out its role in diverting huge quantum of waste from landfilling towards recycling or energy recovery etc. The environmental benefits in terms of **CO^2 E emission mitigation** that can be attained at full capacity is also huge amounting to over 1,04,646 MT.

There has been a 60% increase from 2016 and we expect a 200% increase this FY. The increase is with more awareness and sensitization amongst the public. Simultaneously, we must think how big the opportunity to convert waste to wealth with more infrastructure development is across the nation.

Nepra's MRF built on **Public Private Partnership model with Ahmedabad Municipal Corporation.** It receives dry solid non-hazardous waste from waste pickers, residential area, malls,commercial complexes, industrial plant waste etc. in the city of Ahmedabad. Dry segregated material is received in a mixed form consisting of a combination of fibers (card board, mixed paper, magazines etc.) and comingled containers (Plastic, glass, metal etc.), among other material. These are sorted by using automated machines since quantities to be handled are large. MRF, here, is further enabled to separate 2Dimensionalarticles from 3Dimensional and helps in removing

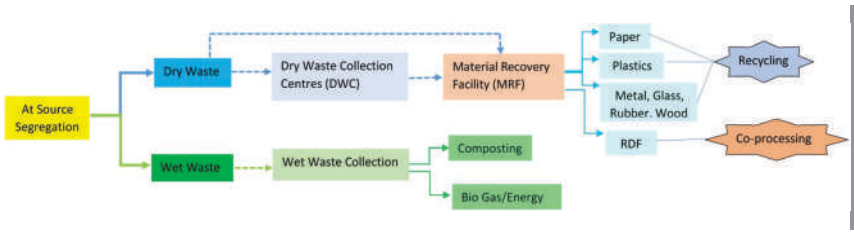
rejects. The waste is sorted and sent to balers for volume reduction with further recycling. Non-recyclables are shredded and sent to cement industries as RDF (Refuse Derived Fuel) or for road making. NEPRA has established system of collection of waste from **waste pickers** who lie at the bottom of pyramid and are often neglected. Segregated waste is collected from them and incentives are provided to them, thus uplifting their standard of living. Nepra also builds and operates several controlled MRF for its several clients that has paved their way to becoming '**Zero Waste to Landfill Organization**' through garbage minimization and improved resource recovery.

Nepra is dedicated to research and developments in this arena. It has its own ERP system based on **real time analytics** where all the transactions from collection to end user waste disposal is transparent and maintained on cloud. It is also developing robotic sorting solution with **robotic vision guidance** system and image processing system which aims to reduce overall cost of the plant and increase time efficiency. Hence, it is worthy to note the role of MRF in handling the gargantuan amount of waste and in meeting the high quantum demand of recycling industry or waste to energy units etcOurs is an inclusive model which has been successful in the city of Ahmedabad. The same is best suited for Indian scenario as it



Typical flow diagram:
Basic Process flow at Nepra's MRF

integrates at different levels with all the stakeholders.Integration of the waste pickers, BOP and women laborsleads to big social impacts that the society needs presently. Creation of a 'Circular Economy', mitigation of carbon-dioxide equivalent emissions and prevention of waste dumping, cost savings and reduced burden on local bodies are amongst the many economic and environmental benefits that it offers. .Even though much progress has been made under the Swacch Bharat Abhiyan (SBA), on



The stages in MSW waste management: Several DWC can be set up with MRF or waste can directly reach MRF. At higher scale, the role of MRF, with automation and technology, becomes important for a sustained demand and supply chain management. On the other hand for wet waste, several other technologies can be taken up.

aspects of open defecation, health and hygiene, a lot more is hoped for development of waste management systems. MRF of different capacities in villages, towns, cities can be built to give value to all kind of waste. It will act to encourage the citizens to segregate waste and drop it at the MRFs. Presently, people question their efforts in waste segregation in absence of appropriate infrastructure to manage the segregated streams. The same can be easily resolved with MRF.There is an urgent need to promote development of MRFs across the nation for success of other technologies and to move towards a Zero Waste Clean India.

Importance of waste segregation, recycling and energy recovery, establishment of MRFs is also laid down in statutory regulations/ guidelines/ National Action Plans by the CPCB and the Ministry. With MRFs several multinationals and industries can also easily comply with their legal and environmental responsibilities of creating a **SWACHH BHARAT.... ■**

Entrepreneurial Problems in Setting Up Waste Disposal & Energy Generation Projects in India

It has been experienced that developers, who are investing their precious resources like time & money have to run from pillar to post for getting various clearances/ permissions/consents etc. before even digging at the location to set up machinery. Minimum one year is needed to compile all the requisite permissions & start the project work. This frustrating experience, especially for foreign technology vendors or investors is so discouraging, that they prefer to stay away from India as market.

Dr. Harshvardhan Modak, Vice President, NSWAI

Preamble: Everyone is aware that MSW disposal is a perennial problem in India. Although MSW Rules 2016 prescribes various methods for MSW disposal, the Committee of Chief Ministers appointed by Govt. of India to develop final recommendations for the same, has acknowledged that for large cities & towns, incineration is preferred method of choice, with or without energy recovery. Since energy recovery involves a payback for making the project economically feasible, incineration shall always be with recovery of energy. Since incineration is established in many Developed Countries & erstwhile problems of air pollution control have been solved by modern emission control technologies, this method has also been recommended by Niti Ayog, India's highest planning authority. (Apart from Incineration, Gasification/Pyrolysis & Plasma are other incarnations of thermal technologies to dispose waste, but not yet established.) In view of Incineration being so recognized, the regulators should have come up with encouraging policies suitable for setting up waste to energy. However, it is far from the same, as per my first hand experience gained while setting up few such projects. The prevailing situation is in fact utterly discouraging. Let us delve into the situation & identify the troubling parameters, where remedial action is urgently needed, if India wants to indeed dispose the waste.

Problems in Implementing Incineration Projects:

The problems experienced are Technical & Non-Technical. The Technical Problems are sub-divided into (a) Regulatory (b) Technological (c) Infrastructural. The Non-Technical problems are sub-divided into (a) Regulatory (b) Administrative. It has been experienced that developers, who are investing their precious resources like time & money have to run from pillar to post for getting various clearances/ permissions/consents etc. before even digging at the location to set up machinery. Minimum one year is needed to compile all the requisite permissions & start the project work. This frustrating experience, especially for foreign technology vendors or investors is so discouraging, that they prefer to stay away from India as market. As a result, ULBs have to rely on existing bidders, who are fly by night operators & opportunity hunters, without any serious intent of investment or access to technology. The successful bidder uses his selection as opportunity to earn a fast buck premium by making a passable arrangement with serious investors, with blessings from officialdom.

Let us look at individual problems, on lines of above-mentioned classification.

Technical Problems (a) Regulatory:

- The tender documentation is prepared by some so called consultants, devoid of any technological knowledge, so that serious bidders have to break their heads to get it modified in pre-bid meetings. Significant time & money is lost.
- Location clearance: The proposed project site is selected by ULB without any consideration to project parameters, especially energy harvesting & Grid injection. Secondly a plethora of govt. bodies have to form a committee under Chairmanship of District Collector, which either never gets constituted, or if constituted, it seldom meets to thrash out the clearance. They surprisingly apply parameters of Landfill to waste to energy project & time is wasted in convincing them.
- Once site is selected with everyone's negotiated consent, one has to undergo prior environmental clearance. In spite of exemption offered for such projects, there are so many grey areas within exemption clauses & that vital time is lost in getting actual clearance recorded in minutes.
- Once location is cleared, the influential politicians/local leaders etc. step in to invoke NOT IN MY BACKYARD syndrome. The matter goes to high court or National Green Tribunal & projects may stay in limbo.
- Side by side, officials at Pollution Control Boards (state or central) drag their feet in giving (a) Authorization to ULB with project investor as Operator (b) Consent to Establish to project investor (c) Technology clearance for the proposed technology & its vendor. They themselves avoid taking stand & propose a committee for getting recommendations on these aspects. The experts in committee are from premium research bodies with big names, which in private acknowledge that they do not know anything & they have not seen anything bigger than their laboratory set up. However their opinion matters, since Pollution Control Authorities avoid responsibility.
- After Authorization/ consent to Establish (two separate permissions, but with identical procedure), investor can attempt to set up machinery. Before trial run is taken, he has to apply for Consent to Operate, where again the same set of people command the show.
- Simultaneous process for clearances & registrations for various govt. dept. like factory inspector etc. goes on. Airport authority clearance is one such funny thing, very difficult to obtain. Wonder why is it needed, when waste disposal actually solves problem of bird menace.
- Permission to connect to grid is again dependent on plethora of govt. dept. & clearance from state controlled electricity utility. Files go back & forth, wasting time & money.
- Power Purchase Agreement (PPA) is again dependent on tariff regulator like state Electricity Commission, which takes its sweet time to grant a certain tariff. Unless it proclaims it, no PPA can be made & banks do not release any loan.
- Import polices are not supportive for importing vital equipment at low/no taxes & duties. Import procedure is very cumbersome.

(b) Technological:

Reliable technology vendors are abroad & imports have to be made to procure vital parts/spares/systems. The weak Indian currency prohibits purchase of reliable systems & overall project cost starts spiraling upwards.

(c) Infrastructural:

Getting adequate & suitable land is a huge problem. Many ULBs are not ready to offer the land & ask the investor to procure on own. Industrial estates created for industrial developments are governed by Industrial Development Corporations. Setting up waste to energy is NOT allowed in their policy. So getting a land, against stiff opposition from people is really tough. Setting up grid connection, laying lines & pylons is really difficult & state electricity boards are always against, even if the facility is purchased. Setting up computer controlled real time devices for energy measurement is another difficult task.

Non-Technical Problems:

Regulatory:

The primary responsibility of waste disposal rests with Urban Local Bodies (ULBs). Thus whether it a metropolis generating thousands of metric tons (MT) of waste/day or a small township hardly few MT/day, the procedure is through tendering, tendering fee, earnest money, bank guarantee, pre-bid meetings, presentation to various officials, Standing Committee, General Body, BOT

Committee. This results into string of repetitive activities at every nook or cranny of the whole country. That means there is a repetition of all these activities over thousands of ULBs in the whole country. Whatever strength of any company, it can hardly venture to participate in just few of ULBs. So much funds will be locked in security deposits & bank guarantees that the eligible companies with good technology will restrict them only to big cities & all B class onwards ULBs will be ignored. This is exactly what is happening.

Administrative: At every ULB the waste management is looked after by least interested people, devoid of any technological knowledge. As a result it becomes uphill task to get many things approved/cleared for moving forward. Secondly, there are all types of politicians & their cronies one has to face & keep them happy for getting our work done smoothly. The ULBs are ridden with malpractices.

Result & Status: In face of all these difficulties, many professional companies either avoid bidding for contracts or act only as technology vendors. As a result, unprofessional substandard companies, which have skill to manage corrupt officials & politicians, venture into this field. However at slightest difficulties in the projects, they run away, since they have no botheration for image or zeal to run the project or tendency to ride over difficulties. They have unprofessional attitude. Thus all over India, many projects are abandoned & in neglected state.

Solution & Way Forward: National Solid Waste Association of India at every forum has been advocating formation of the National Mission with entire powers to execute waste disposal projects. At NITI Ayog too NSWAI advocated, formation of National Waste Disposal Corporation. NITI Ayog too has entrusted a responsibility to National Thermal Power Corporation Ltd. (NTPC) to execute 10 such waste disposal & energy generation projects. It can also be done at state level too, whereby a suitable State Body will have entire powers to take possession of waste, allot land, offer clearances, sign PPAs & offer tipping fee, if needed. (However, our calculations show that it is prudent to embark on waste disposal projects on EPC basis, against strict performance guarantees & O & M contracts for significant long period. In this model, no tipping fee is needed & huge payout through tipping fee is saved.) ULBs should not have any control to obstruct any such projects. Suitable enactment needs to be made, otherwise waste disposal shall keep languishing throughout India leading to environmental damage & outburst of diseases.

