Practical experience with MBT in emerging nations – Example Brazil –

Christiane Dias Pereira

Faber Serviço Ltda., São Sebastião, Brazil

Abstract

Wilhelm Faber GmbH is part of the Faber Group and has operated successfully in the market for many years. By applying our expertise and know-how, we plan, build and operate technical plants and projects. We are especially concerned with the protection of natural resources and the environment.

One problem in our consumer society requires a particularly urgent solution: The environmentally sound treatment of the waste masses.

Uncontrolled or inadequately treated waste endangers the health of the population and the environment. A great part of the waste we produce cannot be commercially reused and ecologically recycled. This waste endangers our natural resources such as the soul, the ground water and the atmosphere. Against the background of these problems and a growing environmental awareness, well-ordered waste management with an adapted, environmentally-suited waste disposal solution at reasonable cost becomes significant.

Through a thorough pre-treatment of waste the technical requirements for a controlled waste sedimentation are reduced thereby lowering environmental pollution of waste dumps. The mechanical-biological waste treatment of the FABER-AMBRA® process ensures an environmentally friendly, flexible alternative at reasonable cost and with the least technical resources. Due to its great flexibility, the FABER-AMBRA® process can be implemented even in fast-developing nations and third world countries without problems, taking local economical situations into consideration.

Abstract deutsch

Dieser Beitrag ist auch vollständig auf Deutsch im Tagungsband enthalten.

Keywords

Abfallwirtschaft	Waste management
Mechanisch-biologische Abfallbehandlung	Mechanical-biological waste treatment
Internationale Aktivitäten	International activities
Abfallwirtschaftliche Beratung	Advice on waste treatment
Schulung	Training
Konzeptentwicklung	Concept development
Qualitätssicherung	Quality assurance
Überwachung	Controlling
Individuelle Modullösungen	Individual module solutions

1 Introduction

The matter of solid waste in Brazil has been discussed thoroughly by the society because the waste management in an integrated way means to assure correct and safe environmental waste destination.

In Brazil in agreement with the research performed in 2000, are daily collected about 228.413 tons of solid waste, being ca. 125.258 tons household waste. Regarding the generation of household waste we have a national average value of 0,74 kg/hab/day.

Regarding the average waste composition, the organic material is always the largest component.

The evolution of the final destination of household waste in Brazil starting from 1991 up to 2000. Generally, it is noted an improvement of attention given to treatment and final destination, represented by the reduction of the amount of waste deposited on landfills and an increase of controlled and sanitary landfills, besides a small growth of other kind of treatment like material separation for recycling, decomposition of the organic material and incineration of hazardous waste.

In Brazil of the ca. 5.500 existent cities the predominance, 96%, is of small and medium cities that means cities with less than 100.000 habitants.

The big cities present such similar problems as:

- scarceness of areas for final disposal
- conflicts of soil use, with the established population resident at the surroundings of treatment and final disposal areas
- waste transportation and disposal by neighbor cities can generate resistance
- wild and controlled landfills operated in an inadequate way polluting the hydric resources

Besides this, the medium and small cities need to find solutions for the generated waste with few resources.

The municipal authorities are fundamental parts in the integrated administration of the municipal waste. They do not only have the responsibility for implementation of actions related with waste but they also establish the parameters for its development. Their challenge, however, will be to make conscious citizens, technicians and planners on that unavoidable need.

Discussion regarding MBWT implementation takes place because: landfills are an integral part of waste management, landfills are long term problem, amount of waste going to landfills should be reduced and landfills have a complicated aftercare.

In 1999 the firma Faber started in Brazil with a research project in Rio de Janeiro supported by the German Ministry. The aim of the research project was to prove the efficiency of a mechanical-biological process for the treatment of household waste under the climatic and waste characteristics in Brazil. This research project was realized in cooperation with the University of Braunschweig and the Federal University of Rio de Janeiro. With the research project it could be proven that, due to the FABER-AMBRA® process for mechanical-biological waste treatment, the German standards for treated waste disposal can also be kept under Brazilian conditions.

After the successful realization of pilot project the cities of São Sebastião and Blumenau have been changed their operation to the MBWT. There are also operations in Mexico and Thailand.

2 Technical Conception

Mechanical and biological process where the waste is crushed and homogenized and the biological process is aerobic and the windrows are static. The aeration is passive named chimney method where air convection takes place due to temperature gradient formed during biological decomposition and environmental temperature.

The FABER-AMBRA®-process stands out through the availability of its different modules and their wide adaptability to local conditions and waste parameters.

The realization of the concept requires a mechanical-biological waste treatment as the basic module. This treatment step is initially described in the attached references for the Meisenheim plant.

