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Municipal Solid Waste Management: A Case Study of Phursungi Plant, Pune

***Mane A. V. and Parveen Anjum**

Department of Environmental Sciences, Fergusson College, Pune

***Corresponding author: ashishmane145@yahoo.co.in**

Abstract:
Solid-waste management is a major challenge in urban areas throughout the world. Solid waste management is associated with controlling the generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accordance with the best principles of sustainability. It includes all administrative, financial, legal, planning and engineering functions involved in the solutions. The present case study is based on one of such solid waste treatment plants located at Phursungi, Pune. The plant is using multi-product recycling and waste minimization (MPRWM) techniques. The principle of the process is to extract usable, commercially viable end products out of the municipal solid waste (MSW) and create a processed remnant of less than 20% of the input volume, for the landfills. The people are demanding to shift the plant elsewhere to maintain healthy conditions in the area. It is now well understood that the plant have already completed its waste dumping potential and the rapid growing housing patterns surrounding to it making the problems more complex. Many experts have already recommended the shifting of garbage dump site to some other area. We suggest that an integrated solid waste management with sustainable approach is the final way necessary for waste management. Waste should not be treated as a waste, it should be considered as a resource as it is able to sustain part of living needs. We also urge for strict legislative efforts and effective implementation by active participation of people. Active involvement of public and private agencies is vital for the safe and meaningful management of solid wastes.

Keyword: Municipal solid waste, management, treatment, conservation, sustainable approach, legal efforts

1.0 Introduction:
Solid waste management is a major challenge in urban areas throughout the world. The problem of solid waste management (SWM) in India, in combination with rapid urbanization, population growth and unplanned development is worsening day by day. Solid waste management (SWM) is the most urgent need and one of major challenges of the present times. According to United Nations Development Programme survey of 151 mayors of cities from around the world, the second most serious problem that city dwellers face (after unemployment) is insufficient solid waste disposal (UNDP, 1998). Without an effective and efficient solid waste management program, the waste generated can result in health hazards with negative impact on environment. The serious situation in future may arise due to the toxicity of ecosystems and unavailability of dumping grounds to treat and manage such wastes generated in huge quantities due to population pressure. Solid waste management is associated with controlling the generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accordance with the best principles of sustainability. It includes all administrative, financial, legal, planning and engineering functions involved in the solutions. The growing volume of solid waste generated by communities is a concern for public health officials as well as for environmentalist. Pune city is a known for its scenic beauty, rich natural resources as well as several educational institutes. However, this cultural, aesthetic and knowledge base has also created dump just outside of the city area by depositing lakhs of metric tons of garbage, out of which 900-1,200 tons comes every day. Solid waste results from various sources including animal wastes, hazardous

wastes, industrial, medical wastes, food wastes, mineral wastes etc. Urban solid waste includes domestic wastes, street sweeping, construction and demolition debris, sanitation residues, trade and industrial refuse and biomedical solid waste (CPCB, 2000). The burial of non-biodegradable end products which are difficult to treat has lead to the conversion of huge chunks of fertile lands into non-usable, poisonous landfills. Ultimately this leads to soil pollution, groundwater contamination and formation of highly toxic leachate.

The daily per capita generation of municipal solid waste in India ranges from about 100 g in small towns to 500 g in large towns. The solid waste generated in Indian cities has increased from 6 million tons in 1947 to 48 million tons in 1997 and is expected to increase to 300 million tons per annum by 2047 (CPCB, 2000). The municipal solid waste amount is expected to increase significantly in near future as the country strives to attain an industrialized nation status by the year 2020 (Sharma and Shah, 2005; CPCB, 2004). Solid waste pollution occurs when the ecosystem functioning is hampered by an over load in the carrying capacity of the natural environment due to the sheer bulk and complexity of waste (Contreras et al. 2008; Da Zhu et al. 2008). The management of solid wastes is going through a critical phase, due to unavailability of suitable facilities to treat and dispose of the larger amount of wastes generated. Landfilling of municipal solid waste (MSW) is a common waste management practice and one of the cheapest methods for organized waste management in many parts of the world (Jhamnani et al., 2009, Longe and Balogun, 2010). More than 91% of MSW collected is still landfilled or dumped on open lands and dumps (Department of Economic Affairs, India), affecting public health, deteriorating quality of life and causing environmental pollution. Currently, the implementation and practice of sanitary landfilling are severely constrained in economically developing countries (like India) by the lack of reliable information specific to these countries (United Nations Environment Programme). It is found that landfills causes serious health and environmental risks in the form of externalities like formation of leachate and landfill gas leading to water and air pollution and disamenity effects like increased population of pests, flies, vermin, and visual impacts (Lee and Jones-Lee 1993, CPCB 2000). The alkaline nature of the solid waste is responsible for the increase in soil pH (Goswami et al 2008).