Hopefully the wiser counsels in the regulatory corridors will prevail & the waste disposal activity gets essential impetus, it requires. ■

Zero Liquid Discharge Through Bio-Composting in Distilleries

Mr. Nitin S Deshpande,
Managing Director,
Trio-Chem Sucrotech Engineering and Projects Pvt Ltd, Pune, India

Mr. Vinayak S Anawalikar,
Director,
Trio-Chem Sucrotech Engineering and Projects Pvt Ltd, Pune, India

> ***"TAS BIO-COM' PROCESS is arguably the most widely implemented and popular method of Treatment and Disposal of spent wash by the distilleries in large parts of the world."***

Preamble

The major challenge faced by any distillery is the proper treatment and disposal of its highly obnoxious effluent, the spent wash. On an average about 8-10 Ltrs of spent wash is generated per every litre of alcohol.

It means a distillery of modest capacity of 30 KLPD consumes about 300 M^3 good quality water & transforms it into a dark brown coloured, foul smelling, acidic waste water having very high load of organic & inorganic pollutants.

Problems in Spent wash management in Distilleries

Typical environmental concerns of spent wash are as follows:

- Dark Coffee Brown colour
- Foul odour
- High Bio-chemical Oxygen Demand (BOD) and high Chemical Oxygen Demand (COD)
- Highly acidic
- Attracts flies leading to unhygienic conditions
- Contaminates water making it unfit for drinking, cleaning or industrial use
- Repeated application on soil can result in the degradation of soil.

The pollution control authorities have taken a serious note of this pollution problem and have laid down clear and strict guidelines requiring the distilleries to achieve Zero Liquid Discharge (ZLD).

Bio-Composting

'TAS BIO-COM' PROCESS is arguably the most widely implemented and popular method of Treatment and Disposal of spent wash by the distilleries in large parts of the world.

It is the most environment friendly and scientific method of utilizing spent wash by periodically spraying it on press mud in a calculated manner, synchronized with the turning of windrows. The fundamental aspect of this process is the decomposition of organic matter, evaporation of the excess moisture and stabilization through microbial activity.

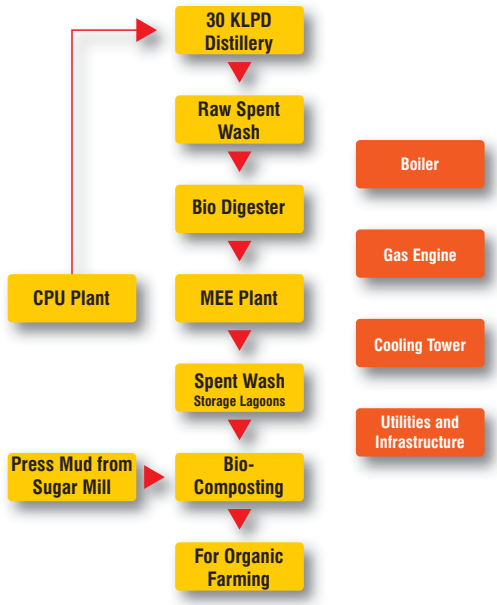
The controlled biological decomposition of organic material by microbes, generating a product called as bio-compost.

Suggested Scheme for Zero Liquid Discharge (ZLD) in a typical 30 KLPD Distillery

- 30 KLPD Distillery
- Multiple Effect Evaporator (MEE) for spent wash volume reduction up to 30%.
- Condensate Polishing Unit (CPU) for condensate recycling.
- Biogas Digester

- Biogas Engine for electricity generation
- Bio-compost Yard (with lagoons, leachate management systems, composting machinery, bagging and Packing plant for bio-compost etc.) for scientific and environment friendly treatment and disposal of spent wash
- 270 Days of Distillery Operation.
- 4200 MT of bio-compost produced
- Zero Liquid Discharge (ZLD) scheme approved by MoEF & CC, CPCB/SPCB in India and are also confirming to guidelines of National Green Tribunal (NGT).

Schematic for Zero Liquid Discharge (ZLD) Scheme Through Bio-composting



Material Balance for Zero Liquid Discharge (ZLD) Scheme through Bio-composting for a typical 30 KLPD Distillery

Particulars	Value	Unit
Distillery Capacity	30	KLPD
Spent Wash Generation @ 6 % Solids	300	M^3/day
Spent Wash Generation @ 30% Solids post	53	M^3/day
Multiple Effect Evaporation Plant		
No. of Working days of Distillery	270	Days
Total Spent Wash Generated	14310	M^3/Season
Press mud to Spent Wash Ratio	1:1.5	
Total Press Mud required for composting	9504	MT
Number of Cycles (60 Days per Cycle)	4	Nos
Press Mud per cycle	2385	MT
Total Area Required for bio-composting project	6.0	Acres
Total Compost Generated	4275	MT. Max
Qty of Decomposting Culture required	9.5	MT/Season
Qty of Enrichment Culture required	1480	Litres/Season

Salient Features of Zero Liquid Discharge (ZLD) Scheme through bio-composting:

- Zero Liquid Discharge (ZLD) scheme approved by MoEF & CC, CPCB/SPCB in India and confirming to guidelines of National Green Tribunal (NGT).
- 270 Days of Distillery operation.
- 4200 MT of bio-compost produced

Advantages of Bio-compost

- Bio-compost improves humus and water holding capacity of soil.
- Bio-compost helps in increased nutrient uptake by crops
- Bio-compost helps in reduction of soil pH
- Bio-compost increase soil fertility in long run
- Bio-compost increases yield of the agricultural land.
- Bio-compost helps in gradual replacement of chemical fertilizers

Typical Characteristics of Bio-compost derived from pressmud and spent wash in India

Parameters	Value
pH	7.0 - 7.4
Moisture	< 35 %
Nitrogen (N)	1.23 - 1.27 %
Phosphorus (P)	2.93 - 2.99 %
Potassium (K)	2.84 - 2.88
Organic Carbon (OC)	23 - 28 %
C : N	15 - 17
Iron (Fe)	0.59 - 0.63
Manganese (Mn)	0.315 - 0.319
Copper (Cu)	0.46 - 0.48
Zinc (Zn)	0.141 - 0.145

Finished compost will be as per the guidelines of Agriculture Ministry, Govt. of India

Conclusion :
It is a Win – Win – Win Situation for all Stakeholders

- Zero Liquid Discharge (ZLD) Through Bio-composting is a Win – Win – Win project for all Stakeholders namely – Farmers, Sugar Factories and Governments.
- Farmers get additional income through increased yield of sugarcane per acre of land
- Statutory compliance made easy for sugar factories. Additional income through sale of Bio-compost.
- Bio-compost helps in partial replacement of Chemical Fertilizers
- Environmentally sustainable technology.

■

Trio-Chem Offers Turn Key Solutions For Bio-Composting Projects

- Compost Yard
- Leachate Management
- HDPE Spray Network
- Tree Plantation
- Storage Lagoon
- Composting Machine
- Microbial Cultures
- Yard Lighting

TRIO-CHEM

Trio-Chem

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Biomedical Waste Management - Indian Scenario

> ***A study conducted by the Indian Institute of Management (IIM) in Lucknow in 2010 quotes, "Presently 50 to 55 per cent of bio-medical wastes is collected, segregated and treated as per Bio-medical Waste Management Rules."***
>
> **Dr. Sanjay Joshi,** Bio Medical Waste Expert, NSWAI

Introduction : In India, the Healthcare has become one of the largest sectors both in terms of revenue and employment. India has emerged as a hub for R&D activities for international players due to its relatively low cost of clinical research. Growing health awareness and precautionary treatments coupled with improved diagnostics are resulting in an increase in hospitalization. Indian system of healthcare, Ayurveda is attracting more number of patients to avail these services in India.

Type of ailment	CAGR (%)
Cardiac	18
Cancer related	16
Diabetes	19

Table indicates the CAGR of hospitalized cases from 2008 – 2016 and has forecast up to 2018

However, although the healthcare sector in India is growing at an unprecedented rate, these facilities are also generating large amount of highly infectious biomedical waste. The advent of disposables in the hospitals has brought in its wake, many illegal practices also. These include inappropriate recycling, unauthorized and illegal re-use and increase in the quantum of waste etc. All round technological progress has led to increased availability of health-related consumer goods, which have the propensity for production of increased wastes.

Waste generated from the Healthcare sector in India

The issue of improper hospital waste management in India was first highlighted in a writ petition in the Hon'ble Supreme Court. Subsequently Govt. of India notified the Bio-Medical Waste (Management and Handling) Rules on 27th July 1998; under the provisions of Environmental Protection Act 1986. According to these rules, biomedical waste is defined as "any type of waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining to the production of drugs in pharmaceutical companies, animal waste generated in the veterinary hospitals and also in the animal houses etc."

Bio-Medical waste is extremely hazardous, and if not managed properly, can lead to serious health and environment problems. Biomedical waste includes pathological, infectious, and hazardous waste such as clinical bandages, gauze, cotton that are contaminated with patients' body fluids, organs and body parts removes during surgery, placenta, dressing materials, aborted fetuses etc. From the research labs, stock cultures, blood and blood products, animal carcasses and tissues or organs form highly infectious category of waste. Apart from this, needles, scalpels and other metal sharps used in hospitals and research labs get contaminated with body fluids of the patient or animals.

As of now several studies on hospital waste have been done. As regards live pathogens found in hospital wastes, the most predominant (80-90%) is the Bacilli with Staphylococci and Streptococci varying between 5 and 10%, whereas the most common pathogens are Staphylococcus aureus (from 2-10 colonies per gram of waste). Escherichia coli, Pseudomonas aeruginosa and Candida albicans are also common along with varying numbers of other common along with varying numbers of other common nosocomial pathogens such as Klebsiella, Proteus, Enterobacter species.

The health hazards created by improper segregation and lack of precautionary measures include injuries from infectious sharps, exposure to materials like bloody bandages and anatomical wastes and exposure to harmful chemical and radioactive waste. Infections caused by such exposures are commonly termed Nosocomial or Hospital Acquired Infections and include HIV, Hepatitis A, B and C, Cholera, Typhoid, Dysentery, Staphylococcal infections, Tuberculosis and Candida infections.

Brief review of legislation for Biomedical Waste Management

The original Bio-medical Waste (Management & Handling) Rules of 1998 were comprehensive and stipulated that 'it shall be the duty of every occupier of an institution generating bio-medical waste which includes a hospital, nursing home, clinic, dispensary, veterinary institution, animal house, pathological laboratory, blood bank as well as operator of a Common Bio-medical Waste Treatment Facility (CBWTF) to take adequate steps for environmentally sound management of such waste".

Through the first amendment in the year 2000, the provisions for prescribed authority i.e. State Pollution Control Board (SPCB)/ Pollution Control Committee (PCC) were stipulated for enforcement of the provisions of these Rules in the respective State, Urban & Local Bodies were made responsible. It required them to provide suitable common disposal/ incineration sites for the biomedical wastes generated in the area under their jurisdiction. In the areas outside the jurisdiction of any municipal body, the responsibility was fixed on the occupier generating bio-medical waste/ operator of a Common Bio-medical Waste Treatment Facility (CBWTF) to arrange for suitable sites individually or in association, so as to comply with the provisions of these rules.

In the latest amendment in 2016 some new provisions have been incorporated thus increasing the responsibilities of the occupiers as well as those of the operators of CBTWF. The Central Government have made these rules bearing short title as the Bio-Medical Waste Management Rules, 2016.

In these rules, in addition to various sources of generation of BMW as mentioned in the original rules of 1998, some new establishments have been added as the sources of generation of biomedical waste. These are, Ayush hospitals, research or educational institutions, health camps, medical or surgical camps, vaccination and blood donation camps, first aid rooms of the schools and the forensic laboratories and healthcare waste generated at domestic level. The still recent amendment has been brought into effect in March 2018 which covers the waste like sanitary napkins, adult and baby diapers etc. generated in the households.

A study conducted by the Indian Institute of Management (IIM) in Lucknow in 2010 quotes, "Presently 50 to 55 per cent of bio-medical wastes is collected, segregated and treated as per Bio-medical Waste Management Rules."

