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IN THIS ESSUE

EDITORIAL

Solid waste management poses a major problems common to many countries of the world including India. The growth in population along with urbanization has thrown difficult to manage challenges. Local municipal bodies carry out the task of collection, transport and final disposal of discarded materials. Poverty and lack of sanitation facilities especially in slum areas not only create heaps of unattended solid waste but also put forth health problems due to unclean environment. Lack of proper collection and inappropriate final disposal of wastes are the major problems faced by many cities in India. Most wastes are disposed off in open dumps, burnt or deposited on vacant land. It generates considerable pollution and poses risks to human health and the environment.

In India, urban areas generate approximately 30 million tonnes of solid waste every year. Unattended waste is either dumped in land, without proper treatment, or contaminate water bodies, leading to water pollution and sometimes spread of water-borne diseases. Hospital waste which is hazardous in nature needs special attention as its incineration should not be overlooked. The solid waste problem also has a silver lining to it as it can be converted into wealth by adopting environment-friendly waste-to-energy technologies. Adoption of such methods would not only reduce the quantity of waste, but generate energy as an alternate source which is the need of the hour.

Solid waste management can be carried out efficiently if a collective effort is made by the community at large and municipalities in particular. The current disposal methods like landfill, chemical and effluent treatment, recycling, incineration, waste minimization, waste to energy clean technologies, waste monitoring need further support by invention of new and cleaner technologies. There is an urgent need to create public awareness regarding minimization of waste generation, segregation of waste, its proper disposal and efforts to keep the environment clean. Many cities in our country especially in hill areas have put ban on use of plastic bags, which is an effort towards minimization of non-degradable waste. A collective effort involving communities and regulatory bodies can go a long way in creating a clean and green environment.

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ODDS AND ENDS

Greenhouse gases emission from municipal waste management: The role of separate collection

The municipal solid waste management significantly contributes to the emission in the atmosphere of greenhouse gases (e.g. CO_2, CH_4 & N_2O) and therefore the management process from collection to treatment and disposal has to be optimized in order to reduce these emissions. In this paper, starting from the average composition of undifferentiated municipal solid waste in Italy, the effect of separate collection on greenhouse gases emissions from municipal waste management has been assessed. Different combinations of separate collection scenarios and disposal options (i.e. landfilling and incineration) have been considered. The effect of energy recovery from waste both in landfills and incinerators has also been addressed. The results outline how a separate collection approach can have a significant effect on the emission of greenhouse gases and how wise municipal solid waste management, implying the adoption of Best Available Technologies (i.e. biogas recovery and exploitation system in landfills and energy recovery system in Waste to Energy plants), can not only significantly reduce greenhouse gases emissions but, in certain cases, can also make the overall process a carbon sink. Moreover it has been shown that separate collection of plastic is a major issue when dealing with global warming relevant emissions from municipal solid waste management.

Waste Management 2009, 29(7): 2178-2187.

The municipal solid waste landfill as a source of ozone-depleting substances in the United States and United Kingdom

This study provides observation-based national estimates of CFC-11, CFC-12, CFC-113, and 1,1,1-trichloroethane emissions for the United States (US) and United Kingdom (UK) from municipal solid waste (MSW) landfills. The scarcity of national estimates has lead to the assumption that a significant fraction of the lingering ozone depleting substance (ODS) emissions, which have been detected in industrialized countries, could be emitted from landfills. Spatial coverage was achieved through sampling at seven landfills in Massachusetts and through data provided by nine UK landfills. Linear least square

regressions of recovered ODS vs. CH_4 were used in combination with national estimates of landfill CH_4 emissions to estimate 2006 national US and UK ODS landfill emissions. The ODS landfill emission estimates were then compared to recent estimates of total US and UK ODS emissions. US ODS landfill emissions are 0.4%–1% (0.006–0.09 Gg/year) of total US emissions. UK ODS landfill emission estimates are 1% (0.008 Gg/year) and 6% (0.03 Gg/year) of total UK CFC-11 and CFC-12 emissions, respectively. This indicates that landfills are only a minor source of lingering ODS emissions in the US, but may be more significant for CFC-12 emissions in the UK. The implication is that the majority of current ODS emissions in industrialized countries is likely coming from equipment still in use.

Atmospheric Chemistry & Physics 2010, 10: 1899-1910.