India is the second largest country in world, with a population of 1.21 billion, accounting for 18% of world's population. Due to increase in population, industrialization, urbanization and growth, a significant increase in MSW generation has been seen especially since last two decades. SWM in India is becoming inherent problem of the communities as the current SWM practices are inefficient to do the needful practices and strict implementation of the legal measures. This process requires heavy expenditure and affects public health and environment. Rapid urbanization and industrial diversification has led to generation of hazardous waste. The per capita generation of solid wastes has also increased tremendously in recent days mainly due to huge resource consumption and waste generating life style. In general, per capita generation rate of MSW in India ranges from 0.2 to 0.5 kg/day (CPCB, 2004). Population is rapidly consuming the once vast supply of natural capital, especially the resources of deep and rich agricultural soils, natural sources of groundwater, and biodiversity (Nancy Kanbar, 1999). There has been a significant increase in generation of solid wastes in India over the last few decades and reason is largely associated with population growth. The huge number of public and private organizations have emerged that have been working to collect, dispose and treat wastes generated in country at various places and also seeks to have huge investment and good expected returns. There is much need to apply 3 R's approach in order to cause minimum resource consumption and reduction in the dumping grounds with the help of latest technologies. The messages have to be made clear and conveyed to all about the wastes being full of wealthy resources. Empowerment of the poor and employment generation are also the major demands in developing countries like India and these can be fulfilled by the newly emerging waste treatment organizations.

Pune city is known on the world map because of its scenic beauty and rich natural resources as well as its educational institutions. "Phursungi - Uruli Devachi" area is one of the most beautiful areas on Pune's boundary where hundreds (about 900-1200 tons) tons of solid waste are dumped every day. All of this has accumulated in the past 20 years creating huge amounts of garbage. This humungous amount of garbage includes degradable waste, plastic as well as dead animals (www.**pune**garbage.org). The present case study is based on such one of the largest and solid waste treatment plants located at Phursungi-Urali, Pune and also the recent issues that are associated with the overall handling with the solid wastes generated in the city. Efforts are made to put views of the company, civic bodies and also of the people living nearby the dump site.

2.0 Study Area and Methodology:

Pune is the eighth largest metropolis in India and the second largest in the state of Maharashtra. It is situated 560 metres (1,837 feet) above sea level on the Deccan plateau at the right bank of the Mutha river (Nalawade S. B.). As per the 2011 Census of India estimate, the population of the Pune urban agglomeration is to peg around 5,049,968 (Census of India 2011). It is still developing and expanding by lips and bound and by 2025 it is expected to go upto 65 lakhs. Pune is one of the premier industrial centers of India (www.punediary.com). The city of Pune is managed by the Pune Municipal Corporation (PMC). The city of Pune is a historical city and well known for its educational importance. Today the city is also an IT Hub. The information mentioned in the present article is collected by the personal visit. The website of company and other information as secondary data was collected through the opinions and other articles available online. Some observations were also made by repetitive visits to the dump site.

3.0 Current Practices in Management of MSW:

Over 4 lakh households in Pune (of a total 10 lakh households) have their daily wastes collected by SWaCH, a co-operative of thousands of waste-pickers in the city. SWaCH, formed in 2007, was a culmination of over 14 years of work by the KKPKP (Kagad Kach Patra Kashtakari Panchayat), a waste pickers' union established in 1993. The PMC authorized SWaCH to collect waste daily in 2008 and since then SWaCH employees, mainly comprising female former waste pickers and other urban poor have been collecting waste door-to-door and transporting it to decentralized waste management facilities provided by and paid for by the PMC. A nominal user fee of Rs. 10 to 30 per month is charged from each household (ww.transparentchennai.com). A report by German scholars Judith Wolf and Fabian Schroth on 'Tracing back the choice: Implementation of primary collection of municipal solid waste in two Indian cities' states that the Pune model is more sustainable in comparison with Varanasi model of solid waste management. The two examined the implementation of primary collection models as per the MSW Rules 2000. They consider the Pune model as more sustainable as it integrates the waste pickers and socially marginalized people. Knowledge base, awareness and supportive local conditions have played important role in management of solid wastes in Pune. They concluded that a formal collaboration with the SWaCH since 2007 have also played important role in proper collection, resource recovery, scraps trade and waste processing (http://articles.timesofindia.indiatimes.com). PMC is playing a positive role in door-to-door collection of waste by deploying vehicular fleet where cycle rickshaws, Ghanta trucks and separate system for collection hotel waste with the help of trucks. Due to augmented doorstep collection services, PMC could achieve in making container free areas by reducing more than 300 containers of 3;8 cu.mt, capacity and similar number of compact buckets (Gidde et al., 2008). For waste collection and transportation, PMC has set up different ramps at strategic locations in the Pune city. The solid waste from each collection point is brought to these ramps, by dumper placers or other transportation equipments. Before sending entire waste to disposal site at Devachi Urali, the entire waste is sent to transfer stations for weighing and a computerized record is maintained (Gidde et al., 2008).

Fig.1: Elements of SWaCH Model behind Successive Implementation of SWM

All these features have played a positive role in Pune for better implementation of solid waste management with few challenges and problems. The new and changing political establishments have proven an obstacle to the expansion of SWaCH's activities to serving the rest of Pune (www.transparentchennai.com).