So where is the rest of this waste going? It is dumped in hospital's backyards, thrown on the side of roads and mixed with municipal garbage. It has been widely recognized that the first step towards improving biomedical waste management is simply to spread awareness and knowledge about the present situation. A greater and more widespread understanding of BMW's potential hazards will help us to reconsider how we perceive waste and further emphasize the importance of public health and environmental issues. ■

The Hiriya Recycling Park

> ***The Hiriya Recycling Park has for twenty years now served as an example of a conceptual and environmental revolution leading society to a better place. We are proud to be at Israel's environmental forefront***
>
> **Adv. Doron Saphir,** Chairman, Miriya Recycling Park, Deputy Mayor, Tel Aviv, Israel

These days, as Dan Region Association of Towns in Israel, marks twenty years under the leadership of its chairman Doron Sapir - the man with the dream of transforming the Garbage Mountain into an advanced, leading recycling park. Today, it is hard to believe Hiriya used to be a symbol of neglect and an environmental hazard in the heart of the State of Israel. Nowadays the Recycling Park is home to some of the world's most advanced solid waste separation, sorting and recycling facilities.

The Hiriya Recycling Park is operated by the Dan Region Association of Towns. The waste arriving at the Park is collected from six local authorities, all members of the Association, and from other towns and communities within and around the Tel Aviv Metropolitan Area. The Recycling Park serves a population of about 1.5 million inhabitants. It handles about one million tons of household waste annually (approx. 2700MT/day), which is a quarter of the solid waste produced in the State of Israel.

This being said, Hiriya has not always been the symbol of environmental awareness. Ever since it was established in the early 1950s, Hiriya served as an enormous dumpsite rising 60 meters above the surrounding plain. Visible for miles around, it had become part of Israeli folklore. 1998 was the year that marked a change in direction. It was then that the Minister of Environmental Protection ordered a cessation of the landfill operations while at the same time Adv. Doron Sapir was appointed chairman of the Association.

Immediately upon assuming his new role, Adv. Sapir recognized both the need to take environmental corrective measures and the inherent potential of waste. Sapir set three goals from the outset: rehabilitation of the Mountain of Waste and its transformation into a green park, building a recycling park to use the resources within the waste and educating the public, especially the young generation, on proper consumption and proper waste management.

From Nuisance to Resource - Recycling Facilities in the Park

To accomplish these goals Sapir set up a hub in Hiriya - an incubator for environmental initiatives, calling on developers and entrepreneurs to set up facilities for waste treatment. Out of this incubator, which in itself was groundbreaking, came the first recycling plant operating in the Park - ArrowBio - an innovative, state-of-the-art home-grown Israeli technology for sorting waste and using it to generate green energy.

The Israeli plant is considered one of the leading municipal mixed waste treatment facilities worldwide. It occupies an area of about 5,500 square meters with a daily intake capacity of 400 tons of waste. Following the initial sorting stages involving devices like magnets and trommels, the waste is separated in water, where specific gravity and the other properties of the various waste components is used in the separation process.

The organic waste obtained within the process undergoes further treatment, including hydraulic crushing and anaerobic fermentation. This process ultimately produces two outputs: organic sludge, which can be used as fertilizer, and biogas for generating energy.

The biogas produced at ArrowBio routed through an underground piping network to a textile factory located 5 KM from the park, where it is used as a fuel replacing the previously used fossil oils.
This unique project was the first to be accredited by the UN for trading in greenhouse gases under the Clean Development Mechanism (CDMM) of the Kyoto Protocol. It positioned Sapir, who has also been serving on the ISWA board in recent years, as a world-renowned expert on waste management.

The RDF Plant - a Dream Come True
As part of the efforts to set up an advanced, synergetic recycling park capable of delivering end-of-pipe solutions for all types of solid waste, the Dan Region Association of Towns constructed RDF (Refuse-Derived Fuel) plant, one of the largest environmental projects ever undertaken in Israel and among the largest of its kind in the world. The project got underway in early 2010 as the brainchild of the Dan Municipal Sanitation Association, jointly with Nesher Cement and Veridis.

This unique plant in Hiriya enables the extraction of alternative fuel from solid waste, which serves as an energy source for the Nesher cement factory. It is a ground-breaking project, the largest waste management project undertaken so far in Israel.
The plant receives about 1,500 tons of household waste per day - about half of all the solid waste arriving at the Hiriya Recycling Park. The waste gets sorted into its various components, where recyclables such as organic waste, metals and plastics are separated, and non-recyclables with a high caloric value (such as wood, plastic, cardboard, textile, paper etc.) - are used to make a dry combustible material (fuel).

Construction & Demolition plant
A construction waste treatment plant was set up in Hiriya to provide a solution of C & D waste. The products of this recycling of construction waste are used for road & new construction, resulting in saving of raw materials. The construction waste plant has so far operated in temporary sites. Each day it has processed over 1,000 tons of waste from construction and demolition projects. The process of handling the construction waste begins with sorting and separation and continues with crushing into raw materials and bedding.

Green Waste in Hiriya
In 2000, a plant for treating green waste collected in the Tel Aviv Metropolitan Area was inaugurated. Each day some 300 tons of plant-based waste are received. The green waste is separated and sorted at the plant, and then, after a shredding and mulching process, the green waste is ready for use in its various applications, such as the extraction of green energy obviating the need to burn fossil fuels, production of fresh compost, use as a sludge absorbent material for wastewater treatment facilities, as mulch for covering soil, and as dairy farm padding.

Hiriya Center for Environmental Education
The Center for Environmental Education was opened in the heart of the Hiriya Recycling Park, serving as an education and outreach center on issues of waste and proper consumer behavior.
The Hiriya Center has quickly become the leading resource in Israel on environmental education, well-versed in assimilating educational contents and curricula in these fields. Garbage Mountain, which had been an environmental nuisance, has been transformed into a modern, advanced, state-of-the-art recycling park.
They continue the search for the next innovative solution, which will still further optimize treatment of the solid waste produced by the residents of the Tel Aviv Metropolitan Area. These days the Association has issued a tender for the construction of another modern, advanced recycling plant to join the existing recycling plants and process another 1000 tons of solid waste daily.
The Hiriya Recycling Park has for twenty years now served as an example of a conceptual and environmental revolution leading society to a better place. We are proud to be at Israel's environmental forefront", concluded Adv. Sapir. ■

India's Leading Trade Fair for Water, Sewage, Solid Waste and Recycling

IFAT India

> ***Water and wastewater is the most promising sub-sector in India's environmental segment. This accounts for 26% of India's environmental technologies industry, and is expected to grow at 13-15% every year over the next five years.***
>
> **Mr. Bhupinder Singh,** Chief Executive Officer, Messe Muenchen India Pvt. Ltd.

The environmental sector in India has been gaining momentum and has been growing exponentially every year. How has this impacted IFAT India over the years? What are your expectations regarding number of exhibitors for this year's trade fair?

As per the World Bank, India has made a substantial effort in attempting to address environmental challenges. It has endorsed rigorous environmental legislation and has created relevant institutions to monitor and enforce legislation. In response to the threat of climate change, the Prime Minister's National Council on Climate Change issued India's first comprehensive National Action Plan. All the roads are now leading towards identification of solutions which enable environment conservation.

As one of the contributors, we at Messe Muenchen India have been bringing the thought leaders, technology providers and government officials together at one platform to offer right technologies.

IFAT India is a leading environmental technologies exhibition, and each year we bring more than 200 key technology providers from more than 19 countries who showcase solutions for water, sewage, solid waste and recycling. At the upcoming edition, scheduled for October 15-17, 2018 at Bombay Exhibition Centre in Mumbai – companies such as Larsen & Toubro, Suez Water Technologies and Solutions, Kirloskar Brothers, LG Chem, Lanxess India, Wilo Mather and Platt Pumps, Wipro Enterprises, Jay Water Management, Astral Poly Technik, CNIM Martin, Naturetech Enviro Protection, Xylem Water Solutions India, Ion Exchange (India), among many more are going to showcase their latest offerings.

We are pleased to be associated with the Municipal Corporation of Greater Mumbai, also known as Brihanmumbai Municipal Corporation, which is the governing civic body of Mumbai. We welcome them as a Co-Host Partner of IFAT India 2018.

IFAT India has been offering numerous networking platforms to its attendees. How do you plan to achieve this in the coming edition? How will you be facilitating the engagement to ensure actual business transpires?

Each year, we bring informative and compelling supporting programs to enhance the visiting experience of our attendees. Our key supporting programs include Innovation Exchange Forum, Active Learning Center, Business-to-Government (B2G) and Buyer Seller Forum.

Designed to deliberate and exchange ideas and highlight solutions for a sustainable Water, Waste & Resource Management in India, the Innovation Exchange forum features key notes and panel discussions. Active Learning Center on the other hand is a place to experience and explore innovations by our exhibitors, see products in practice and learn about latest technologies in a face-to-face discussion with the presenters.

The agenda of these conferences will be shortly announced and will be open to all professionals.
A new addition to our supporting programs would be the 'Buyer-Seller Forum', where our exhibitors and visitors will get a chance to pre-schedule their meetings. This will mean even higher return on investments (ROI) for our exhibitors and higher return on time invested (ROTI) for our visitors.

New technologies are being introduced to the market every day, what are the recent cutting edge technological developments in the environmental and water treatment industry that will be showcased and demonstrated at the trade fair?

The trade fair will showcase the environment industry's most comprehensive range of products and services in the region, the latest state-of-the-art technology and a wide range of superior-quality services for all sub-sectors of the environment industry. The current demand is largely driven by commercial and industrial sectors, followed by Municipal corporations and the government. You can expect to see the latest technologies for these sectors mainly focusing on water extraction and treatment, sewage treatment, water distribution and sewers, solid waste disposal and recycling, energy from waste materials, air pollution control and other allied technologies.

IFAT India features several international pavilions, where exhibitors showcased innovation and technical expertise from their countries. How many country pavilions are you expecting to be added to this edition of the exhibition?

IFAT India is expecting participation from more than 19 countries namely – Australia, Austria, Belgium, China, Columbia, Denmark, France, Germany, Italy, Japan, Korea, Poland, Singapore, Sweden, Switzerland, Turkey, UK, USA and India. The trade fair will showcase various country pavilions including China, Germany, Korea and Switzerland. We are definitely looking forward for wider country pavilion participation expecting a wider spectrum of technologies at this edition.

With the exponential growth in spending on environmental technologies in the emerging markets, how well do you think the indigenous industry participants will be benefited?

Water and wastewater is the most promising sub-sector in India's environmental segment. This accounts for 26% of India's environmental technologies industry, and is expected to grow at 13-15% every year over the next five years. Procurement is almost equally split between government and the private sector projects. However, sales to the industrial sector are growing at a higher rate. The government is primarily involved in the treatment of raw water, water transmission and distribution and sewage treatment operations. The private sector industries in power, food and beverage, pharmaceuticals, refineries and textiles sectors are generating immense opportunities for water and wastewater treatment equipment.
We invite the industries to IFAT India as they prefer advanced treatment technological systems for treating their wastewater. With presence of new technologies and customizable solutions, we are optimistic about the business, networking and learning taking place at IFAT India 2018. ■

Pre-processing / Segregation of Municipal Solid waste

> ***For all these years no MSW processing company was thinking about Shredding (size reduction) and automatic segregation of waste as they were not planning to recover above said materials. Of late when there is no carbon credit market, and there is a huge need for survival with the recoverable /recyclable materials.***
>
> **Mr. S. Sampath,** Chief Executive, SAMKITEC resources

One of the most neglected areas despite its adverse effect on environment and public health, is the safe disposal of solid and liquid waste in this country.

As early as year 2000, we never heard of the word "Solid Waste Management". But things have started moving with the announcement of Swachh Bharat Mission. Due to sudden pressure to change the style of solid waste management and implementation, more confusion is created than clarity.

There is no standard uniform methodology for disposing the solid waste throughout the country. Many states have been neglected even in the case of evaluating their local policies.