Life cycle assessment of municipal solid waste management with regard to greenhouse gas emissions: Case study of Tianjin, China

The environmental impacts of municipal solid waste (MSW) management have been highlighted in China, due to the continually increasing amount of MSW being generated and the limited capacity of waste treatment facilities. Of particular interest is greenhouse gas (GHG) mitigation, aided by the Kyoto Mechanisms. China is an important case study for this global issue; however, an analysis of the entire life cycle of MSW management on GHG emissions is not available for China. This study evaluates the current and possible patterns of MSW management with regard to GHG emissions, using life cycle assessment (LCA), based on the Tianjin case. They assess the baseline scenario, reflecting the existing MSW management system, as well as a set of alternative scenarios, five exploring waste treatment technology innovations and one exploring integrated MSW management, to quantitatively predict potentials of GHG mitigation for Tianjin. Additionally, a sensitivity analysis is used to investigate the influence of landfill gas (LFG) collection efficiency, recycling rate and methodological choice, especially allocation, on the outcomes. The results show GHG emissions from Tianjin's MSW management system amount to 467.34 Mg CO_2 eq. per year, based on the treatment of MSW collected in the central districts in 2006, and the key issue is LFG released. The integrated MSW management scenario, combining different improvement options, shows the highest GHG mitigation potential. Given the limited financial support and the current waste management practice in Tianjin, LFG utilization scenario would be the preferred choice. The sensitivity analysis of recycling rate shows an

approximately linear relation of inverse proportion between recycling rate and total GHG emissions. Kitchen waste composting makes a considerable contribution to total GHG emissions reduction. Allocation choices result in differences in total quantitative outcomes, but preference orders and contributions analysis are found to be robust, suggesting LCA can support decision making.

Science of the Total Environment 2009, 407(5): 1517-1526.

Solid waste, its health impairments and role of rag pickers in Tiruchirappalli city, Tamil Nadu, Southern India

In India, the significant increase in the generation of municipal solid waste (MSW) during the last few decades is due to the rapid population and economic development. Though the appropriate attempts are made through the 3-'R' principles, waste management still needs to be envisaged seriously by everybody for a cleaner and greener environment. Rag-pickers, who contribute to solid waste management to some extent, are the people who rummage through garbage bins to pick out 'rags' for their livelihood. These rag-pickers usually collect the materials that have good re-sale value as these materials are mostly recycled or reused. In the present study, the collection and the management of solid waste and the level of microbial pollution generated through air, soil and solid waste were studied. A questionnaire survey based on age, sex, educational status, socio-economic status, habits and health effects was conducted from 65 randomly selected rag-pickers from various places of Tiruchirappalli city. The results revealed that they can be properly educated and trained to protect themselves from unhygienic practices and addiction. Either the Government or non-governmental organizations (NGOs) should devise a suitable proposal to monitor and make use of these unorganized rag-pickers who are indispensable to the society.

Waste Management & Research 2009,
doi: 10.1177/ 0734242X09352705

Risk factors associated with treatment of mixed municipal solid waste in the Indian context

Across India, all small and large urban local bodies (ULB) alike are grappling with the problem of municipal solid waste (MSW), which has reached critical dimensions because of rapidly increasing quantities and complex characteristics, inadequate regulation, lack of awareness, concern and cooperation on the part of the urban residents, limited resources for collection, transport and safe disposal, and limited expertise on the part of the ULBs. A number of ULBs have attempted to address the two-fold constraint of resources and land by setting up treatment plants under the premise of generating revenue and reducing liability of safe disposal. Over the last three decades, under the paradigms of converting 'waste to energy' and 'waste to wealth' various technologies have been tried out, however time and again it is seen that irrespective of the technology, MSW treatment plants run in to difficulties and/or close down. The issues do not pertain just to technology but are systemic and encompass project development, feedstock delivery system including quality and quantity, climate, high life-cycle costs, low value realization on outputs and adverse environmental and social impacts. With such a wide range of risk factors, experience has shown that the probability of manifestation of any one of them or a combination thereof at one or the other stages of the project is quite high. Investment in a mixed MSW treatment plant therefore can not deliver positive financial returns, rather it can become a non-performing asset without even guaranteeing the desired environmental and public health benefits. This study therefore argues for the adoption of a robust, elastic and most forgiving option of sanitary landfill as a dependable and safe disposal system for MSW.

Waste Management & Research 2009, 27(10): 996-1001.