4.0 Hanjer Biotech Energies Private Limited:

Hanjer biotech energies private limited is an Indian group having various processing units across the country out of which one is solid waste management. The company processes the waste to produce recycled products like bio-compost, sand, green fuel, plastic and is also involved in the operations to reduce wastage for landfill. The company is engaged in these activities since last ten years and is also working under varied climatic and weather conditions to handle mixed and residual wastes. The company has shown successful implementation of technology for waste management and green product development from the wastes. Less generation for land filling is one of the major aims of the company. It generates ecofriendly recycled products and less than 20% of the entire waste goes for land filling. Overall with a capacity of 9,100 tones per day, Hanjer has 24 operational facilities in India with ISO 9001:2008, ISO 14001:2004 and OSHAS 18001:2007 certifications which clearly indicates that the company is running standard processes as per guidelines of International Organization of Standardization. Presently the company works with 15 municipalities in India (Pune, Surat, Faridabad, Agra, Nagpur, Salem, Vadodara, Durgapur, Mira Bhayandar, Virar Vashi, Rajkot, Gwalior, Bhavnagar, Junagarh and Jalgaon). Hanjer's 24 operating plants in India operate at a total installed processing capacity of 4 million tones per year. Six more projects in 4 cities with an additional 1 million ton processing capacity are in implementation stage. It is among few first companies in India which can be credited as the pioneer to turn wastes into green products. Overall the company runs business of preservation, maintenance and improvement in the environment in real sense with the principle of sustainable development. The company also claims to propagate the green lifestyle and encourages the society to choose sustainable and low waste generating life style. The 'Green Heart' as one of the symbols in Hanjer's initiatives is to reach out to the community and inspire them to choose a green way of life. As per the policy and objectives associated with solid waste management, the Hanjer's green heart symbolizes hope, future, change and action. The company's key operational features are based on the technology which is capable of handling mixed municipal solid wastes, completely covered plants without odor generation and treatment to the leachate to reduce the further contamination of the groundwater.

5.0 Technology and Process:

As per the policy, the company is committed to develop green technology and processes that will develop the ideal and standards in the field of recycling and recovery from the waste. The company wants to develop these technologies for the clean and green cities and treatment of wastes by using the best possible means. Hanjer has well in advance the local acts based on the global visions. The company also runs some of its projects in sensitive and problematic issues where citizens are educated about the things happening in their surrounding. Hanjer also organizes the awareness programs and meeting with its stakeholders, civic authorities and the community where projects run. The company is trying to give best possible support to the people in order to solve waste generation and associated problems. Minimal damage to the environment, due to pollution is also an important aspect that always remained at the top of company's agenda.

Among all the projects, Hanjer Biotech, Pune is the largest, with 1,378 tones of MSW per day in India. Hanjer's facility at Rajkot has been projected as 'Model Project' by JNNURM. Similarly the Mira Rd-Bhayendar plant has been described as the most modern plant of its nature in Maharashtra, by an expert committee appointed by the Chief Minister. Hanjer has also got technology sharing and understanding with leading institutions such as NEERI, Thermax, French agency Proparco, African Development Bank and DEG of Germany. Hanjer's cheaper business and the environment friendly approach have widely accepted and are favored by smaller municipal corporations also. The municipal solid wastes are delivered to the allotted Hanjer treatment facility in each city, in addition wastes let over by the rag pickers is also picked up by the Hanjger units. The increasing population and the urbanization along with changing life styles has generating huge amount of wastes and without segregation such may pose a great challenge for the proper treatment. The company has taken the task to treat with the formal aim to produce the green products especially which can be reused in construction, power generation, fuel generation and the compost for the plant growth. Hanjer provides a complete recycling solution to keep the environment clean. The eco-innovation technology followed by Hanjer makes them one of the true international achievers. Hanjer Biotech also received the prestigious 'International Achievers Award', for Business Excellence in 2011. Thus, company has taken a challenge to treat the waste and produce the green products especially which can be reused for power generation, fuel, fertilizers and compost for growing plants.