There is no system or guidelines on technologies to be adopted uniformly. It is a good thinking that NITI Aayog is proposing Incineration as the solution along with thermal pyrolysis and Plasma Gasification to dispose 1,70,000 tons per day of waste generated in India. While doing so if they follow the rulings of the National Green Tribunal, the objective will be fully achieved scientifically. **The solid waste must be segregated scientifically before it goes for Thermal Process.**

Requirement of Automatic Segregation of MSW in INDIA:

Traditionally Trommels are used for segregation of waste. Size wise separation with holes of sizes ranging from 5 -100 mm is used. The smaller hole size Trommels are used during composting irrespective of their content/ composition. With moisture and fines , the holes get choked in no time.

All the MSW processing companies follow this tradition of separating the 100 mm less and 100mm plus sizes. Entire MSW which fall into the category of 100 mm plus goes straight for land filling

This is what happens in most of the municipalities. In other words neither the valuables are removed nor there is concern on landfill volume.

In a country like ours it is not justifiable to dump valuables or recyclables in the landfill such as plastics, wood, metals, textiles, clothes etc which can be recovered and used to generate energy.

For all these year no MSW processing company was thinking about Shredding (size reduction) and automatic segregation of waste as they were not planning to recover above said materials. Of late when there is no carbon credit market, and there is a huge need for survival with the recoverable /recyclable materials.

The NEW TREND should be:

- To minimize the land filling
- Produce RDF with all the combustibles
- Recover the recyclables
- Convert C&D waste and Fines into reusable formats.

Technology for Segregation of Municipal Solid Waste

BMH Offers complete automatic line for segregation of all material from MSW.

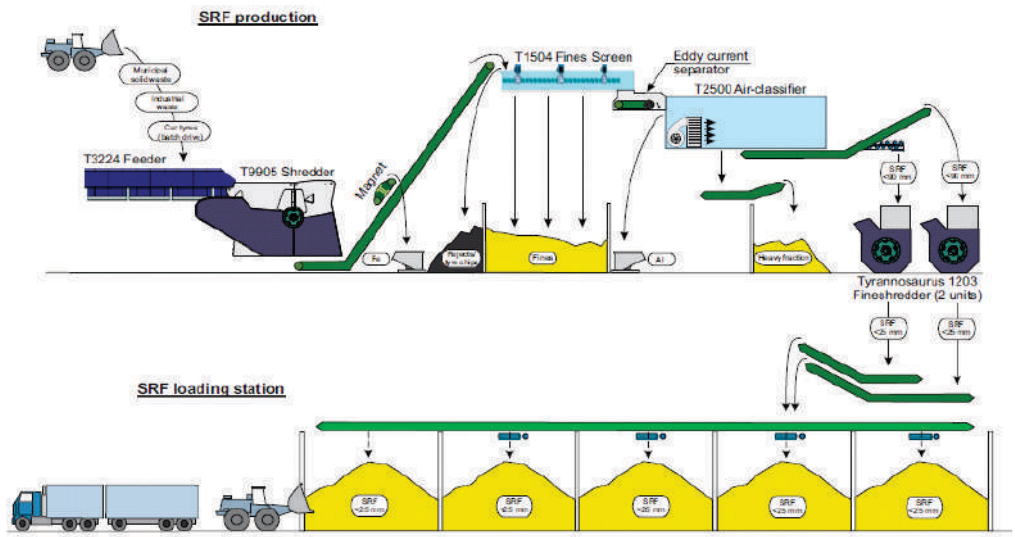
BMH Technology Oy, is a Finland based well-established company, specializing in turn-key deliveries of TYRANNOSAURUS®RDF (SOLID RECOVERED FUEL) PRODUCTION PLANTS and solid fuel handling systems for power plants and cement kilns.

They have supplied more than 100 plants all over the world and have experience of

handling waste in Asian countries like Thailand, Korea, China and partly India
BMH offers robust shredders right from 15 TPH to 80 TPPH (tones per hour) and can shred most of the material found in Indian Waste.

TYRANNOSAURUS System to produce RDF
The process starts with the raw material in the **feeder.** Tyrannosaurus Feeder is made to work optimally together with the shredder. If the shredder has a big mouthful to chew, the feeder slows down, allowing the production line always to work at maximum capacity.
Tyrannosaurus **Shredder** is simply the biggest, strongest and smartest shredder in the world. It weighs up to 90 tonnes, is made of a 60 mm solid steel frame and never stops working. Not only is it robust, but it is intelligent, too. It is equipped with MIPS® (Massive Impact Protection System), which means that it will spit out bigger pieces of metal that cannot be crushed and keep on shredding the rest.
At maximum capacity, it can reduce particle size to 75 mm in one single stage. ZeroGap® shredding means that particle size and quality are maintained even with the wear of knives. The knives are hydraulically adjustable to keep on working optimally and to lengthen the service interval.
After **ferrous** metals have been separated by belt magnets, Tyrannosaurus **Fines Screen** separates sand, glass, soil, organics and other small heavy and wet particles. This is followed by separating conductive metals by eddy current separators. The final touch is given by Tyrannosaurus **Air Classifier.** This is the decisive stage concerning the quality of the fuel.
In the Tyrannosaurus System, one can adjust the process online, allowing it to make the optimal fuel for the end user, e.g. cement kiln or power plant.
Should smaller particle sizes (20 – 25 mm) be needed, Tyrannosaurus **Fine Shredders** – the biggest in the world – can be added to the production line.
BMH offer **Storage silos** as an alternative to expensive bunkers

- RDF is free from all non-combustibles like inert and dust with guaranteed calorific value of 3500+ kcal/kg and lower moisture content
- RDF's High Calorific value means higher value realization.
- Flexibility to have required output sizes.
- The Segregation system is a complete Material Recovery Facility (MRF).
- All recyclables such as metals, rigid plastics, glass, wood etc are recovered during the process.



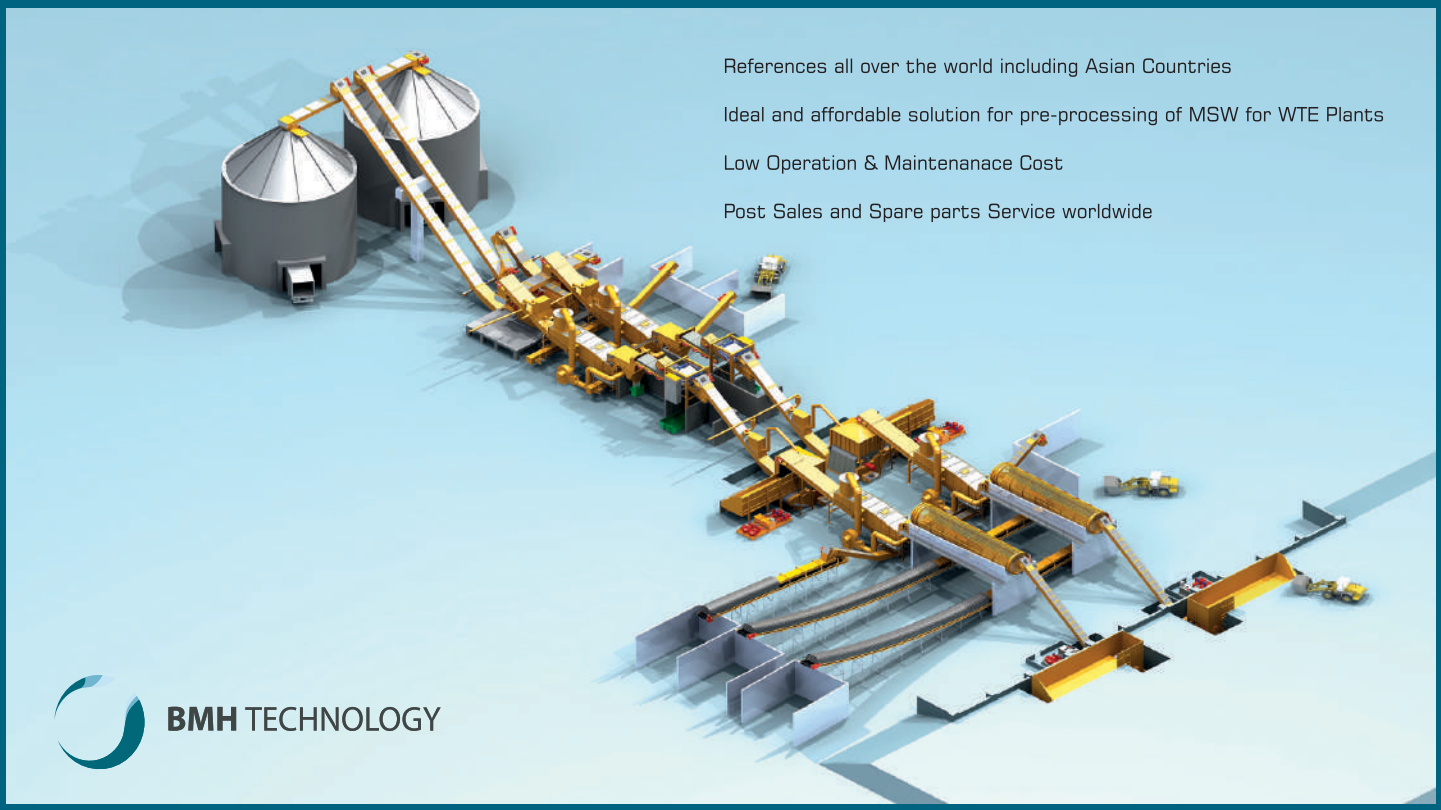
The fuel quality as illustrated below, stays maximized as impurities are minimized and the yield increases automatically

Many do not consider the Segregation of waste as an integral part of the Waste Management and end up processing all the inert, metals, glass, stone with more and more Energy & Cost, leading to a big reduction in overall efficiency. Segregating MSW is a must for proper material recovery and to prepare the combustibles (free from Inert, metal and moisture) as RDF for burning in Clinkers or in Waste to Energy plants. ■

BMH TECHNOLOGY
Finland

Solutions for

Segregation & Pre-processing of Municipal Solid Waste



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Environment-Show off or A Serious Business

> ***As far as our experience of Indian Market is concerned, it may not result into so favourable a situation, until & unless appropriate amount is not invested in collection mechanism, reverse logistic network and environment friendly treatment/disposal facilities.***
>
> **Mr. B K Soni, CMD,** Eco Recycling Ltd.

It has become fashion to talk about Environment & Climate Change. Fortunately, every single person has a solution to rectify the mistake made by the previous generations (nothing wrong done by the present) and the same set of persons keep making an emotional statement that we need to take care of the nature & natural resources because we have borrowed the same from our children. Such huge statements have become part of our day to day life which is flooded with theoretical, non-implementable, ineffective & impractical ideas.

The word green is being abused in several ways including green painted walls, green coloured artificial plants etc. etc. Some persons feel proud by planting a few trees but spend disproportionate number of trees (paper made from trees) on its publicity. There are millions of ideas and billions of people available with great innovations even then, we are unable to move ahead an inch to solve the problems associated with climate change, waste disposal, replenishment of natural resources & balancing equilibrium to avoid natural calamities and these are the reason why nature is showing its different colour across Globe.

It may be a subject of discussion, whether partial or complete ban on certain items and Extended Producers' Responsibility (EPR) in certain cases is really effective & workable solution? As far as our experience of Indian Market is concerned, it may not result into so favourable a situation, until & unless appropriate amount is not invested in collection mechanism, reverse logistic network and environment friendly treatment/disposal facilities.

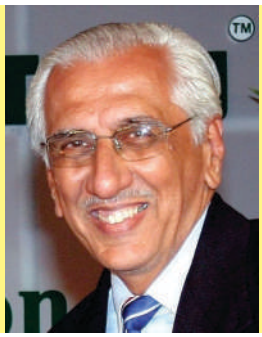
In one sense, our country is very fortunate that it has millions of informal workers associated with the waste collection and its recycle, though, of course, not everyone meeting environmental norms. Incidentally, reverse logistic network developed by these informal workers is a great backbone available for the movement of the secondary source of commodities. If we club the above resources with the formal & environment friendly practices of collection, recycling & disposal, I am more than confident that we may achieve desired results at much faster pace.