Risk of cancer in the vicinity of municipal solid waste incinerators: importance of using a flexible modelling strategy

Ecological study was conducted in four French administrative departments and highlighted an excess risk in cancer morbidity for residents around municipal solid waste incinerators. This study showed how important is advanced tools and statistical techniques to better assess weak associations between the risk of cancer and past environmental exposures. The steps to evaluate the association between the risk of cancer and the exposure to incinerators, from the assessment of exposure to the definition of the confounding variables and the statistical analysis carried out are detailed and discussed. Dispersion modelling was used to assess exposure to sixteen incinerators. A geographical information system was developed to define an index of exposure at the Integrated Risk Information System (IRIS) level that is the geographical unit we considered. Population density, rural/urban status, socio-economic deprivation, exposure to air pollution from traffic and from other industries were considered as potential confounding factors and defined at the IRIS level. Generalized additive models and Bayesian hierarchical models were used to estimate the association between the risk of cancer and the index of exposure to incinerators accounting for the confounding factors. Modelling to assess the exposure to municipal solid waste incinerators allowed accounting for factors known to influence the exposure (meteorological data, point source characteristics, topography). The statistical models defined allowed

modelling extra-Poisson variability and also non-linear relationships between the risk of cancer and the exposure to incinerators and the confounders. In most epidemiological studies distance is still used as a proxy for exposure. This can lead to significant exposure misclassification. Additionally, in geographical correlation studies the non-linear relationships are usually not accounted for in the statistical analysis. In studies of weak associations it is important to use advanced methods to better assess dose-response relationships with disease risk.

International Journal of Health Geographics 2009, Volume 8: Article 31: Page No 1-16.

National and regional generation of municipal residue biomass and the future potential for waste-to-energy implementation

Municipal residue biomass (MRB) in the municipal solid waste (MSW) stream is a potential year-round bioenergy feedstock. A method is developed to estimate the amount of residue biomass generated by the end-user at the scale of a country using a throughput approach. Given the trade balance of food and forestry products, the amount of MRB generated is calculated by estimating product lifetimes, discard rates, rates of access to MSW collection services, and biomass recovery rates. A wet tonne of MRB could be converted into about 8 GJ of energy and 640 kg of carbon dioxide (CO_2) emissions, or buried in a landfill where it would decompose into 1800 kg of CO_2 equivalent (in terms of global warming potential) methane (CH_4) and CO_2 emissions. It is estimated that approximately 1.5 Gt y^{-1} of MRB are currently collected worldwide. The energy content of this biomass is approximately 12 EJ, but only a fraction is currently utilized. An integrated assessment model is used to project future MRB generation and its utilization for energy, with and without a hypothetical climate policy to stabilize atmospheric CO_2 concentrations. Given an anticipated price for biomass energy (and carbon under a policy scenario), by the end of the century, it is projected that nearly 60% of global MRB would be converted to about 8 EJ y^{-1} of energy in a reference scenario, and nearly all of global MRB would be converted into 16 EJ y^{-1} of energy by the end of the century under a climate policy scenario.

Biomass & Bioenergy 2010, 34(3): 379-388.

An assessment of municipal solid waste compost quality produced in different cities of India in the perspective of developing quality control indices

A study was conducted to investigate physico-chemical properties, fertilizing potential and heavy metal polluting potentials of municipal solid waste composts produced in 29 cities of the country. Results indicated that except a very few samples, all other samples have normal pH and EC. Organic matter as well as major nutrients N and P contents in MSW composts are generally low as compared to the composts prepared from rural wastes. Heavy metal contents in composts from bigger cities (>1 million population) were higher by about 86% for Zn, 155% for Cu, 194% for Cd, 105% for Pb, 43% for Ni and 132% for Cr as compared to those from smaller cities (<1 million population). Composts prepared from source separated biogenos wastes contained, on average, higher organic matter (by 57%), total N (by 77%) and total P (by 78%), but lower concentrations of heavy metals Zn (by 63%), Cu (by 78%), Cd (by 64%), Pb (by 84%), Ni (by 50%), and Cr (by 63%) as compared to those prepared from mixed wastes. Partial segregation at the site of composting did not improve quality of compost significantly in terms of fertilizing parameters and heavy metal contents. Majority of MSW composts did not conform to the quality control guideline of 'The Fertilizer (Control) Order 1985' in respect of total organic C, total P, total K as well as heavy metals Cu, Pb and Cr. In order to enable the relevant stakeholders to judge overall quality, a scheme has been proposed for the categorization of composts into different marketable classes and restricted use classes (RU-1, RU-2, and RU-3) on the basis their fertilizing potential and as well as potential for contaminating soil and food chain. Under the scheme, 'Fertilizing index' was calculated from the values of total organic C, N, P, K, C/N ratio and stability parameter, and 'Clean index' was calculated from the contents of heavy metals, taking the relative importance of each of the parameters into consideration. As per the scheme, majority of the compost samples did not belong to any classes and hence, have been found unsuitable for any kind of use. As per the regulatory limits of different countries, very few compost samples (prepared from source separated biogenos wastes) were found in marketable classes and some samples were found suitable only for some restricted use.