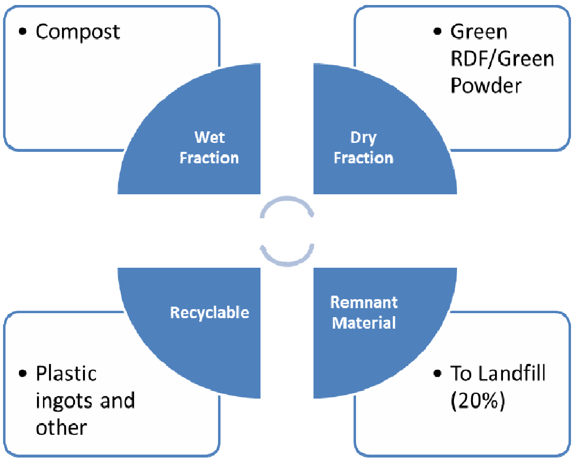

Fig.2: Solid Waste Management and Processing at Phursungi

The task of solid waste treatment at Phursungi-Urali is given to Hanjer Biotech Pvt Ltd, a company which aims to cause minimum impact on the environment by following 3 'R' approach and also helping the community and cities to give better results. It is scientifically proved and well established that the best practices for waste management can be achieved by well known '3 Rs' principle. These '3 Rs' are the foundation of most waste minimization strategies. There is urgent need of public awareness and contribution by all the citizens on these aspects. 1) Reduce: The most uncontrollable phase in solid waste management is 'waste generation'. It is always advisable that to reduce the generation of solid waste at source. 2) Reuse: Reutilization value of any item should be well known and should be identified. In this connection NGO's and private sector can play a crucial role in educating the people about the benefits related to it. 3) Recycle: The process of transforming materials into secondary resources for manufacturing new products is known as recycling and ultimately saves energy a lot.

This is all done by better technology selection, trained man-power, public awareness, strengthening institutional mechanism, enforcement of law provision and participation of stakeholders and forms the platform in the field of waste management of various types. The plant is working under the standard practices mainly include reduction in consumption of land, scientific landfill of the inert residue, reduction in air pollution and odor's, reduction in health problems and protection of water resources by making secondary useful ecofriendly products which are biodegradable and reduces methane emissions. The technology used in the present plant is capable of handling mixed municipal solid wastes. As the company claims, the whole processing plant is completely covered, odorless and the formed leachate is fully treated.

5.1 Compost Preparation: The company is producing organic fertilizer made under controlled conditions with the help of fruit peels, remains of vegetables, food and by-products of agro process industry. The compost is used at the time of drilling or broadcast sowing or also be applied along the rows or encircling the plant. The color of mature and well digested compost produced is black to dark brown and is a free coarse powder having earthy smell. The moisture content of the produced compost is in the range of 20 to 25 % and the organic matter also lies in the similar range. The compost is having alkaline pH and all the useful macro nutrients as per standard levels.

5.2 Green Fuel Preparation: Dry municipal solid waste is dried, crushed, screened and packed into brick form and used as solid fuel source as a substitute to conventional fossils fuels. It can be specially used in boilers. The fuel thus prepared is having 15 to 20 % of moisture and 0.27 % of sulphur with high amount of volatile matter as recorded as 53 %. The bricks are prepared in size of 8"/15" and the calorific value of this solid fuel is also high and ranges form 2250 to 3500 Kcal. The company also claims that the particulate matter and the concentration of sulfur dioxide and oxides of nitrogen are also in range of the acceptable limits.

5.3 Recycled Plastic: The plastic after separation from the mixed waste is sorted into various grades by using infra rays and then converted into granules, as this is a completely dry process, it does not cause any contamination of the environment. This plastic helps in reducing demand for fresh plastic and is used to manufacture bags, plastic pipes, ropes and various types of moulds.

5.4 The Residual Sand: The waste coming from municipal solid waste is treated further to extract sand. Remnants of the sand can be used to supplement dredged sand for construction. Thus, the solid waste management is well understood and incorporated by this plant based on concept of three R's i.e. recycle, reuse and reduce approach. This is in fact very necessary to have positive impact on costs, environment and the community.

6.0 Current Issues:

Nowadays, huge chunk of land is used for the burial of non-biodegradable end products obtained after the treatment which cannot be treated further. This led to soil pollution and formation of highly hazardous complex leachates making groundwater prone to pollution. In general, the interactions between groundwater resources and solid waste leachates are quite complex and have received the attentions of many researchers worldwide (Suresh and Kottureshwara, 2009; Karunakaran et al., 2009; Akudo et al., 2010; Rajkumar et al., 2010; Umadevi et al., 2010) have been conducted across different parts of the world and revealed a high prevalence of groundwater pollution, due largely to migration of leachates from SWD sites.

The municipality is dumping solid wastes more than twenty years. It is noted that the plant has completed its dumping capacity. Overall about 30% of the collected garbage remains untreated. Over 3,000 metric tones garbage remained, dumped (not lifted) in the city owing to the agitation by Phursungi-Urali villagers (http://timesofindia.indiatimes.com, Dec. 22, 2011). There are increasing issues in the city since last few years related with overflowing of bins, increased number of rodents, ticks, flies and mosquitoes in many localities and is very common in the nearby areas of Hanjer plant. To resolve this issue, either the processes at the plant should be altered, shifted or the village should be shifted. Currently due to complex nature of SWM and other issues, no option is possible to implement in easier way. The Pune Municipal Corporation (PMC) is able to process only 70% of the city's garbage, while the remaining 30% remains untreated due inadequate staff, vehicles and failure of door to door collection system in addition to this shortage of electricity problems, machinery breakdown, maintenance cost and other local issues are increasing the intensity of he problem (ESR, 2012). Pune Municipal Corporation (PMC) is planning to set up a leachate treatment plant (http://timesofindia.indiatimes.com, Dec. 22, 2011) in order to treat the leachate formed mainly in rainy season due to already dumped and untreated solid wastes.