Last but an equally important submission is that we should restrict awareness / education / training campaigns only to the the persons / organisations responsible for handling of such climate related issues only. The entire population of the country need not be burdened with the awareness of everything. If we restrict as suggested, we may save billions of dollars spent on awareness of the 1.3 billion public of the country and the same money we can deploy on developing infrastructure for disposal of rubbish.

Let's work together to develop

"Saaf Aur Swachh Bharat"

Plastic Waste Challenges in India Suggestions for Overcoming Hastily Announced Bans



"The main challenge with plastic waste in India are with the billions of sachets and pouches for items such as pan masala, gutka, snacks and savouries due to their small size, difficult to collect from streets and lack of recycling technologies for their waste."

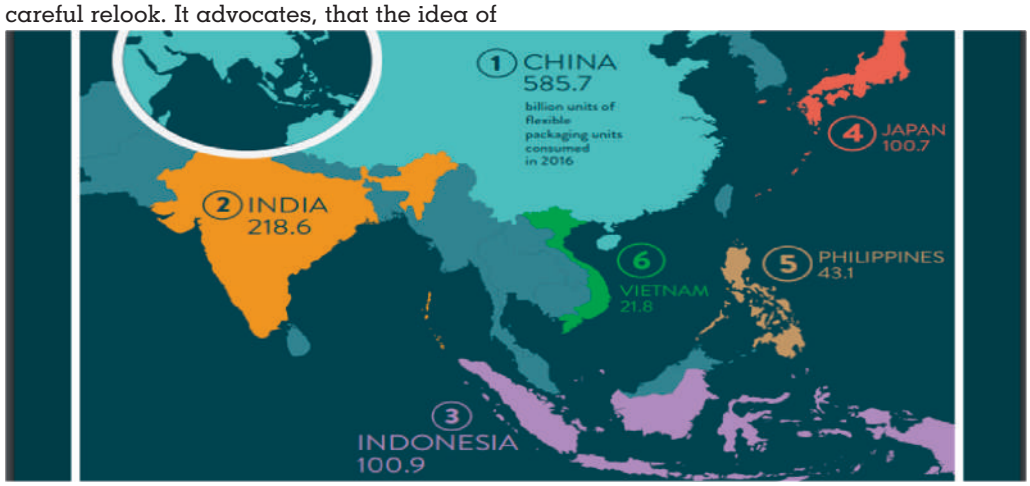
Mr. Vijay Merchant, Member Governing Council, ICPE

Note: The views expressed by the author are his own not necessarily of institutions he is a member of.

In the recent past in India there is awakening for environment. The leaders seem committed to combating Climate Change, Global Warming & Conserving Natural Resources & preventing waste. The report **The New Plastic Economy by Ellen MaCarthur Foundation at WEF** appears to be a resourcebook for policy makers to draft rules and implement them fast to prevent plastic waste nuisance in our country.

The fact is despite our Ministry of Environment & Forests having notified Plastic Waste Management Rules since 15 years with revisions in 2016 & 2018 the states in India failed to realize the importance of implementing them at municiple levels. Little or no infrastructure created to collect dry & wet waste. There was no serious effort to reduce waste to landfills or more efficient waste management. However suddenly it was announced to **BAN SHORT LIFE PLASTICS as advocated by the rich nations.** In this context, **a report made by The Environment Research Institute, Delhi (TERI)** on plastic waste policies needs a careful relook. It advocates, that the idea of the Extended Producers' Responsibility (EPR) introduced by the 2016 rules was novel but lacked detailing. There is a need for a real-time assessment and a state-wise mapping of producers of plastic as well as the demand and supply, for formulating realistic and accountable EPR targets.

There is today a need for a holistic approach across all 29 states & 7 Union Territories of India towards plastic waste collection & recycling from all stakeholders, with each stage of the supply chain needing to work together to combat the problem of plastic waste litter which citizens see as a big nuisance. The need is to enforce responsibilities fairly. However the approach seems fragmented, different and confusing. There needs to be more communication across the entire country in order to fully realise what needs to be done. It is beyond doubt that there is adequate recycling spare capacity but the waste does not seem to reach those who want to recycle nor is it segregated to realize full value of the material.



Difference in Plastic Waste Nuisance India Vs. Europe & Path Ahead

It is pertinent to note that what the west considers as a nuisance to ban may not be completely relevant to India. Out of 5 short life plastic items that channels like CNN are highlighting in TV programmes across the world only two items seem of concern in India which is Thin carry bags & Very light Food containers.
CNN is showing the following 5 items made of plastics that need to be curbed urgently.

1.Carry bags
2. Straws
3.Drink Bottles
4.Take away containers (thin PP & EPS)
5.Chewing Gum

Since almost all plastic bottles (over 85%) introduced in the Indian market are collected & almost 5% to 10% are reused by customers can we ban PET bottles? PET bottles do not pose a waste challenge as in the west but ensure safe drinking water- a necessity. There are almost 30 organised PET bottle recyclers that collect 420 crore PET bottles for recycling into fibre & sheets in India every month. The main challenge with plastic waste in India are with the billions of sachets and pouches for items such as pan masala, gutka, snacks and savouries due to their small size, difficult to collect from streets and lack of recycling technologies for their waste. The continuation of inaction by brand owners in terms of introducing billions of small multilayers packs but not working on collection systems has led to action against Plastic Packaging in India.

Flexible Packaging Units of Asian Countries

- **CHINA** 585.7 billion units of flexible packaging units consumed in 2016
- **INDIA** 218.6
- **INDONESIA** 100.9
- **JAPAN** 100.7
- **PHILIPPINESS** 43.1
- **VIETNAM** 21.8

Primarily it is littered packaging waste of plastics that is the serious environment problem in India. Long life plastic items do not cause our waste problems here.

What is the path ahead for India?
If the Plastic Waste Management Rules (PWM) are to have teeth it is imperative that these rules must address five main gaps. The plastic waste that rag pickers do not collect is multilayer sachets and pouches or MLP bags. However the PWM Rules in current form would not help us overcome the problems in India. In view of the same, the following suggestions are offered.

1. All those Brand Owners must be asked to start immediately with a 50 % recovery recycling target in 2018, without procrastinations.

2. Create a National Awareness about Environmental Nuisance of "very thin bags-use" Suitably enforce Ban of Thin Carry Bags in every state of India i.e. bags below 50 microns.

3. Enforce segregation of Waste by every home & municipalities take away only wet waste & facilitate dry waste collection by NGOs & recyclers so that clean plastic waste definitely lends to larger recycling and no plastic waste goes to landfills.

4. Unlike the west little of our waste is from beaches. Most of it comes from rivers and nullahs several miles before the water enters our oceans. Create awareness drives for schools near the rivers or nullahs to stop the plastic waste at source from getting into water.

5. Bin Culture- Local bodies must provide waste bins on all roads and markets, stations etc. so citizens avoid litter on streets. Infrastructure must be a duty of the states in this drive against litter and plastic waste in India can definitely be much better managed. ■

Why Biological Filtration Systems Are The Best Solutions For Wastewater Treatment Under Most Conditions

For developing regions of the world, including India and Africa, the focus is on building cost effective and sustainable decentralized systems, wherein wastewater can be treated at the source. This is where innovation comes into play in India.

Shri Atul Shroff - Chairman Transchem Agritech Pvt. Ltd

Mr. Rahul Chhabra

The 20th century has brought a lot of innovations and development but unfortunately not in the field of wastewater treatment, particularly in developing countries like India. There are various options for wastewater treatment, from conventional Effluent Treatment Plants (ETPs) / Sewage Treatment Plants (STPs) to Bio-Filtration wastewater treatment. In the 21st century, the solutions providers who win will inevitably be those that are efficient, decentralized and with minimal land use, all of which allows substantially reduced costs. The emerging trend is to treat wastewater at its source with a decentralized approach since water transportation costs are 70-82% of governments in most countries. Trans Bio-Filter is a patent pending, proprietary, green, sustainable and cost-effective wastewater treatment technology developed with 25 years of Research & Development keeping the need of the society in mind.

bio-filter technology | **wastewater treatment** | **sustainability** | **decentralized treatment**

For developing regions of the world, including India and Africa, the focus is on building cost effective and sustainable decentralized systems, wherein wastewater can be treated at the source. This is where innovation comes into play in India

INTRODUCTION : Trans Bio-Filter is an innovative technology that harnesses the energy, carbon and other elements of wastewater and converts it to "Bio-nutritional" products, Bio-Fertilizer and nutrient rich water with the use of hybrid earthworms, organic and inorganic media.

Earthworms

- Are versatile waste eaters and decomposers
- They harbor wide range of microorganisms and enzymes; these half-digested substrates decompose rapidly and are transformed to vermi-compost

Organic Media
- Supports hybrid earthworms and microbes

Inorganic Media
- Sand, gravel and pebbles of various sizes in diameter

Vermi and Microbial-processes simultaneously work together. There is an increase in dissolved oxygen levels in treated water as a result. The filtration as a principle originates from the fact that earthworms, in the process of feeding on the substrate, increase its surface area for further microbial colonization.
During this process, the important plant nutrients such as Nitrogen, Potassium and Phosphorus are converted through microbial action.
It also involves removal of organic matter by adsorption & filtration followed by biological degradation. There is also oxygen supply by natural aeration to the treatment system. It is a natural way of recycling nutrients and removing toxins.

The advantages of Trans Bio-Filter technology:

- The Life-Cycle is 100% green. The output is nutrient-rich water.
- There is a range of applications from domestic sewage & municipal wastewater to industries e.g. Dairy, Dyes, Chemical and Food-related.
- While no chemicals & sludge are involved, it is odor free & works without high-maintenance.
- Technology can be used for treatment of domestic as well as industrial effluent with high COD, BOD and TDS concentrations.
- Trans Bio-Filter works at variable hydraulic loads. The outlet results are achieved even at 5% of the hydraulic load capacity.
- Decentralized system to treat wastewater at its source saves high transportation costs. It also reduces power costs.
- Substantial conservation of depleting freshwater resources as the treated water can be reused.

DESIGN

Overview

The Trans Bio-Filter has four layers, consisting of a bed filled with organic and inorganic media along with hybrid earthworms. The wastewater passes through the filter beds where the organic matter is retained. The organic matter is then degraded. Trans Bio-Filter is designed for maximum removal of contaminants.

Details

Layer characteristics:
- The top most active layer comprises of custom organic and inorganic media consisting of earthworms, microbial cultures & bedding material.
- Next layer comprises of gravel, sized from 50 – 70 mm.
- Below that is a layer of big gravel aggregates of 100 – 150 mm in size.
- The bottom most layer comprises of big rubbles, sized from 200 - 230 mm.

METHODOLOGY

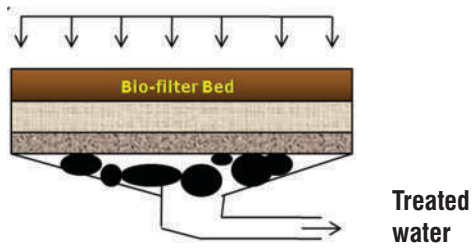


Figure 1. Flow Diagram of Trans Bio-Filter wastewater treatment

For domestic sewage, there are two flow rate options: 2000 liters per square meter or 6000 liters per square meter. For industrial effluent, the flow rate ranges from 150 to 750 liters per square meter.
When wastewater flows in, it is evenly sprayed on the surface. Through gravity, it trickles down. While it passes the system, it gets treated.

RESULTS OF SEWAGE TREATMENT

Sr. No	Parameters	Units	Before Treatment inlet	After Trans Bio-Filter Treatment	Standard Irrigation Norms*
1	pH	–	7.0 – 7.8	**7.5 – 8.0**	5.5-9.0
2	Color	–	Dark Grey	**Pale yellow**	–
3	Odor	–	Strong	**Odorless**	–
4	T.D.S.	ppm	1500 – 2000	**1200-1800**	2100
6	Turbidity	NTU	100 – 150	**<10**	–
7	C.O.D.	ppm	500	**50-80**	100
8	B.O.D.	ppm	100 – 200	**10-20**	30
9	DO	ppm	Nil	**3-4**	–
10	Fecal Coliform	MPN / 100 mL	$> 10^6$	**$< 10^3$**	$< 10^3$

Table 1. Key parameters of sewage treatment.
* Indian standard irrigation norms

There is a reduction of 90% in COD and BOD levels in case of sewage when treated with Trans Bio-Filter. The outlet treated water is ideal for irrigation and with tertiary treatment, the treated water can be used for a variety of applications like flushing, irrigation, washing and can even be used for drinking purposes. We have already installed four plants in India on the concept of "Toilet to Tap" where we are treating sewage using our Trans Bio-Filter technology and with tertiary treatment making it available for drinking purposes.