Waste Management 2010, 30(2): 192-201.

Bioconversion of municipal solid waste (MSW) and Water hyacinth (WH) into organic manure by fungal consortium

Coimbatore is an inland district in the Tamil Nadu state in India. The amount of municipal solid waste generated in Coimbatore city has been increased dramatically during the past several years. Coimbatore Municipal Corporation is facing problems associated with solid waste management system. The modern concept of environmental management is based on the recycling of waste. In this context, composting appears to be a safe form of treatment of some waste. During the last few years, composting has gained wide acceptance as a key component of integrated solid waste management. It has been promoted as an eco-friendly and sustainable solution to urban waste management. It encourages the production of beneficial microorganism (mainly the fungus) which in turn breaks down organic matter to create humus. Humus, a rich nutrient filled material, increase the nutrient content on soils and helps soil to retain moisture. Compost has also been shown to suppress plant diseases and pests and enhance higher yields of agricultural crops.

The study was carried out to assess the degrading efficiency of the fungal consortium (Cellulolytic fungi -

Paecilomyces variotti and Chaetomium globosum; lignolytic fungi - *Pleurotus florida and Tramates versicolor and actinomycetes - Streptomyces lavendulae and Thermobifida fusca*) in converting the municipal solid waste (MSW) and *Water hyacinth* (WH) mixture into an eco-friendly value added organic manure. The results revealed that the biomanure obtained by inoculation of fungal consortium into the MSW and WH mixture was found to be efficient in enhancing the rate of decomposition within as they showed a drastic reduction in the biochemical parameters like organic carbon (21.09 per cent), cellulose (20.56 per cent), phenolic content (0.46 mg g^{-1}) and reducing sugars (0.67 mg g^{-1}). C:N ratio was narrowed down from 92:1 to 15:1, while nitrogen content increased from 0.37 percent to 1.39 per cent compared to uninoculated MSW-WH compost. β-glucosidase and urease enzyme activities were much pronounced upto 75 days from 0.05 to 2.82 Ul -1enzyme protein (β-glucosidase) and from 0.93 to 2.39 µ mol of ammonia formed mg -1enzyme protein (urease) in fungal consortium inoculated MSW-WH over the uninoculated MSW-WH compost.

Journal of Sustainable Development, 2010, 3(1): 91-97.

Ethanol production from the organic fraction obtained after thermal pretreatment of municipal solid waste

The use of organic fraction from municipal solid waste (MSW) as substrate for ethanol production based on enzymatic hydrolysis was evaluated in this study. MSW was subjected to a thermal pretreatment (active hygienization) at 160 °C from 5 to 50 min. The organic fiber obtained after 30 min was used as substrate in a simultaneous saccharification and fermentation (SSF) and fed-batch SSF process using cellulases and amylases. In a fed-batch mode with 25% (w/w) substrate loading, final ethanol concentration of 30 g/L was achieved (60% of theoretical). In these conditions, more than 160 L of ethanol per ton of dry matter could be produced from the organic fraction of MSW.

Applied Biochemistry & Biotechnology 2010, 161(1-8): 423-431.

Modeling of leachate generation from MSW landfills by a 2-dimensional 2-domain approach

The flow of water through Municipal Solid Waste (MSW) landfills is highly non-uniform and dominated by preferential pathways. Thus, concepts to simulate landfill behavior require that a heterogeneous flow regime is considered. Recent models are based on a 2-domain approach, differentiating between channel domain with high hydraulic conductivity, and matrix domain of slow water movement with high water retention capacity. These models focus on the mathematical description of rapid water flow in channel domain.

The study highlights the importance of water exchange between the two domains, and expands the 1-dimensional, 2-domain flow model by taking into account water flows in two dimensions. A flow field consisting of a vertical path (channel domain) surrounded by the waste mass (matrix domain) is defined using the software HYDRUS-2D. When the new model is calibrated using data sets from a MSW-landfill site the predicted leachate generation corresponds well with the observed leachate discharge. An overall model efficiency in terms of r^2 of 0.76 was determined for a simulation period of almost 4 years.

The study confirm that water in landfills follows a preferential path way characterized by high permeability (Ks = 300 m/d) and zero retention capacity, while the bulk of the landfill (matrix domain) is characterized by low permeability (Ks = 0.1 m/d) and high retention capacity. The most sensitive parameters of the model are the hydraulic conductivities of the channel domain and the matrix domain, and the anisotropy of the matrix domain.