2.1 Basic module description

Valuable or hazardous materials are separated from the delivered waste before the mechanical treatment is initiated. During this mechanical treatment the waste is crushed and homogenized in a closed drum, with the addition of seepage from any dump (for instance from old waste dumps) without incurring further costs, and maintaining an environmentally friendly disposal. The next step is the biological treatment of the waste. During this stage, the biological decomposing organic waste mass is treated as an aerobic-cell (with oxygen) and microbiological process to achieve almost entire waste decomposition.

This stage can be reached by a rotting duration of approx. 6-9 months. Complete decomposition of the biological organic mass is the exact aim. (Any remaining biological decomposing organic mass in the waste causes an uncontrollable anaerobic-cell (without oxygen) and microbiological decomposing process as found in traditional waste dumps). The optional stage is the mechanical treatment II and consists of sieving of material prior to final disposal. After the biological stage the treated material can be landfilling with a special equipment focusing to increase the emplacement density from 1,1 to 1,4 t/m³ .

2.2 Mechanical Treatment

The mechanical treatment is composed of 2 phases, the first where the waste is selected, plastic bags are broken, the waste is moistened and homogenized and the second phase that is alternative where the treated waste is sieved.

Prior to homogenization there takes place the removal of hazardous or voluminous materials, which may damage the drum or the biological process. At this moment is also possible to introduce some selection process of recyclable material.

There are two models of homogenizing drums – the static and the movable one. The evaluation of each operations requirement will determine the model of equipment be used. Such equipments are required at the stage of mechanical treatment I.

Thereafter the drums are supplied with waste issued from the home collection with the help of a loading shovel.

During this mechanical treatment the waste is crushed and homogenized in a closed drum, with the addition of leachate from any dump.

After filling of the drum with waste, homogenization takes place, where all bags are torn and all waste is mixed and moistened into a homogenized mass during 20 to 45 minutes.

The next step is the drum’s unloading and channeling of the material towards biological treatment.

2.3 Biological Treatment

During the phase of biological treatment it is necessary that the area and the windrow’s base are prepared. Then the windrows are built, covered with biofilter and require a stabilization period, which varies from 6 to 9 months, mainly depending on the local climatic conditions.

Before stacking of the homogenized waste on decomposition windrows, preparation of the area (suitability of the ground, declivity and compacting) and mounting of the windrow foundation with wooden pallets and aeration tubes necessary for oxygenation of the waste mass during the biological treatment take place.

Thereafter the waste is disposed on pallets of maximum 2,80 meter high.

The windrow is covered with a layer named biofilter, which can be made of different materials depending on local conditions as will be shown in the next slides. The biofilters function is to maintain the temperature and humidity of the waste mass and to avoid the presence of birds and rodents. The types of cover named as biofilter can be: geotextile for places where the rain intensity is high, triturated stem and branches, and also volcanic soil or cocoanut fiber.

It is necessary to moisten windrows in case the project is implemented in areas where the intensity of rain is low, since aerobic bacteria require water in order to carry out their activities.

Decomposition takes place in a static way and with passive aeration that means, there is no need of revolving the windrows. Decomposition time occurs between 6 to 9 months. The exact determination of the time is related to waste composition involved in the treatment and also to the local climatic conditions.

The optional stage is the mechanical treatment II and consists of sieving of material prior to final disposal. After the stabilization time the option presents itself of sieving the material prior to final disposal. Fractions smaller than 60 mm will be integrated into the process of covering the windrows such as bio filter, and the remaining material will be landfilled in an area prepared in accordance with environmental requirements.

2.4 Emplacement

After the biological stage the treated material can be landfilling with thin layers. Appropriated compacting equipment can be used to increase the emplacement density from 1,1 to 1,4 t/m³ .

2.5 Monitoring

Since the stabilization is biologic it is necessary to implement some control procedures that allow to investigate the stabilization suitability : as temperature measuring, gases, leachate load, solid material and emplacement density.

During aerobic degradation liberation of energy in the form of heat takes place and temperature increases in parallel to the activity of microorganisms, with the possibility of reaching 70ºC.

In order to control the processes of organic decomposition it is possible to use several analytical procedures such as: measuring of oxygen, methane or carbon emissions.

Execution of liquid emission analysis to find out the degree of contamination through its organic load during the biological treatment. With the pre-treatment of waste, a reduction of 90% of the organic load by stabilized material takes place.

Respiration activities and gas potential after the biological treatment are under the German regulation for emplacement of treated waste.

The solid material analyses demonstrate that TOC is under 18 % in conforming with the German regulation and loss of ignition under 30 %.