NUTRIENT RECOVERY THROUGH TRANS BIO-FILTER

Sr. No	Parameters	Units	Before Treatment inlet	After Trans Bio-Filter Treatment
1	NH_4-N	ppm	25-40	**< 1.0**
2	No_3	ppm	10-20	**> 50**
3	Total P	ppm	4-8	**1-2**
4	Available P	ppm	1-21	**5-7**
6	Potassium	ppm	0-15	**20-25**

Table 2. Nutrient Conversion in Treated Water.

Table 2 summarizes how the treated water is rich in nutrients like Nitrogen, Phosphorus and Potassium.
Considering the nutrient content in treated water as:

- Available Nitrogen – 50 mg/l
- Available Phosphorous -- 7 mg/l
- Available Potassium – 25 mg / l

For 800 meter cube treated water, the nutrient availability is:

- Nitrogen – 40 kgs/day i.e. 14000 kgs/annum equivalent to 28 tons of Urea
- Phosphorous – 5.6 kgs/day i.e. 2000 kgs/annum equivalent to 4.0 tons of DAP
- Potassium – 20 kgs/day i.e. 7000 Kgs/annum equivalent to 12.0 tons of Potash

INDUSTRIAL EFFLUENT TREATMENT WITH TRANS BIO-FILTER: CASE STUDIES

Biological trickling filter through vermi filtration is age old technology and is being used for treatment of sewage across the world. We have been able to treat complex industrial effluents through our biological treatment system, Trans Bio-Filter.
Our biological system Trans Bio-Filter reduces COD and BOD loads and other impurities like Ammonia-NH3, H2S etc even in presence of high TDS and at varied hydraulic load giving cost effective sustainable results.
In one case where we have replaced a conventional Industrial effluent treatment plant (chemical industry effluent containing Sulphur and chloride) with Trans Bio-filter system, with a plant capacity of 180 KLD, the results were as follows:

- The power load was reduced by 82%
- The retention time was reduced by 99% from 10 days to 45 minutes
- The Capital Expenditure was reduced by 75%
- The Operations Expenditure was reduced by 65%

The reductions in contaminants sector-wise and effluent-wise are summarized as follows:

Distillery Effluent- Slop Multi Effect Evaporator Condensate

For MEE condensate from Distillery spent wash the results show that Trans Bio-Filter system can be one of the best technologies giving consistent reduction in contaminants. Even when there is shock load of 700% in the effluent concentration our system works, whereas conventional systems might get disturbed and do not give desired outlet results with such shock loads. The studies at lab level were done with effluent having COD concentration of 4900 ppm and the same was reduced to 250 ppm. During onsite pilot plant live trials for a period of 30 days the effluent COD concentration went up to 38000 ppm and the same was reduced to 2790 ppm. The plant is giving consistent reduction of 93% even at 700% shock load. The results can be seen in Table 3.

Distillery Effluent	MEE Condensate Treatability studies results		MEE Condensate onsite pilot studies results	
	COD (ppm)	Turbidity (NTU)	COD (ppm)	Turbidity (NTU)
Before treatment inlet	4900	25	38000	212
After Trans Bio-Filter treatment	250	35	2790	89

Table 3. Distillery Effluent results.

Phenolic Effluent treatment

Trans Bio-Filter system shows outstanding results for complex compounds like Phenol as well. The Phenol concentration of 1325 ppm was reduced to less than 1 ppm without

the addition of any chemicals or tertiary treatment in case of Phenolic effluent. Table 4 shows the results.

Phenol Effluent	COD(ppm)	Phenol(ppm)
Before treatment inlet	4605	1325
After Trans Bio-Filter treatment	**Less than 250**	**Less than 1**

Table 4. Phenol Effluent results.

Natural Dye

In one of the installation of Trans Bio-Filter in Dye industry, the effluent is generated from Natural Dyeing/Block printing. The treated water is re-used in-house for washing purposes. The COD concentration of 1500 ppm was reduced to less than 150 ppm after treatment.

Natural Dye Effluent	COD(ppm)	BOD(ppm)
Before treatment inlet	1500	500
After Trans Bio-Filter treatment	**<150**	**<30**

Table 5. Natural Dyeing results.

Caprolactam Effluent treatment

Trans Bio-Filter system can handle complex effluent with COD concentrations up to 52000 ppm in presence of TDS of 48,000 ppm. There is a reduction of COD to 5634 ppm which when further subjected to simple tertiary treatment gets reduced to under 250 ppm or 99%. It can also handle concentration loading of Sulfates, Sulfides and So_3.

Caprolactam effluent	COD (ppm)	Sulfates (ppm)	Sulfide (ppm)	SO_3(ppm)
Before treatment inlet	52416	2044	105	39
After Trans Bio-Filter treatment	**5634**	**635**	**10**	**Nill**

Table 6. Caprolactam Effluent treatment results.

Dairy Effluent

Trans Bio-Filter system also works well for the treatment of Dairy effluent with high organic load. Detailed studies were conducted on effluent generated from ice cream manufacturing and Cheese Whey. COD concentration of more than 60000 ppm was reduced to 600 ppm and BOD concentration of 48,000 was reduced to 120 ppm.

Dairy – Cheese and Ice cream Manufacturing	Cheese Whey effluent			Ice cream effluent		
	COD(ppm)	Turbidity(NTU)	BOD(ppm)	COD(ppm)	Turbidity(NTU)	BOD(ppm)
Before treatment inlet	60000	10000	48000	14000	1000	8000
After Trans Bio-Filter treatment	600	50	150	250	50 - 80	120

Table 7. Dairy effluent treatment results.

6. CONCLUSION

The results of the data clearly show that treatment through Trans Bio-Filter system for all effluents, even with shock loads, is very effective for the reduction of BOD, COD and solids found in the wastewater. When treated at source, the water can be used for non-potable applications like agriculture and potable application using simple tertiary treatment systems. ■

Problems and Prospects in Urban Waste Management: Study of Pune City

For any city to implement a practical waste management solution, it is important to have three clear objectives: reducing the quantity of waste generated, increasing segregation with timely waste collection and transportation to disposal plants, and scientific and environment-friendly waste disposal.

Mr. Vishwesh Pavnaskar, Senior Research Associate, World Institute of Sustainable Energy, Pune

United Nations' Sustainable Development Goal #11 aims to make cities and human settlements inclusive, safe, resilient, and sustainable.

India is projected to add 300 million new urban residents by 2050. Rapid urbanization, in India, is exerting pressure on resources and public health. According to recent statistics, urbanization has gradually risen from 29.24% in 2005 to 32.75% in 2015

However Solid Waste Management for all these has lagged behind, in terms of garbage that is inadequately processed by most cities.

Solid waste management is not simply a problem of scientific and sanitary waste disposal but also of collection. In spite of exorbitant quantity of waste in India, it is still could have been managed, only if it is collected regularly and timely manner. MOEF data estimates that, only about 75-80% of the municipal waste gets collected.

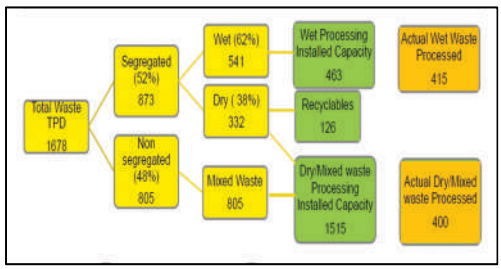
The Problem

It is one of the more aggressive problems created by unmanaged urbanization because cities generate more per capita waste than villages. Considering changing lifestyles and concentration of population in urban areas, it is predicted that by the year 2031 the annual MSW generation in India will reach to 165 million tonnes and further to 436 million tons by 2050.

To add fuel to the fire, only about 23% of the waste collected is processed in environment friendly manner. With lack of proper design, operation & implementation of sanitary landfills, existing landfills are nothing but the dumping sites producing maximum possible nuisance to the surrounding population and environment. If cities continue to dump the waste at present rate without treatment, it is estimated that India will require 1240 hectares of land per year and with projected generation of 165 million tons of waste by 2031, the requirement of setting up of land fill for 20 years of 10 meters height will require 66,000 hectares of land.

Pune City

Pune city generates about 1,678 tons of waste per day Out of which, 52% is segregated while 48% of collected waste is mixed. It has to be noted that, once the waste is mixed, options of waste treatment are quite limited. Current waste management scenario can be mapped as below;



Here again, it is not just the quantity, the waste composition varies too. The more developed a country, the lesser is its organic waste. Organic waste has the least calorific value. Non-organic waste (except inert ones, like stone & dust etc.) has more stored energy that can be used as fuel. If non-organic waste is used to create fuel, it solves a waste management problem along with providing power. While organic waste is reducing in larger Indian cities to 50%, it is encouraging compared to 38% in OECD countries.

This calls for indigenised waste management systems for India because pyrolysis or gasification plants that produce electricity in developed countries will not be profitable for the amount of non-organic waste generated in the country.

The Solution: Social Model for Decentralised Waste Management

For any city to implement a practical waste management solution, it is important to have three clear objectives: reducing the quantity of waste generated, increasing segregation with timely waste collection and transportation to disposal plants, and scientific and environment-friendly waste disposal.

The 'ideal model should help decentralize solid waste management and incorporate the waste collectors into the formal system of waste management. The model should address the two key challenges faced by every city in India that is collection and segregation of waste, and supports to treat wet waste as near as possible to the generation point. By achieving optimum segregation of waste and selling the dry waste to scrap dealers through waste collectors, the model can minimize the need of Land Filling.

Container Free – Zero Garbage Wards

Pune has successfully experimented such model. Pune Municipal Corporation in partnership with Janwani , SWaCH Cooperative and Cummins India developed and implemented the model in the year 2011.The public-private partnership developed a new innovative system for waste management in the city that decentralizes solid waste management and fully incorporated waste collectors into the formal system. In this system, the Municipal Corporation continues several duties, including street sweeping and industrial waste collection. The change is in the system for household and commercial property waste and complete integration of waste pickers into door-to-door services.

The pilot for "zero garbage ward" project was done in one of Pune's suburbs, Katraj. This model aimed to make a "prabhag", an administrative division of the city, a ward into a self-contained unit with respect to municipal solid waste disposal. The concept was to think of each ward as an urban forest – to get all waste generated within the geographic bounds of a ward processed within that ward itself, thus avoiding transportation to a central landfill. The vision was to device a self-sufficient system that would export the minimum, if at all, waste and instead locally recycle the material to create a new type of value. Following these principles, the developed model as implemented in Katraj was a resounding – but very hard-earned – success.

Before	After
24 community waste containers	4 community waste containers
30% door-to-door collection	90% door-to-door collection
10% segregation by citizens	70% of households provide segregated waste
20 waste pickers	Streamlining door to door waste collection by 45 waste pickers
Lack of wet-waste processing plant	Biogas plant of 5 TPD in operation
Approximately 10 tons of waste per day to landfill	Less than 2 tons of waste per day to landfill

Conclusion

In a global picture, the problem of waste management in India might seem smaller in comparison to the rest of the world, but the country still has waste management issues that need immediate attention. In India itself, we are seeing sprouts of movements towards better solid waste management. Government-led initiatives in a couple of towns in Kerala and Tamil Nadu, and a private programme in Solapur, another town from Maharashtra are a few examples. It is clear that people are beginning to realise the importance of segregation and appropriate reuse or disposal.

The Swatch Bharat And Solid Waste Management Rules (SWM),2016

The SWM Rules, 2016 diminish hopes in pushing for adoption of a decentralised mechanism for solid waste management.