Waste Management 2010, doi:10.1016/j.wasman.2010.03.020

Influence of particle size on pyrolysis and gasification performance of municipal solid waste in a fixed bed reactor

Pyrolysis and gasification of municipal solid waste (MSW) were carried out in a lab-scale fixed bed reactor in order to evaluate the effects of particle size at different bed temperatures on product yield and composition. The bed temperature was varied from 600 to 900 degrees C and the MSW was separated into three different size fractions (below 5mm, 50-10 mm and above 10mm). Particle size and temperature had integrated effects on product yield and composition: higher temperature resulted in higher gas yield with less tar and char, and, at the same temperature, dry gas yield increased with a decrease in particle size, and char and tar yield decreased. The differences due to particle sizes in pyrolysis and gasification performance practically disappeared at the highest temperatures tested. Smaller particle sizes resulted in higher H_2 and CO contents for both pyrolysis and gasification of MSW. Minimizing the size of raw materials is an alternative method to improve the gas quality of MSW pyrolysis and gasification.

Bioresource Technology 2010, doi:10.1016/j.biortech.2010.03.060

Gasification characteristics of MSW and an ANN prediction model

Gasification characteristics make up the important parts of municipal solid waste (MSW) gasification and melting technology. These characteristics are closely related to the composition of MSW, which alters with climates and seasons. It is important to find a practical way to predict gasification characteristics. In this study, five typical kinds of organic components (wood, paper, kitchen garbage, plastic and textile) and three representative types of simulated MSW are gasified in a fluidized-bed at 400–800 °C with the equivalence ratio (ER) in the range of 0.2–0.6. The lower heating value (LHV) of gas, gasification products, and gas yield are reported. The results indicate that gasification characteristics are different from sample to sample.

Based on the experimental data, an artificial neural networks (ANN) model is developed to predict gasification characteristics. The training and validating relative errors are within ±15% and ±20%, respectively, and predicting relative errors of an industrial sample are below ±25%. This indicates that it is acceptable to predict gasification characteristics via ANN model.

Waste Management 2009, 29(1): 240-244.

Isotope technique (^{14}C, ^{131}I) for safety analysis of domestic solid waste disposal site in Jakarta, Indonesia- a case study

Bekasi is one of city around Jakarta which has been developed for the last 10 years. In the south of Bekasi placed sanitary landfill area for domestic solid waste of Jakarta Metropolitan as a Disposal Site. The objective of the present study is to evaluate the location of Bantar Gebang Bekasi solid waste disposal site for safety analysis. The geo-hydrological parameters are determined by using isotopes techniques (^{14}C, ^{131}I) to study the shallow groundwater characteristics of the site. From the results of ^{14}C the direction of groundwater movement is found to be from South to the North and turned to North West of Jakarta at Jakarta Center. From radiotracer method (^{131}I) the direction of shallow groundwater in the rainy is observed to be from the disposal site to the surrounding area and the Ciketing canal which flows to the North. For the dry season from the disposal site to the surrounding area. The results from environmental isotopes and hydrochemistry analysis indicate that the pollutants from the site have given an impact to the surrounding area of disposal site which was shown by migration of nitrate. It is recommended that the decision maker should give high priority to the geology, geohydrology and environmental pollution studies for consideration of disposal site for the safety of sanitary landfill.

Modern Applied Science 2010, 4(3): 20-27.

Optimum municipal solid waste collection using geographical information system (GIS) and vehicle tracking for Pallavapuram municipality

Waste collection and transportation is the contact point between waste generators and waste management systems. A proposal for an innovative model for the collection and transportation of municipal solid waste (MSW) which is a part of a solid waste management system using a spatial geo database, integrated in a geographical information system (GIS) environment is presented. Pallavapuram is a fast-developing municipality of Chennai city in the southern suburbs about 20km from Chennai, the state capital of Tamil Nadu in India. The disposal of MSW was previously occurring in an indiscriminate and irrational manner in the municipality. Hence in the present study an attempt was made to develop an engineered design of solid waste collection using GIS with a vehicle tracking system and final disposal by composting with investment costs. The GIS was used to analyse existing maps and data, to digitize the existing ward boundaries and to enter data about the wards and disposal sites. The proposed GIS model for solid waste disposal would give information on the planning of bins, vehicles and the optimal route. In the case of disposal, composting would be a successful strategy to accelerate the decomposition and stabilization of the biodegradable components of waste in MSW.