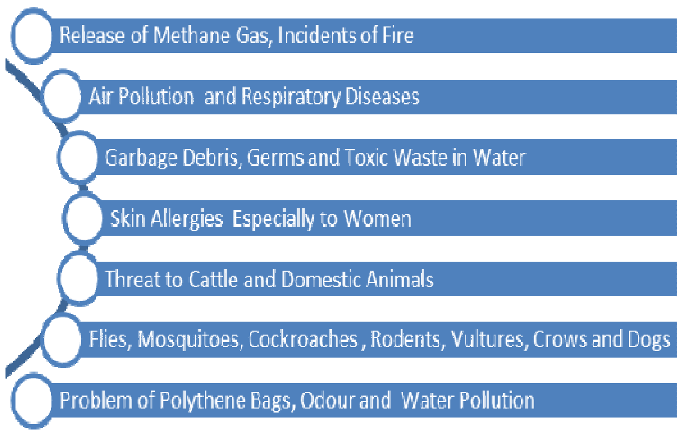

Fig.3: Current Issues Associated Solid Waste Management and Processing at Phursungi

As per the study conducted by NGO named Nagrik Chetana Manch, the PMC does not follow the mandated procedure for handling and managing garbage and overall there is absence of systematic management of municipal solid wastes (www.nagrikchetna.com). The study also revealed that there are inherent defects in site selection and design of the Hanjer plant at Uruli Devachi-Phursungi causing the odor at neighboring villages and contamination of ground water at large especially severe in rainy season. A sample test of the organic manure manufactured by the Hanjer plant showed presence of high levels of mercury above the acceptable level, which is harmful to plants and even to those who will consume the manure used crops due to bioaccumulation. The metal is also neurotoxic as well as carcinogenic and is one of highly hazardous metals (Askarain et al., 2004; Remy, 2001). Metal induced toxicity is very well reported in the literature (Leonard et al. 2004). The PMC had decided to build a treatment plant after the Maharashtra Pollution Control Board (MPCB) had issued a show-cause notice the civic body for releasing thousands of liters of highly toxic leachate into an open ground at Phursungi where in doing so, it had violated the Water (Prevention and Control of Pollution) Act 1974. There are many cases of odor and the other problems faced by the people who reside near plant area due to huge dumps and accumulation of the wastes. It is also always pointed out by various organizations and experts that the location of plant is inappropriate because the windrow (where the wet garbage is kept for about 45 days for drying and for culturing) is in the direction of the west-east winds, which covers the Phursungi village. As the Hanjer plant is capable of processing mixed garbage, the PMC neither has any compulsion nor has provided any incentive to ensure garbage segregation at source, which is mandatory as per the MSW (Handling and Management) Rules, 2000.

Overall it can also be said that the capacity of the plant could be increased by a quarter if only the treatment of wet garbage is carried out in the plant. This is possible only if PMC is 100% abide by the rules and the segregation of the garbage at source. Municipality has insufficient manpower and shortage of garbage collecting vehicles. As of now the civic body has 4,000 sweepers who work in the 14 ward offices. With the city's area now encompassing 243.96 sq km, the workforce is insufficient. Very recently as per the protest against civic body's poor management of municipal solid waste, villagers from Phursungi-Urali have also tried to block garbage containers from entering in their village. The villagers allege that the operator has been openly dumping garbage at garbage depot with complete disregard to environmental norms. The company is claiming to use treated leachate but again it may cause contamination of the groundwater due to seepage when reused for some other purposes as some contaminants may remain in the recycled leachate water. In general it is seen throughout the country that the garbage generation increases during the festival seasons. Very recently the agitators from the Phursungi-Urali had decided to go on a 'maun-vrat' (vow of silence). Even nowadays, the residents of Urali-Phursungi area are not willing to become a part of the city as they feel it will add to their problems and issues are increasing day by day. At present there are less chances of ban on dumping and shifting of the treatment plant even if the village becomes part of PMC.

7.0 Solutions by Company and PMC:

The company is trying best to reduce land, soil and groundwater pollution in the village area to the best possible extent and helping to save land from being wasted. The bio-organic fertilizer is made by accelerated bioconversion process using remains of biodegradable wastes like fruits peels, vegetables, food and by-products of agro process industry. The plastic after being segregated from mixed MSW is sorted into various grades using infra-red beams and then converted to ingots/granules. Such recycled ingots or granules reduce the requirement of fresh plastic and are used in manufacturing of trash bags, agricultural pipes, moldings, ropes etc. Overall the material being sent to the landfills is also not more than 20%. Remnants of the sand can be used to supplement dredged sand for construction. It is now well understood that the solid waste management should be well understood based on the concept of three R's approach i.e. recycle, reuse and reduce. This is in fact very necessary to have positive impact on costs, environment and the community where the plant is working. In order to solve the problems faced by people there is need to reduce air pollution. Special health checkup units for workers and nearby people at nominal cost should be promoted by Municipal Corporation. Heavy taxes should also be laden by the municipalities on the groups that produce larger amount of wastes. There is also need to form newer products like composts and recycled ones which are ecofriendly and long lasting. The methane gas formation technologies should also be used by maximum extent to generate energy and use for various purposes.