Dr. S L Patil, Secretary NSWAI

The Union Ministry of Environment, Forests and Climate Change (MoEF&CC) recently notified the New Solid Waste Management Rules (SWM), 2016. These will replace the Municipal Solid Wastes (Management and Handling) Rules, 2000, which have been in place for the past 16 years.

The New rules fail to incentivise and impose a strict penalty in case of poor implementation. The rules have not pushed for decentralised management of waste but have encouraged centralised treatment such as waste to energy, the present state of which is not good in the country. Also, the informal sector has been considerably neglected in the new Rules.

According to the then Union Minister of State for Environment, Forests and Climate Change, Prakash Javedkar, 62 million tonnes of waste is generated annually in the country at present, out of which 5.6 million tonnes is plastic waste, 0.17 million tonnes is biomedical waste, hazardous waste generation is 7.90 million tonnes per annum and 15 lakh tonnes is e-waste. He added that only about 75-80 per cent of the municipal waste gets collected and only 22-28 per cent of this waste is processed and treated.

The new rules are now applicable beyond municipal areas and have included urban agglomerations, census towns, notified industrial townships, areas under the control of Indian Railways, airports, special economic zones, places of pilgrimage, religious and historical importance, and State and Central Government organisations in their ambit.

Major highlights of the new SWM Rules, 2016

Segregation at source

The new rules have mandated the source segregation of waste in order to channelise the waste to wealth by recovery, reuse and recycle. Waste generators would now have to now segregate waste into three streams- Biodegradables, Dry (Plastic, Paper, metal, Wood, etc.) and Domestic Hazardous waste (diapers, napkins, mosquito repellents, cleaning agents etc.) before handing it over to the collector.

Institutional generators, market associations, event organisers and hotels and restaurants have been directly made responsible for segregation and sorting the waste and manage in partnership with local bodies and sending waste to waste collector or agency, as specified by the local authority.

All hotels and restaurants will also be required to segregate biodegradable waste and set up a system of collection to ensure that such food waste is utilised for composting / bio methanation. The rules mandate that all resident welfare and market associations and gated communities with an area of above 5,000 sq m will have to segregate waste at source into material like plastic, tin, glass, paper and others and hand over recyclable material either to authorised waste-pickers and recyclers or to the urban local body.

Collection and disposal of sanitary waste

The manufacturers or brand owners of sanitary napkins are responsible for awareness for proper disposal of such waste by the generator and shall provide a pouch or

wrapper for disposal of each napkin or diapers along with the packet of their sanitary products.

Collect Back scheme for packaging waste

As per the rules, brand owners who sale or market their products in packaging material which are non-biodegradable, should put in place a system to collect back the packaging waste generated due to their production.

User fees for collection

The new rules have given power to the local bodies across India to decide the user fees. Municipal authorities will levy user fees for collection, disposal and processing from bulk generators. As per the rules, the generator will have to pay "User Fee" to the waste collector and a "Spot Fine" for littering and non-segregation, the quantum of which will be decided by the local bodies.

Also, the new rules have mentioned about the integration of rag pickers, waste pickers and kabadiwalas from the informal sector to the formal sector by the state government.

The rules also stipulate zero tolerance for throwing; burning, or burying the solid waste generated on streets, open public spaces outside the generator's premises, or in the drain, or water bodies.

Waste processing and treatment

As per the new rules, it has been advised that the bio-degradable waste should be processed, treated and disposed of through composting or bio-methanation within the premises as far as possible and the residual waste shall be given to the waste collectors or agency as directed by the local authority. The developers of Special Economic Zone, industrial estate, industrial park to earmark at least 5 per cent of the total area of the plot or minimum 5 plots/ sheds for recovery and recycling facility.

Waste processing facilities will have to be set up by all local bodies having a population of 1 million or more within two years. For census towns with a population below 1 million or for all local bodies having a population of 0.5 million or more, common, or stand-alone sanitary landfills will have to be set up in three years time. Also, common, or regional sanitary landfills to be set up by all local bodies and census towns with a population under 0.5 million will have to be completed in three years. Also, the rules have mandated bio-remediation or capping of old and abandoned dump sites within five years.

Promoting use of compost

As per the rules, the Department of Fertilisers, Ministry of Chemicals and Fertilizers should provide market development assistance on city compost and ensure promotion of co-marketing of compost with chemical fertilisers in the ratio of 3-4 bags is to 6-7 bags by the fertiliser companies to the extent compost is made available for marketing to the companies. Also, the Ministry of Agriculture has been involved in the process

Promotion of waste to energy

The SWM Rules, 2016 emphasise promotion of waste to energy plants. The rules mandate all industrial units using fuel and located within 100 km from a solid waste-based Refuse-Derived Fuel (RDF) plant to make arrangements within six months from the date of notification of these rules to replace at least 5 per cent of their fuel requirement by RDF so produced.

The rules also direct that non-recyclable waste having calorific value of 1500 K/cal/kg or more shall be utilised for generating energy either through RDF not disposed of on landfills and can only be utilised for generating energy either or through refuse derived fuel or by giving away as feed stock for preparing refuse derived fuel. High calorific wastes shall be used for co-processing in cement or thermal power plants.

As per the rules, the Ministry of New and Renewable Energy Sources should facilitate infrastructure creation for Waste to Energy plants and provide appropriate subsidy or incentives for such Waste to Energy plants. The Ministry of Power should fix tariff or charges for the power generated from the Waste to Energy plants based on solid waste and ensure compulsory purchase of power generated from such Waste to Energy plants by Discoms.

Revision of parameters and existing standards

As per the new rules, the landfill site shall be 100 metres away from a river, 200 metres from a pond, 500, 200 metres away from highways, habitations, public parks and water supply wells and 20 km away from airports/airbase. Emission standards are completely amended and include parameters for dioxins, furans, reduced limits for particulate matters from 150 to 100 and now 50. Also, the compost standards have been amended to

align with Fertiliser Control Order. There is much debate on the difficulty faced by the ULBs and NO land is easily available. This is challenge

Management of waste in hilly areas

As per the new rules, construction of landfills on hills shall be avoided. Land for construction of sanitary landfills in hilly areas will be identified in the plain areas, within 25 kilometers. However, transfer stations and processing facilities shall be operational in the hilly areas. This again abig area of concern due to Demographic conditions as the plain areas in hillock are used for crops and survival of local community

Constitution of a Central Monitoring Committee

The government has also constituted a Central Monitoring Committee under the chairmanship of Secretary, MoEF&CC to monitor the overall implementation of the rules. Similarly such provision is existing with PCBs which need to be implemented The Committee meet once a year

Way ahead

The SWM Rules, 2016 diminish hopes in pushing for adoption of a decentralised mechanism for solid waste management. However, it would be challenging to see how segregation at source shall work on the ground. A massive awareness campaign in association with communities, NGOs, students and other stakeholders needs to be planned to push for better implementation of these rules. ■

Why Burn and Create Pollution... When there is a Solution?

Mr. Nitin S Deshpande,
Managing Director,
Trio-Chem Sucrotech Engineering and Projects Pvt Ltd, Pune, India

Mr. Santosh Gondhalekar,
Technical Director,
Primove Engineering Private Limited, Pune. India

> ***600 million tons of agricultural wastes are generated every year in the country. With very few uses for this residue, most of it is wasted***

Stubble is the biomass, leftover in the field after harvesting of the crop. Since the farmer has to prepare the land within a short time for the next crop & since there is no incentive for him to collect, bale & send it as fuel, farmers choose the easiest method of setting fire to it. Such stubble burning in Punjab, Haryana and U.P. simultaneously just before winter season, gives rise to heavy air pollution due to significant particulate matter.

Pollution problems of Delhi have been at a level of critical level & cause serious health concerns. The capital's average daily air quality index (AQI) was noted at a season high value of 478 which is expected to be around 100 for a safe living. Delhi government is now finding ways to fight this pollution scenario. The smog that engulfs the area causes delays in flight and train services and hampers several activities in the National Capital Region (NCR).

Primove Engineering, Pune has come up with a unique technology to produce energy from this stubble whose burning creates havoc in NCR. Produced exclusively from agricultural waste and plant material, AgroGas i.e. BioCNG, also known as 'Fuel of the Future' is a much-needed invention from the labs of Primove. Patented and tested, AgroGas (BioCNG) is delivering a 3-fold socio-environmental impact – reducing carbon footprint, conserving fossil fuels and giving a sustainable entrepreneurial opportunity to the farmers thereby undoing the wrongs of fossil fuels.

India's Petroleum and Natural Gas Scenario

India has total reserves of 763.476 MMT of Crude Oil and 1488.73 BCM of Natural Gas, according to a research study conducted by Ministry of Petroleum and Natural Gas, India in FY 2014-15. However it severely falls short of demand, most of the crude needed to produce fossil fuels is imported. In view of the same, making an import substitute fuel like AgroGas available, will by avoiding stubble burning will be of great benefit.

The Innovation

Primove Engineering Private Limited, a clean tech company, based in Pune has built India's first BioCNG plant where BioCNG is made using Agricultural waste. This BioCNG can be used to power automobiles with the same efficiency as fossil fuel CNG and is now dispensed under the brand name AgroGasTM.

What is BioCNG?

BioCNG or Biologically produced, Compressed Natural Gas is extracted using a patented process, from natural sources like farm stubble, consisting of briquettes of Rice straw, Soybean thrash, Maize straw, Napier grass and Sugarcane bagasse etc.. Biogas is generated from the briquettes which are then further purified into usable BioCNG. This BioCNG has physical and chemical properties that are effectively the same as Fossil CNG which is imported for our use in India.

Mr. Santosh Gondhalekar, Director, R & D at Primove Engineering said, "600 million tons of agricultural wastes are generated every year in the country. With very few uses for this residue, most of it is wasted". Primove's process converts this agricultural waste into BioCNG.

Features

- Compressed Natural Gas made from agricultural and plant residue
- Indigenously developed through a patented technology and with a Proof of Concept already up and running successfully
- Physically and chemically same as CNG that is currently being imported
- BioCNG has a high calorific value and can be used in blast furnaces plus, it can be converted into electricity

Production Process

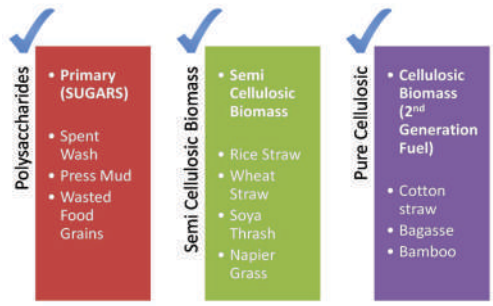
Primove Engineering has set up a pilot plant in Pirangut as a Proof of Concept (PoC), which was recently inaugurated on August 14, 2016, in Pune. Close to INR 5 crore have been invested in the pilot plant so far and about INR 16 crore is required to construct an entire standalone facility for producing 5 tons of BioCNG per day. The BioCNG is produced in 5 main steps.

Step 1: Extraction. Biogas is produced in a single stage reactor from biomass through a Primove Patented process. This biogas is a mixture of Methane (Ch4), Carbon Dioxide (CO2), and Hydrogen Sulphide (H2S).

Sources of Biomass:

- Agricultural Residues: Farm waste or agricultural waste derived from farms or food processing
- Food Waste: Wastes produced as a by-product from food processing plants or after consumption by consumers
- Industrial Waste: Bio-wastes from industries like sugar manufacturing plants and beer distilleries
- **MSW:** Organic fraction of municipal solid waste, garbage, and sewage slurry
- **Energy Crops:** Crops that have high energy content grown specifically for this purpose

Various Biomasses Which Can be Used



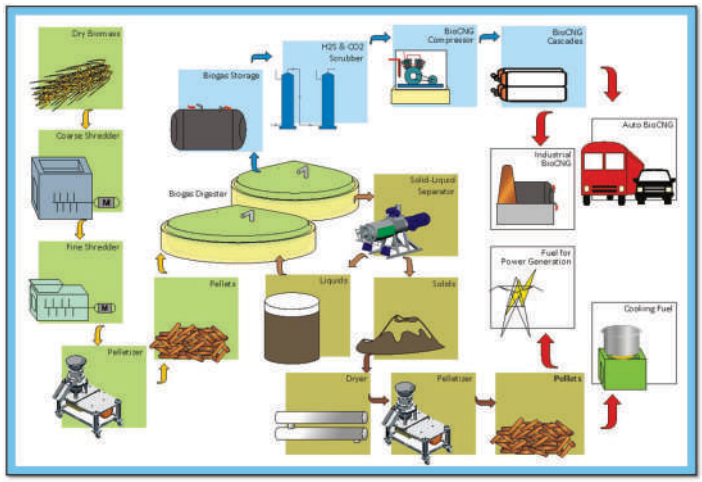
Step 2: Purification. The next phase in the process is to purify this biogas into highly purified Biomethane, adhering to the standards set by the government regulatory bodies.