Waste Management & Research 2010,doi:10.1177/0734242X10366272

Biological stability of municipal solid waste from simulated landfills under tropical environment

Biological stability of the municipal solid waste (MSW) is assessed under tropical climatic condition using landfill lysimeters. Various landfill operating conditions and two different substrates were employed. Solid waste samples collected during different time intervals of landfill operation assessed for volatile solids (VS), organic carbon (OC), specific oxygen uptake rate (SOUR), and water extractable components. Organic carbon achieved faster stabilization than the nitrogen content in MSW within the various landfill operating conditions. At the end of 960 days of lysimeter operation, the MSW from different landfills were aerobically and anaerobically stable and results comparable with compost. Further, bioreactor landfill given better biological stability and high methane content than other landfill operating conditions with continuous leachate treatment is compelling benefit.

Bioresource Technology 2010, 101(3) : 845-852.

Municipal solid waste management in Kolkata, India - a review.

Kolkata is one of four metropolitan cities in India. With an area of 187.33sqkm and a population of about 8 million, it generates around 3,000 $td^{(-1)}$ of municipal solid waste (MSW) at a rate of 450-500 g per capita per day. With rapid urbanization as a result of planned and unplanned growth and industrialization, the problems associated with handling MSW have increased at an alarming rate over the past few years. No source segregation arrangement exists; there is only limited (60%) house-to-house collection; and 50-55% open vats are used in the

present collection system. The operational efficiency of the Kolkata Municipal Corporation (KMC) transport system is about 50%, with a fleet composed of about 30-35% old vehicles. The majority (80%) of these, particularly the hired vehicles, are more than 20 years old. The newly added areas covered by KMC have even lower collection efficiencies, and only an informal recycling system exists. The waste collected has a low energy value (3,350-4,200 $kJkg^{(-1)}$) with high moisture and inert content. A 700 $td^{(-1)}$ compost plant set up in 2000 has not been functioning effectively since 2003. Open dumping (without liners and without a leachate management facility) and the threat of groundwater pollution, as well as saturation of an existing landfill site (Dhapa) are the most pressing problems for the city today. KMC spends 70-75% of its total expenditures on collection of solid waste, 25-30% on transportation, and less than 5% on final disposal arrangements. The Kolkata Environmental Improvement Project, funded by the Asian Development Bank, is seen as only a partial solution to the problem. A detailed plan should emphasize segregation at the source, investment in disposal arrangements (including the use of liners and leachate collection), and an optimized transport arrangement, among improvements.

Waste Management 2009, 29(4): 1449-58

India Waste to Energy

The problems caused by solid and liquid wastes can be significantly mitigated through the adoption of environment-friendly waste-to-energy technologies that will allow treatment and processing of wastes before their disposal. These measures would reduce the quantity of wastes, generate a substantial quantity of energy from them, and greatly reduce pollution of water and air.

Potential for recovery of energy from urban wastes by state

State/Union Territory	Liquid Wastes	Solid Wastes	Total
Andra Pradesh	16.	107.0	123.0
Assam	2.0	6.0	8.0
Bihar	6.0	67.0	73.0
Chandigarh	1.0	5.0	6.0
Chhattisgarh	2.0	22.0	24.0
Delhi	20.0	111.0	131.0
Gujarat	14.0	98.0	112.0
Haryana	6.0	18.0	24.0
Himachal Pradesh	0.5	1.0	1.5
Jharkhand	2.0	8.0	10.0
Karnataka	26.0	125.0	151.0
Kerala	4.0	32.0	36.0
Madhya Pradesh	10.0	68.0	78.0
Maharastra	37.0	250.0	287.0
Manipur	0.5	1.5	2.0
Meghalaya	0.5	1.5	2.0
Mizoram	0.5	1.0	1.5
Orissa	3.0	19.0	22.0
Pondicherry	0.5	2.0	2.5
Punjab	6.0	39.0	45.0
Rajasthan	9.0	53.0	62.0
Tamil Nadu	14.0	137.0	151.0
Tripura	0.5	1.0	1.5
Uttar Pradesh	22.0	154.0	176.0
Uttaranchal	1.0	4.0	5.0
West Bengal	22.0	126.0	148.0
Total	226.0	1457.0	1683.0

http://www.eai.in/ref/ae/wte/wte.html

Projects based on Urban Waste

Name	Location	Installed Capacity
6-MW MSW-based power project	Hyderabad	6-MW
6-MW MSW-based power project	Vijayawada	6-MW
5-MW MSW-based power project	Lucknow	5-MW

DID YOU KNOW ?

