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Biodegradation of hazardous biological infectious wastes from hospitals by using a thermal composting process

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Background

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HBIW

- 15%
- Biodegradable

Background

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In México: 1,111 hospitals:

- General hospitals: 920 (83%)
- Specialty hospitals: 191 (17%)

Generation of hazardous biological infectious wastes (HBIW):

- 200 ton/day
- 180 kg/hospital/day

Treatment:

- Incineration: 75 % (150 ton/day)
- Disposal without control in landfills: 25% (50 ton/day)

Background: incineration

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Merits:

- Most common practice in Mexico and developing countries
- Waste reduction: 90% in volume, 75% in weight

Weakness:

- High costs of installation, maintenance, and emissions control
- Inefficient process may generates dioxins and furans
- Hazardous biological infectious biodegradable wastes (HBIBW) from hospitals: 70 – 80% water

Thermal Composting Process (TCP)

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- Aerobic process
- Temperature: 50 – 60°C
- Moisture content: 50 – 60%
- No bad odors

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Methods

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Efficacy evaluation of TCP:

- Two pilot systems installed: private hospital and public hospital
- Operation and monitoring of the systems: 8 months
- Biodegradation of HBIW (pathological: placenta): simple respirometry tests in extracts of compost (Lasaridi and Stentiford, 1998)

Inactivation/elimination of pathogens (NOM-004-SEMARNAT-2002, Mexican biosolid standard):

- Salmonella spp: standards for the use or disposal of sewage sludge. Final Rules. 40 CFR parts 257, 403 and 503. EPA, 1993
- Fecal coliforms
- Helminthes eggs: Mexican standard (NMX-AA-113-SCFI/1999)

Results: Efficacy of TCP

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Installation of pilot systems

Private Hospital

Public Hospital

Results: Efficacy of TCP

Operation and monitoring

Operation of private hospital:

- From March 15 – December 9, 2011
- HBIW (pathological) degradation: 351.58 kg

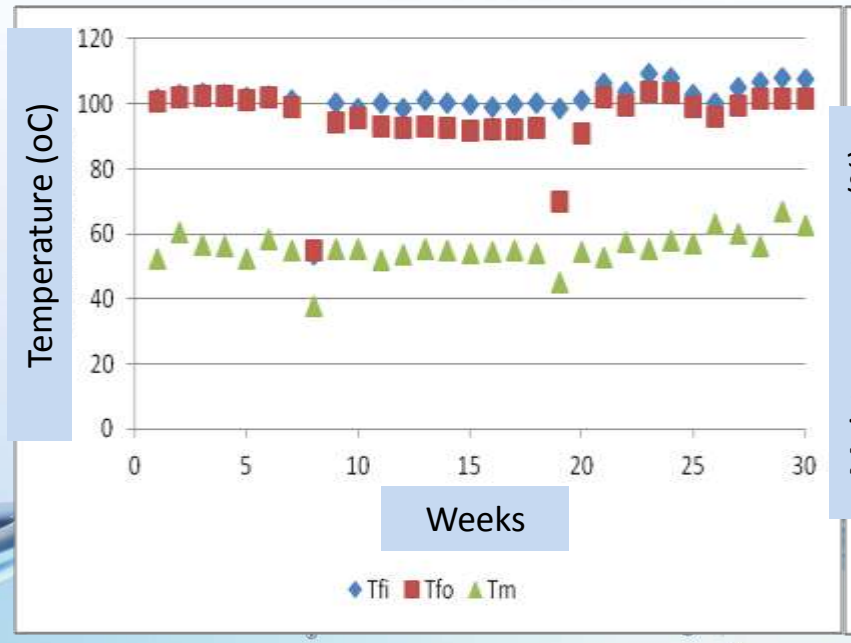
Results: Efficacy of TCP

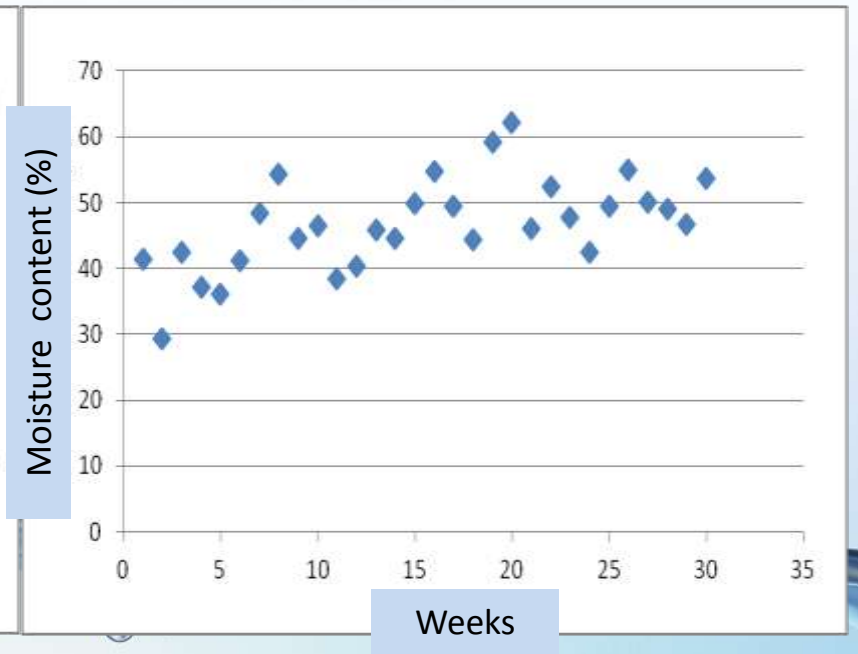
Operation and monitoring

Operation of private hospital:

- From March 15 – December 9, 2011
- HBIW (pathological) degradation: 351.58 kg

Monitoring:



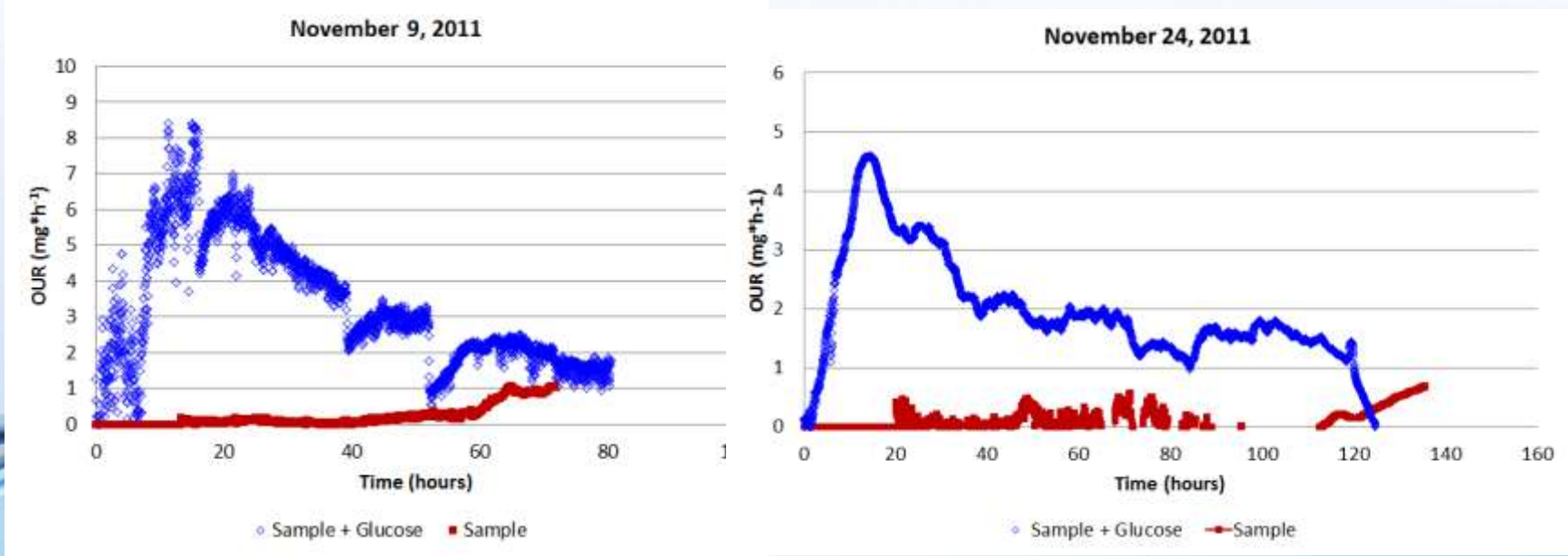


Results: Efficacy of TCP

Biodegradation of HBIW (pathological)

Respirometry tests:

- Compost sample (Dissolved organic matter) + Glucose (200 mg)
- Compost sample (Dissolved organic matter)



Results: Inactivation/elimination of pathogens

Date	Parameter		
	Fecal coliforms (MPN/g), < 1000	Salmonella spp (In 25 g), < 3	Helminthes eggs (Eggs/10g) , < 1
18/April/2011	< 3	Absent	0
02/May/2011	< 3	Absent	0
04/May/2011	< 3	Absent	0
11/May/2011	23	Absent	0
18/May/2011	< 3	Absent	0
24/May/2011	< 3	Absent	0
31/May/2011	< 3	Absent	0
15/Jun/2011	< 3	Absent	0

*Maximum permissible limits NOM-004-SEMARNAT-2002 (Class A)

Conclusions

- Pilot TCP was continuously operated from March 15 to December 9, 2011. A total of 351.58 kg of placenta was treated. Moisture content of the sawdust matrix was kept at 50% in average and the matrix temperature ranged from 50 to 60oC. These conditions were propitious for the biological degradation process, accordingly to the results reported by Lopez Zavala et al. (2005, 2004)

- Results of respirometry tests indicated that organic matter of HBIW (pathological) are completely stabilized during a period of 12 h, approximately, because not oxygen consumption was detected during respirometry tests

Conclusions

- Compost generated during the degradation process of HBIW (pathological) is not toxic for biomass activity. This was verified by adding glucose to the extracts and observing that oxygen consumption occurred.

- Microbiological analysis indicated that compost is free of Salmonella ssp and helminthes eggs because analysis resulted negative. In case of fecal coliforms, they were present in concentrations smaller than 3 as MPN/g. These results denoted that compost is a biosolid Class A (Excellent) that can be reused as a fertilizer or soil conditioner.





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Thank you

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