Municipality collects the garbage from over three lakhs families including the commercial sources. The PMC has started a process to ensure that the leachate does not percolate and mix with ground water. The municipality claims that the leachate problem is only during the monsoon. Almost half of the open dumps have been under capping process to avoid future problems. Municipality authorities claim to give top priority to waste management and hope to complete majority of the capping and related work at Urali Devachi by the end of March 2013. The total area of the twin landfill sites at Phursungi and Urali Devachi is 165 acres of which the Hanjer processing plant occupies 65 acres. Eleven acres were capped a few years ago and 50 to 55 acres of garbage-filled land remains to be scientifically capped. Capping prevents groundwater contamination (Rumer and Ryan, 1995). As cleared by the municipality authorities out of total 1,400-1,500 tones garbage collected in the city daily and roughly 15% of it forms the mixed garbage. The NGO SWaCH model lays emphasis on people's participation, inclusion and sustainability working towards waste management and energy conversion (www.swachcoop.com). The SWach is also engaged in door to door collection of segregated wastes. The NGO also views for not having private treatment managers and not in favor to waste crores of rupees on commercialization of the waste management practices (www.swachcoop.com). Other organizations should also come up with similar intentions.

A quick perusal of the various public private partnership practices in waste management in India display two approaches namely technology driven and community based ways of waste management. The approach of public private partnerships (ppps) at very first is concerned with profit generation and making the cities and municipalities completely dependent on them for managing the huge quantity of wastes generated. The management of the Hanjer Biotech claims that the garbage processing site gets treated on day to day basis and there is problem of old garbage dumping site from where the leachate freely flows outside without being treated and the leachate formed in treatment plant is treated on daily basis with a capacity of over 40,000 liters of leachate per day. Municipality also claims that there are no much high levels of heavy metals and remain firm to estimate such findings by using more scientific methods as compared to those followed by private/NGO members. However the claims made by company and PMC are doubtful/questionable as the problems are increasing day by day. Hanjer Biotech claims to produce green fuel even though there are many drawbacks mainly health hazards and environmental impact caused by use of Refuse Derived Fuel (RDF). The company claims that the plant at Urali Devachi is, in fact, producing green fuel, which is less polluting (June 11, 2009, Times of India). Very recently the PMC had set deadlines for Hanjer to increase its processing capacity to 500 tones even though there are many issues currently faced by the plant managers, civic authorities and the people who reside nearby the plant.

8.0 Key Requirements in SWM:

Solid waste management includes all administrative, financial, legal, planning and engineering functions involved in the whole spectrum of solutions to problems of solid wastes (Tchobanaglous, et al., 1997). In India about 40-80% of plastic waste is recycled compared to 10-15% in the developed nations of the world. However, the recovery rate of paper was 14% of the total paper consumption in 1991, while the global recovery rate was higher at 37% (Pappu et al., 2007). Sorting and recycling at generation source initiated at various places are encouraging activity (Ziadat and Henry 2005). However, this is mainly done for valuable materials. Most recycling in low-income countries is by informal sectors for livelihood and import of material for recycling. However, in high-income countries, recycling technology is intensive and organized for long-term market interest (Lavee, 2007). It is scientifically proved and well established that the best practices for waste management can be achieved by well-known ‘3 Rs’ principle. These ‘3 Rs’ are the foundation of most waste minimization strategies. There is urgent need of public awareness and contribution by all the citizens on these aspects. 1) Reduce: The most uncontrollable phase in solid waste management is ‘waste generation’. It is always advisable that to reduce the generation of solid waste at source. 2) Reuse: Reutilization value of any item should be well known and should be identified well. In this connection NGO’s and private sector can play a crucial role. 3) Recycle: The process of transforming materials into secondary resources for manufacturing new products is known as recycling and ultimately saves energy a lot. Better technology selection, trained man-power, public awareness, strengthening institutional mechanism, enforcement of law provision and participation of all stakeholders are the key elements in solid waste management of various types. Waste-to-Energy combustion (WTE) can also be the other option which a process of controlled combustion, using an enclosed device to thermally breakdown combustible solid waste to an ash residue that contains little or no combustible material and that produces, electricity, steam or other energy as a result (Bureau of Land & Waste Management, 1999). It is known that as much as 95% of a product’s environmental impact occurs before its discarded (World Bank, 1999), most of it during its manufacturing and extraction of virgin raw materials. Capacity building is enabling the stakeholders with awareness, skill, education and research to tackle any crisis in the target area (World Bank, 1999). Thus, recycling is pivotal in reducing the overall life cycle impacts of a material on environment and public health.