- About 0.1 million tonnes of municipal solid waste is generated in India. That is approximately 36.5 million tonnes annually.
- Waste collection efficiency in Indian cities ranges from 50% to 90%.
- Only 5% of the collected municipal waste is composted.
- According to the Organization for Economic Cooperation and Development, Indian municipal waste is expected to increase 130 percent between 2001 and 2030, primarily due to urbanization and new prosperity.
- Solid waste in India has low calorific value, between 700 to 1000 Kcal/Kg.

CURRENT CONCERNS

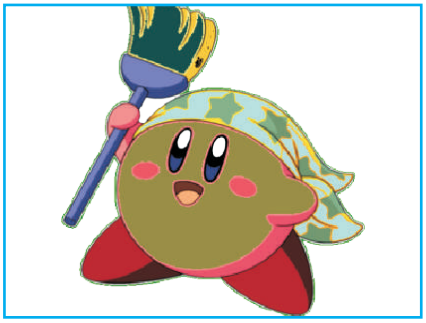
Municipality's major function is to keep the city clean by collecting, transporting, and disposing off solid waste at landfills. In cities there are such areas also where municipality does not function in waste collection usually where low-income communities reside. They dump their garbage at the nearest vacant space, public space, creek, river or simply burn it in their backyards. Uncollected waste can accumulate on the streets and clog drains when it rains, which might cause flooding. Waste can also be carried away by run-off water to rivers, lakes, and seas, affecting the ecosystems. Open dumping of solid waste generates various environmental and health hazards. The decomposition of organic materials produces methane, which can cause fire and explosions, and contributes to global warming. The biological and chemical processes that occur in open dumps produce strong leachates, which pollute surface- and groundwater.

REGULATORY TRENDS

Municipal Solid Waste (Management & Handling) Rules, 2000 were notified by the Ministry of Environment and Forests, Govt. of India. The objective of these Rules is to make every municipal authority responsible for the implementation of various provisions of the Rules within its territorial area and also to develop an effective infrastructure for collection, storage, segregation, transportation, processing and disposal of Municipal Solid Wastes (MSW).

ON THE LIGHTER SIDE

In a chemistry test at Midpark High School in Middleburg Heights, Ohio, one question asked was how to clean the floor after a chemical-powder spill. In detail, A student described the liquid he would combine with the powder in order to dissolve it with chemical bonding and electron transfer. He was pleased with his grasp of molecular structure until the exam papers were handed back. The teacher asked another student to read her answer. She suggested a broom and a dustpan to sweep up the spill -- and got full credit.



ON THE WEB

http://www.epa.gov/osw/nonhaz/municipal/index.htm
This link provides information on landfills, waste combustors, transfer stations, source reduction, recycling & composting.

http://www.nswai.com
National Solid Waste Association of India (NSWAI) is a leading professional non-profit organization in the field of solid waste management including toxic and hazardous waste and also biomedical waste in India.

http://www.wasteconcern.org
Provides information on waste recycling, environmental improvement, renewable energy and sustainable development.

www.elsevier.com/locate/wasman
Waste Management is an international journal devoted to the presentation and discussion of information on the generation, prevention, characterization, monitoring, treatment, handling, reuse and ultimate residual disposition of solid wastes, both in industrialized and in economically developing countries.

CONFERENCES

Waste management 2010: Fifth international conference on waste management and the environment
12 to 14 July 2010 Tallinn, Estonia
Website: http://www.wessex.ac.uk/10conferences/waste-management-2010.html

Microbes in wastewater & waste treatment, bioremediation and energy production
24 to 27 January 2011 Goa, India
Website:
http://www.bitsgoa.ac.in/mwt2011

Food packaging and waste - innovation, anaerobic digestion and nanotechnology
29 June 2010 London, United Kingdom
Website:
http://www.westminsterforumprojects.co.uk/forums/event.php?eid=78

2nd International conference and exhibition on waste to wealth & 6th international conference on combustion, incineration / pyrolysis and emission control
26 to 29 July 2010 Kuala Lumpur,

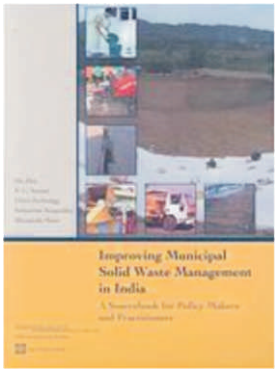
BOOK STOP

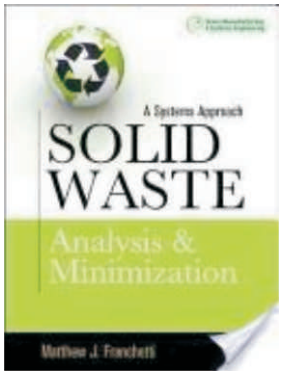
Improving municipal solid waste management in India: A sourcebook for policymakers and practitioners
Authors: Da Zhu, P. U. Asnani & Chris Zurbrugg
Publisher: World Bank Publications, 2008
ISBN:0821373617, 9780821373613