Step 3: Pressurizing and Storage. The purified bio-methane so produced is then pressurized and filled in certified high-pressure cylinders mounted on the Cascades.

Step 4: Dispensation: The BioCNG, so collected, is now ready to be dispensed for use in 2-wheelers, autos, cars as well as trucks and buses.

Step 5: Monitoring. The BioCNG reserve is logged into special software and data analysis systems that continuously track the purity of the BioCNG. The BioCNG plant is continuously monitored for proper functioning and safety.

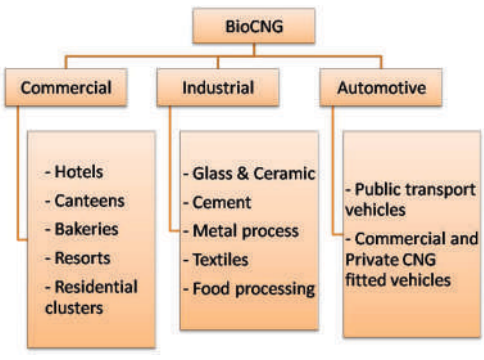
AgroGas Process Flow Diagram



Why to invest in AgroGas (BioCNG)

- Technically feasible – Meets IS 16087 2016 BioCNG standard for vehicles
- Economically viable – Self Sustaining and Profitable Market Supported Project
- Return on Investment – Sustained high return on investment for decades
- Environmentally sustainable – Follows Carbon Neutral Cycle that reduces global warming
- Socially empowering – Creating India's Energy Security with benefits for farmers
- Import Substitution – Huge foreign exchange savings potential of lakhs of crores
- Income for farmers – Income potential of over one lakh crores for farmers

Applications of AgroGas



BioCNG is an equally effective and an efficient fuel alternative to fossil fuels. Setting up tens of thousands of BioCNG production plants and supply stations across the country can cover a substantial requirement of our fuel requirements.

Distribution

The first Zero Liquid Discharge (ZLD) BioCNG production facility has been set up at Pirangut in Pune with all the required permissions, licenses, and approvals. It also meets the IS 16087:2016 standards. Primove's technology can produce over 100 Million ton of crude equivalent BioCNG per year, which is about 50% of India's fuel imports. With the technology patented by Primove, biomass can be compacted and transported in situ, stored and distributed easily. This will cut down the costs in supply chain for BioCNG.

A typical CNG installation can distribute about 5~10 MT of CNG per day. This daily output of 5 tons of AgroGas (BioCNG) can power about:

i. 70 buses (70 kgs/fill)
ii. 500 cars (10 kgs/fill)
iii. 800 auto rickshaws (6 kgs/fill)
iv. A combination of the above

Road Ahead

If we initiate 5000 such BioCNG plants across the country then fuel import cost of Rs. 7 lakh crore could be reduced to almost Rs. 3 lakh crore. If such plants are initiated in every village, then it can provide employment to at least 500 people from that community. In addition to this, AgroGas can prove to be a good import substitute as it is cost effective and pollution free. Our goal is to take the innovation of AgroGasTM plants throughout the length and breadth of India to ensure higher fuel substitution, more livelihood opportunities to the farmers and above all, reduction of carbon footprint, thereby lending a hand to the nation's goals of fighting the effects of pollution at a global level. ■

Cities at crossroads: No more cover-ups

Mrs. Almitra Patel
Member,
Supreme Court Committee for Swm.
National Expert, Swachh Bharat Mission.

Mrs. Isher Judge Ahluwalia
Economist, Chairperson,
Board of Governors,
The Indian Council for Research on
International Economic Relations

"Municipal authorities are opting for capping as a solution to the problem of mixed waste at dumpsites. Bio-remediation and bio-mining may be more desirable."

There are two separate challenges of solid waste management in our cities in India: One, managing the continuous flow of solid waste on a daily basis; and two, dealing with the legacy of neglect, which has resulted in garbage hills having been built up at dumpsites that were meant for waste processing and landfills.

The sites for landfills were originally located outside of the cities, but as the cities have expanded the dumpsites are now almost inside the cities. Delhi's open dumps at Ghazipur (69 metres high), Okhla (55 metres high) and Bhalswa (56 metres high), for example, are all much higher than the permissible height limit of up to 20 metres. It is estimated that more than 10,000 hectares of urban land is locked in these dumpsites in India.

In the absence of exposure to air, the high-rises of rotting mixed waste on these sites generate methane (a greenhouse gas) and other landfill gases which contribute to global warming. They also produce leachate (liquid generated by airless waste), which pollutes groundwater. Frequent outbreaks of fire at the dumpsites lead to air pollution.

Many municipal authorities across the country are opting for "capping" as a solution to the legacy of mixed waste. In Delhi itself, the South Delhi Municipal Corporation is working on capping the Okhla site and hopes to complete this task by the end of 2019. It is important, therefore, to study the environmental and financial implications of choosing capping of a dumpsite as opposed to bio-remediation and bio-mining, particularly since the Solid Waste Management Rules 2016 (hereinafter termed as the Rules) have clearly indicated that bio-treatment of the legacy waste is the preferred way.

The sites for landfills were originally located outside of the cities, but as the cities have expanded the dumpsites are now almost inside the cities. (Illustration: CR Sasikumar)

Bio-remediation and bio-mining are clearly specified as the first choice under Rule 15 (zj) of The Rules for the Safe Treatment of Legacy Waste in all open dumpsites and existing operational dumpsites in India. We had earlier described the simple low-cost solution of bio-remediation and bio-mining in our column, 'A city laid waste'(IE, June 28, 2017), explaining how it effectively reduces the volume of the waste, addresses the issues of pollution and global warming, and also frees up land for beneficial uses. Rule 15(zk) of the Rules specifies that only when bio-remediation and bio-mining of dumpsites are not possible, should the waste be scientifically capped as per landfill capping norms.

The problem arises because the Rules do not specify any criteria for determining whether bio-remediation and bio-mining are possible or not. An obvious constraint will be imposed by geography: Waste thrown down steep narrow valleys in hill towns, for example, may not be accessible for bio-treatment. A possible criterion could be whether the organic content of the waste is less than 10 per cent in the total mixed waste, which would suggest that the waste has already stabilized and has very little organic substance left for microbial action and hence does not require bio-remediation and bio-mining.

Just as the Rules define combustible waste suitable for waste to energy, the Rules could also have defined the quality of waste suitable for bio-remediation.

In the absence of clear technical norms and a lack of clarity on the exemption for geographical constraints, municipal authorities are left with the discretion in dealing with the mounds of legacy waste. The result is that capping is being projected in Indian cities as a solution to the challenges posed by our unlined open dumps, even where bio-remediation and bio-mining are feasible and desirable. In doing so, municipal authorities often draw a false parallel with the closure of scientifically engineered landfills abroad, which start with underground pits that have good impervious bottom and side liners, and proper piping and gas extraction systems to prevent the escape of leachate and gases. Capping unsegregated waste, which has been lying at the dumpsites for decades with an impermeable layer of gravel, high-density polyethylene and soil, and not exposing it to air, is very different from scientific closure.

The danger of capping of untreated dumpsites without adequate precautions was driven home (or was it?) by what happened at the Mindspace Commercial Complex built to international standards at Malad in 2007. The complex was built on what was a dumpsite in a low-lying area. Neither was the site treated/capped, nor was it left alone for the mandatory period of 15 years without building on it.

When MNCs and other high-end companies moved into the complex, they encountered constant disruptions in the functioning of their office equipment. Corrosive landfill gases (containing methane, hydrogen sulphide, mercaptans and other sulphurous compounds) were being released from the unscientifically closed dump into the basements of the buildings nearby. After technicians failed to zero in on the cause of the constant breakdown of computers and air-conditioners in the Mindspace office complex, it was Dr. Amiya Sahu, an environmental scientist and President of the National Solid Waste Association of India, who discovered through air testing in and around the office complex that the real culprit was the unscientific closure/capping of the dumpsite and premature construction of buildings on the site.

Another capping disaster was at Bengaluru, where the Bagalur quarry, full of untreated waste, was covered with a garden. Landfill gases are bubbling vigorously up through leachate almost at ground level in six unused leachate extraction wells.

By contrast, Ambikapur, a small town with a population of 150,000, in Chhatisgarh provides a good example of how to go about correctly capping a dumpsite. In 2016, C Srinivasan of Vellore first set up a decentralised waste management system in Ambikapur to prevent any fresh waste reaching a 40-year-old dumpsite of nine hectares. Next, the legacy waste on the dumpsite was fully stabilized. For aeration, it was moved in six-inch layers to the boundary of the site, and inoculated with a natural bio-culture of cow dung, cow urine and jaggery before adding and inoculating another layer, up to a total height of nine meters. The boundary wall was thus replaced by a 900-metre-long bund with a 15-metre-wide base, 7.5-metre-wide top and stable 45-degree slopes. The area was seeded with 100 kg of ragi seeds mixed with 100 kg sand, then fully covered with porous jute netting. This prevented birds from eating the seeds and retained the moisture from sprinklers. The heap has naturally shrunk to half its original height and is a wonderful green hillock of dense self-seeded ragi grass covering an area of 1.2 hectares. The remaining area is now a popular Sunday picnic park that replaced a stinking landmark beside the highway into town.

The Ambikapur example illustrates what we have often pointed out. Good things are happening in small experiments, but they are not being used to set larger policies right. The Ministry of Environment and Forests and the Central Pollution Control Board should swing into action immediately to issue guidelines on the capping of dumpsites, taking account of health, environment and financial perspectives. And what is more, they should strictly monitor compliance. ■

Source : Indian Express, 29th August, 2018.

Maharashtra Pollution Control Board
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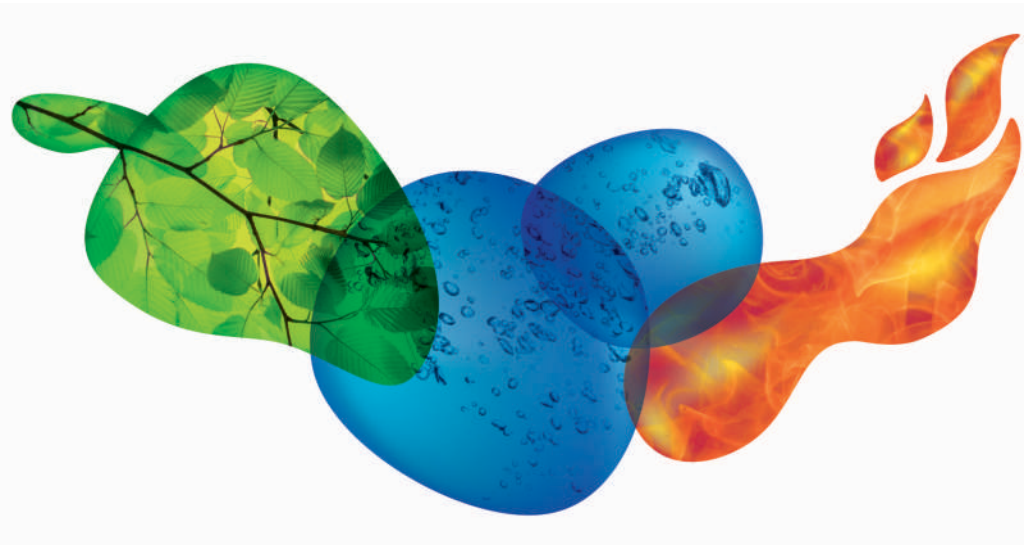

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