Fig.4: Key Requirements in Solid Waste Management

Overall it seems that the laws related with solid waste management in India talk about treatment, handling and other scientific techniques but whether implemented successfully or not is a big question and matter of discussion. On the other hand the picture is also clear that very few laws deal with the monitoring mechanisms on performance evaluation of the government authorities and concerned agencies. Integrated solid waste management provides a framework and ideal guidelines for the treatment of wastes where sustainable waste management practices are followed. The PMC must include the ideal aspects of ISWM. There is need to provide proper funds initially for the treatment of wastes and generate the funds by following the practice of 'wealth from wastes' in order to reduce economic burden on the society. To handle the overall matters of solid wastes the respective pollution control boards and the local agencies must come up with the stringent implementation of the existing laws and the rules therein. 'Polluter pays principle' for the waste generators is one of the best options but should be strictly monitored as may lead to malpractice due to soft provisions mentioned in the laws. Entire SWM scenario requires immediate attention of the governments, civic organizations to stop the environmental problems as increasingly seen in Pune. Support to informal sector workers is also the much needed task in this regard. Proper support should also be given to the NGO's and other organizations that can play a crucial role in implementation of the legal measures.

9.0 Conclusions:

The company is trying best as per the capacity in order to reduce land, soil and groundwater pollution nearby Phursungi but the efforts are not sufficient in order to minimize the impact of the groundwater and other problems faced by the people nearby treating unit. Overall the material being sent to the landfills is not more than 20%. The solid waste management should be well understood based on concept of three R's i.e. recycle, reuse and reduce approach. It is well understood and incorporated by this plant. But still there are many issues faced by the environment and people living in the surrounding of the plant and the reasons could be associated with the extra burden of the waste dumping, mismanagement, unscientific management and the ignorance for the implementation civic bodies for the municipality of Pune. It is always seen that the ideal things are best dealt on paper but actual implementation and field conditions differs widely. The issues must be solved as early as possible to reduce the intensity of complex issues which are worsening due to increasing population and increasing generation of the wastes. This is in fact very necessary to have positive impact on costs, environment and the community.

In order to solve the problems faced by people living around the solid waste management units, there is need to reduce air pollution generated in the form of odor and dust and need to form special health checkup units for workers and nearby people at nominal cost. Heavy taxes should be laden by the municipalities on the groups that produce larger wastes. There is also need to form newer products like composts and recycled ones which are ecofriendly and long lasting. The methane gas formation technologies should also be used by maximum extent to generate energy and use for various purposes. The Plant faces problem in storage and treatment of the waste in rainy days and local people suffer bad odor due to the continue decaying stags of garbage dumps. It is now well understood that the plant have already completed its waste dumping potential and the rapid growing housing patterns surrounding to it making the problem more complex. We suggest implementing an integrated solid waste management in sustainable approach as the final way necessary for waste management strategy needs. The government should take an initiative to improve or modify the solid waste management system or shifting in new area and create a better monitoring system. Waste should not be treated as a waste for it is able to sustain part of living needs. We also urge for strict legislative efforts and effective implementation by active participation of community, public and private agencies is vital for the safe management of solid wastes. Overall the problems faced by the community at large should be settled by the government and all other interested parties in peaceful ways to eradicate the long lasting issues before they turn into the devastating situation.

References:

1) Akudo, E. O., Ozulu, G.O. and Osogbue, L.C. (2010): Quality Assessment of Groundwater in Selected Waste Dumpsites Areas in Warri, Nigeria. Environmental Research Journal, 4(4): 282-285.
2) Askarian, M., Vakili, M., Kabir, G., (2004): Hospital Waste Management Status in University Hospitals of the Fars Province, Iran. Int. J. Environ. Health Res. 14, 295–305.
3) Bureau of Land & Waste Management, Division of Mining & Solid Waste Management. Regulation 67-107.12, SWM: Solid Waste Incineration and Solid Waste Pyrolysis Facilities. *South Carolina Department of Health and Environmental Control.*[Online] May 28, 1999.
4) Census of India 2011 "Urban Agglomerations/Cities having population 1 lakh and above". Census of India 2011. The Registrar General & Census Commissioner, India. Retrieved 3 January 2013.
5) Contreras, F., K. Hanaki, T. Aramaki & S. Connors (2008): Application of Analytical Hierarchy Process to Analyze Stakeholder's Preferences for Municipal Solid Waste Management Plans, Boston, USA. Resources, Conservation and Recycling 52: 979-991.
6) CPCB (Central Pollution Control Board) (2000): Status of Solid Waste Generation Collection, Treatment, and Disposal in Class-II Towns." CUPS/50/1999–2000, CPCB, Ministry of Environment and Forests, New Delhi.
7) CPCB (Central Pollution Control Board) (2004): Management of Municipal Solid Waste. Ministry of Environment and Forests, New Delhi, India.
8) CPCB (Central Pollution Control Board) (2004): Management of Municipal Solid Waste. Ministry of Environment and Forests, New Delhi, India.
9) Da Zhu, P., H. Asnani, C. Zurbrugg, S. Anapolsky & S. Mani. (2008): Improving Municipal Solid Waste Management in India, A Source Book for Policy Makers and Practitioners. World Bank, Washington D.C.
10) Department of Economic Affairs, Ministry of Finance, Government of India.Position Paper on the Solid Waste Management Sector in India.*Public Private Parternships in India.*[Online] November 2009.
11) Gidde, M. R., V. V. Todkar and K. K. Kokate (2008): Municipal Solid Waste Management in Emerging Mega Cities: A case study of Pune City. Indo Italian Conference on Green and Clean Environment. March 20-21, MAEER's MIT College of Engineering. (www.bvucoepune.edu.in)
12) Goswami, Utpal and Sharma, H.P (2008): Study of the Impact of Municipal Solid Waste Dumping on Soil Quality in Guwahati City , Pollution Research, Vol.27(2).
13) http://articles.timesofindia.indiatimes.com/2012-06-26/pune/32424425_1_wet-garbage-hanjer-garbage-segregation
14) http://articles.timesofindia.indiatimes.com/2012-08-17/varanasi/33248244_1_pune-model-solid-waste-waste-pickers.