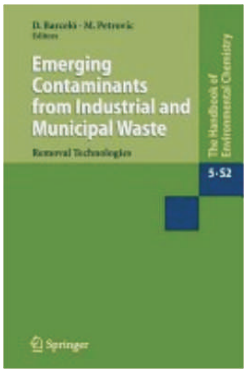
Solid waste: New research
Authors: Adrian Martin & Javier D. Suarez
Publisher: Nova Science Pub Inc, 2008 ISBN: 1604568097

Solid waste analysis and minimization: A systems approach
Author: Matthew J. Franchetti
Publisher: McGraw Hill Professional, 2009
ISBN: 007160524X, 9780071605243

Emerging contaminants from industrial and municipal waste: Removal technologies
Authors: Damià Barceló & Mira Petrovic
Publisher: Springer, 2008
ISBN: 3540792090, 9783540792093







MINI PROFILE OF METHANE

SYNONYMS: Methyl hydride, biogas; fire-damp; marsh-gas; methyl-hydride & R-50 (refrigerant).
CAS RN: 74-82-8

MOLECULAR FORMULA: CH_4

MOLECULAR WEIGHT: 16.04

PROPERTIES: Colorless gas, weak odour, tasteless, bp: -161.4 °C, critical temperature: -82.25°C; critical pressure: 45.8 atm, vapour density: 0.554 (air=1), vapour pressure: $4.66X10^{+5}$ mm Hg at 25 °C, soluble in benzene, methanol, toluene & slightly soluble in acetone.

ANALYTICAL METHOD:

Headspace gas chromatography

USES: In the production of methanol, constituent of illuminating and cooking gas, in manufacture of hydrogen, hydrogen cyanide, ammonia, acetylene, formaldehyde, in organic synthesis. Chemical intermediate (excluding fuel use); constituent of natural gas (about 85% methane); halogenated methanes, carbon disulfide, sodium hydrosulfide, carbon black. Source of petrochemicals by conversion to hydrogen and carbon monoxide, by

MOLECULAR STRUCTURE

steam cracking or partial oxidation. In the form of natural gas, methane is used as a fuel, as a source of carbon black, and as the starting material for manufacture of synthetic proteins.

OCCUPATIONAL SAFETY PARAMETERS:
Permissible Exposure Limit: Simple asphyxiant. Limiting factor is the available oxygen which shall be at least 18%.
Threshold Limit Value (TLV): +8 hr Time Weighted Average (TWA): 1000 ppm.
Excursion Limit Recommendation: Excursions in worker exposure levels may exceed three times the TLV-TWA for no more than a total of 30 minutes during a work day, and under no circumstances should they exceed 5 times the TLV-TWA, provided that the TLV-TWA is not exceeded.
METABOLISM: Methane is absorbed through the lungs in mammals. When inhaled, majority of the absorbed dose is exhaled unchanged. A small amount of methane is converted to methanol and ultimately to carbon dioxide. Uptake in humans is less rapid than in the rat.
TOXICITY DATA: Inhalation-mouse LC_{50}: 326 gm/m^3/2H
PERSONAL PROTECTION: Wear appropriate gloves, face mask & breathing apparatus.

HANDLING AND STORAGE: Compressed gases may be stored in the open only if they are adequately protected from the weather and direct sunlight. Storage areas should be located at a safe distance from occupied premises and neighboring dwellings.

Route	Symptoms	First Aid	Target Organ
Inhalation	Rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgement, depression of all sensations, emotional instability, fatigue, nausea, vomiting, prostration, and loss of consciousness eventually leading to convulsions, coma and death.	Remove victims from the contaminated area. If breathing has stopped administer artificial resuscitation and supplemental oxygen.	Respiratory system
Contact	**None anticipated as it is a gas at room temperature.**		

MAY WE
HELP YOU

To keep abreast with the effects of chemicals on environment and health, the ENVIS Centre of Indian Institute of Toxicology Research, deals with:

Maintenance of toxicology information database on chemicals

Information collection, collation and dissemination

Toxic chemical related query response service

Preparation of monograph on specified chemicals of current concern

Publishing Abstract of Current Literature in Toxicology

for further details do write to

Scientist In-Charge

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