Analyses after 31 months of emplacement show that the leachate organic load is under 400 by COD, 70 by BOD, 50 by NH3 and 7 by pH value. It means that leachate by landfill with treated waste has very low organic load comparing with non-treated waste landfill.

Trials were carried out to determine the achieved density of emplacement of the treated waste. These trials resulted in densities of 1.1 to 1.4 to/m³ in the landfill.

3 Costs

The specific costs of the waste treatment found out in the pilot projects are in a range of 11 to 15 Euros/t of initial material. However, if the effects of obtained savings related to the landfill were subtracted from the TMB costs, the additional specific costs compared with those related to the non-treated waste landfill, are of some few Euros.

Furthermore a volume reduction and the higher compaction feasibility of the treated waste can prolong the useful live of a landfill.

4 Treatment advantages

Possibility of parallel compost production.

Duplication of landfills duration – the area its much larger and consequently the investment fort its acquisition will also be so. However the area with application of MBT, besides being smaller (smaller investments), will suffer less impact and will not affect the neighbouring owners. Also the utilized area may have multiple uses in the management of waste. Example: Centre of selection and preparation of raw material for recycling, without any contamination risks to workers.

Reduction in emission potential - 90% reduction of methane production and of organic load present in leachate

Improvement of landfill operation by reducing dust emissions, paper flow and odour emission

Minor settlings (favourable for the early installation of a surface cap)

5 Operational difficulties

Need of operation adaptation to local conditions – i.e. which material will be used as biofilter depending on the market possibility and climatic conditions? How large should be the aeration pipes? Or windrow high?, among others.

Comparison with traditional costs at short terms – some clients, unable to identify the aggregate value of the treatment, end up by erroneously comparing the costs of investment of traditional methods with the pre-treatment, taking into account only the short-term panorama. Specific norms to define the parameters of landfill aftercare procedures do not yet exist and consequently the advantage of aftercare costs reductions of the landfill is difficult to calculate.

Guarantee of operational quality by operator – when the operation is outsourced - we verified that some operators, notwithstanding the fact that they were trained by our technical team, ended up by jeopardizing the operations quality. When this occurs, only the holder of the license will have administrative and judicial means to determine a recovery of the quality levels

Area availability for biological treatment - we found in some cases a difficulty to identify appropriated areas for the biological treatment because our process requires for each tone of waste one m² area through our stabilization method. It means that sometimes we may need to work as decentralized biological operation increasing our costs.

Difficulty of operation due to bad weather – for instance at sites to intense rain or prolonged periods of draught, a strategic operational plan must be elaborated to overcome these difficulties. As an example, the need of applying material that hinders total penetration of water.

Inability of obtaining support for environmental questions – some clients find it unnecessary to treat waste prior to final disposal, because waste must be landfilled whether treated or not. Such clients do not consider the fact that with traditional methods decomposition remains active for many years, further to taking place in an uncontrolled way, which results in a height rate of emission with considerable chances of jeopardizing the environment. Treated waste has their decomposition monitored and it has been proven that landfills composed of biostabilized waste offer more environmental safety, also for the neighbouring communities because they present a very low level of biological activity.

Inability to enforce environmental laws – in developing countries, the need of previous waste treatment in a legal manner has not yet been ensured, resulting in some controversial positions. For instance – why should I treat may waste if no law exists to enforce such an initiative? It has also proven difficult to obtain a license for the MBWT for lack of evaluation methods, since treated waste obey to the same technical orientations of operation and disposal as the non-treated ones.

6 Conclusion

The MBWT can be implanted successfully in development or semi-industrialized countries.

The importance of MBWT will grow up as risks and costs related to the treatment of leachate and the need to reduce the methane emission is growing up.

The treatment not only causes costs but also contributes to the cost saving at the final waste disposal.

The technologies need to be adapted to the local realities.

Besides all these factors, it also is a fact that the area occupied by a conventional landfill can never be recovered for aluses and besides will require monitoring for another 20 years at elevated costs and will continue creating contamination factors. Therefore the investments or the recovery of areas utilized by MBT are small in view of the impact suffered.

As an approach to the treatment and its differentiation, benefiting the environment and the neighbouring community, we cannot ignore the cost, but it is not a primary strategic goal but rather the feeling of social and environmental responsibility.

7 Literatur

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Author's address:

Dipl.-Ing. Christiane Dias Pereira
c/o Wolfgang Toenges
Wilhelm Faber GmbH
Galgenwiesenweg 23 – 29
D – 55232 Alzey
Phone +49 6731 492 117
Email: c.pereira@faber-ambra.com
w.toenges@faber-gruppe.com
Websites: www.faber-gruppe.de
www.faber-ambra.de