15) http://timesofindia.indiatimes.com, Dec 22, 2011
16) http://www.punediary.com/automobile.html
17) http://www.punegarbage.org/en/home.html
18) http://www.transparentchennai.com/the-way-ahead-experiences-and-experiments-in-solid-waste-management-from-pune-mumbai-and-bangalore/
19) Jhamnani, B. and Singh, S.K. (2009): Groundwater Contamination due to Bhalaswa Landfill Site in New Delhi, Department of Civil and Environmental Engineering, Delhi College of Engineering, Delhi, India, Journal of Environmental Science and Engineering, 1(3), pp 121-125.
20) Lavee, D. (2007): Is municipal solid waste recycling economically efficient? Environmental Management. 40:926-943.
21) Lee, Anne Jones and G. Fred Lee (1993): Ground Water Pollution by Landfills: Leachate Composition, Detection and Water Quality Significance , Sardinia 19931V International Landfill Symposiums. Margherita di Pula, Italy, 11-15.
22) Leonard, S.S., Harris, G.K., Shi, X.L.. (2004): Metal-Induced Oxidative Stress and Signal Transduction. Free Rad Biol Med; 37: 1921-42.
23) Longe, E.O. and Balogun, M.R.(2010): Groundwater Quality Assessment Near A Municipal Landfill, Lagos, Nigeria, Department of Civil and Environmental Engineering, University of Lagos, Nigeria, Research Journal of Applied Sciences, Engineering and Technology, 2(1), pp 39-44.
24) Nalawade, S.B. www.ranwa.org/punealive/pageog.htm "Geogra phy of Pune Urban Area".
25) Nancy Kanbar (2003): An Environmental Economic Approach to Assess the Sustainability of Managing a Protected Area in Lebanon , George Mason University, Beirut.
26) Pappu, A., Saxena, M. and Asokar, S.R. (2007): Solid Waste Generation in India and their Recycling Potential in Building Materials. Journal of Building and Environment. 42(6), 2311-2324.
27) Remy, L. (2001): Managing Hospital Waste is a Big Nasty Deal, Great Western Pacific Costal Post
28) Rumer, R.R. and Ryan, M.E. (1995): Barrier Containment Technologies for Environmental Remediation Applications, John Wiley & Sons, New York.
29) Sharma, S. and Shah, K.W. (2005): Generation and Disposal of Solid Waste in Hoshangabad. In: Book of Proceedings of the Second International Congress of Chemistry and Environment, Indore, India, pp. 749-751.
30) Suresh, T. and Kottureshwara, N.M. (2009): Assessment of groundwater quality of borewells water of hospet taluka region, karnataka, India. Rasayan J. Chem, (1): 221-233.
31) Tchobanaglous, G. Theisen, H. and Eliass-en, R. (1997): Solid wastes: Engineering Principles and Management Issues, McGraw-Hill publications, NewYork, USA. pp. 52
32) Umadevi, A.G. et al. (2010): An Investigation of the Quality of Underground Water at Eloor in Ernakulum District of Kerala, India. E-Journal of Chemistry, 7(3), 908-914.
33) Karunakaran, K., Thamilarasu, P. and Sharmila, R. (2009): Statistical Study on Physicochemical Characteristics of Groundwater in and around Namakkal, Tamilnadu, India. E-Journal of Chemistry, 6(3).
34) UNDP (United Nations Development Programme)-World Bank Water and Sanitation Program-South Asia. 1998. “Lessons for Improving Service Delivery: Learnings from Privateand Nonformal Sectors in Solid Waste Management.” UNDP-World Bank Waterand Sanitation Program-South Asia, New Delhi, India.
35) United Nations Environment Programme. Solid Waste Management.*Division of Technology, Industry and Economics, United Nations Environment Programme.*[Online].
36) World Bank, Urban Development Sector Unit, East Asia and Pacific Region,.What a Waste: Solid Waste Management in Asia. *Environmental Strategies for Cities, Massachusetts Institute of Technology.*[Online] 1999.
37) www.hanjer.com
38) www.nagrikchetna.com
39) www.swachcoop.com
40) Ziadat, A. H. & Henry M. (2005): Assessing Solid Waste Recycling Opportunities for Closed Campuses. Management of Environmental Quality 16: 250-256.