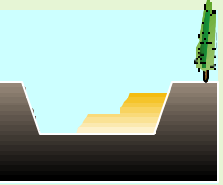

Assessment of the evolution of waste biodegradability with time and operation conditions

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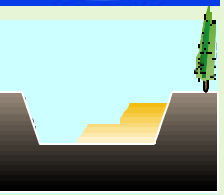


Assessment of the evolution of waste biodegradability with time and operation conditions

1. Objectives

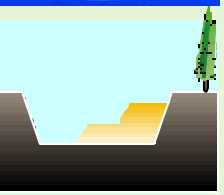
2. Ways of assessing the biodegradation degree

3. Assessing the biodegradation degree with anaerobic tests

4. Waste sampling and analytical results

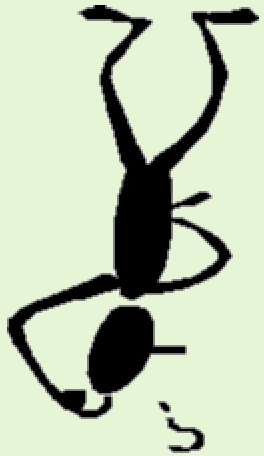
5. How to interpret the obtained results ? kinetics tests

6. Conclusion

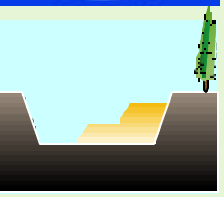

Assessing the biodegradation degree
STAKES AND ISSUES

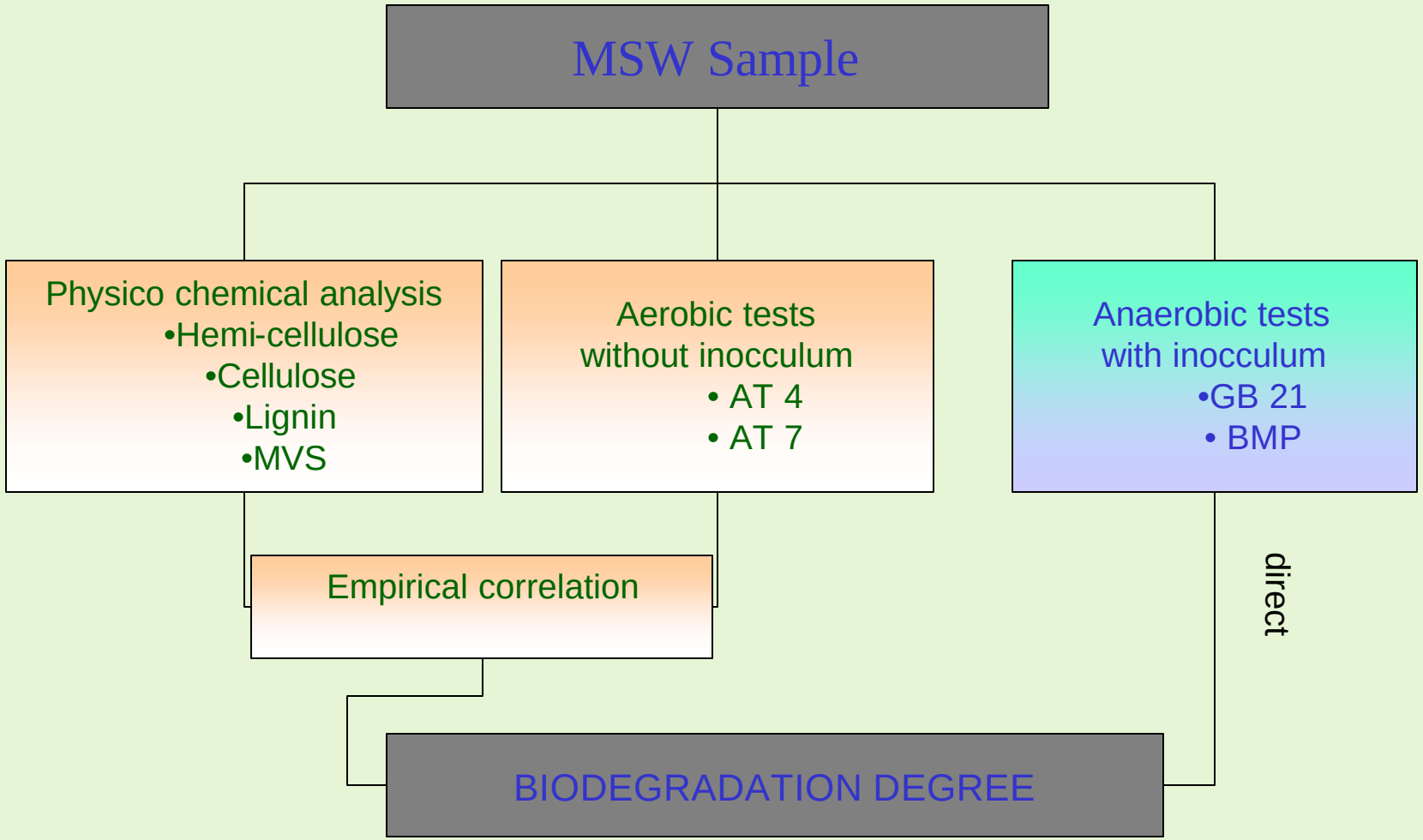
- Assess the potential for landfill gas production
- Assess the efficiency of the different way of treating organic matter
- Assess the duration of the aftercare period

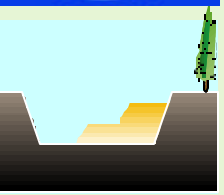


Assessing the biodegradation degree

Several approaches

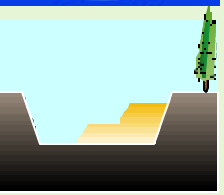




Assessing the biodegradation degree
Applicability of the different approaches

	BIOCHEMICAL ANALYSIS		PHYSICO CHEMICAL ANALYSIS
	Anaerobic	Aerobic	
Duration	-/+	+	+
Reliability	- (need to be duplicated)	+	- (interference)
Representativeness	+	-	- -

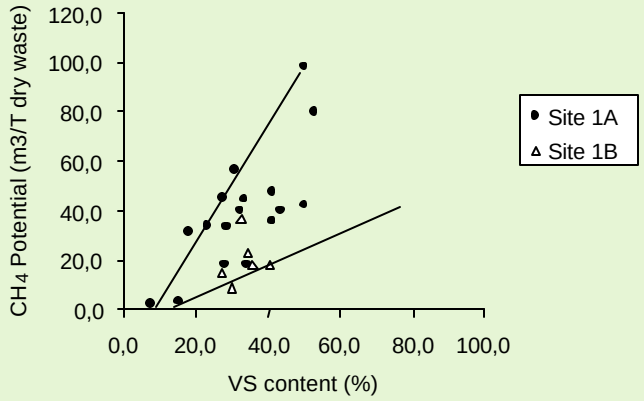
⇒ R&D study on the anaerobic tests

⇒ Evaluation of the aerobic tests in progress

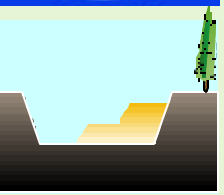




Assessing the biodegradation degree
Applicability of the different approaches

- Measure of the lignin/hemi cellulose/cellulose content : could be influence by the presence of inerts and soils
- Interpretation of the lignin analytical results ⌫ use of the Chandler equation to estimate the biodegradation degree reliable if [lignin] < 20%
- Qualitative relationship between CH_4 potential and VS content

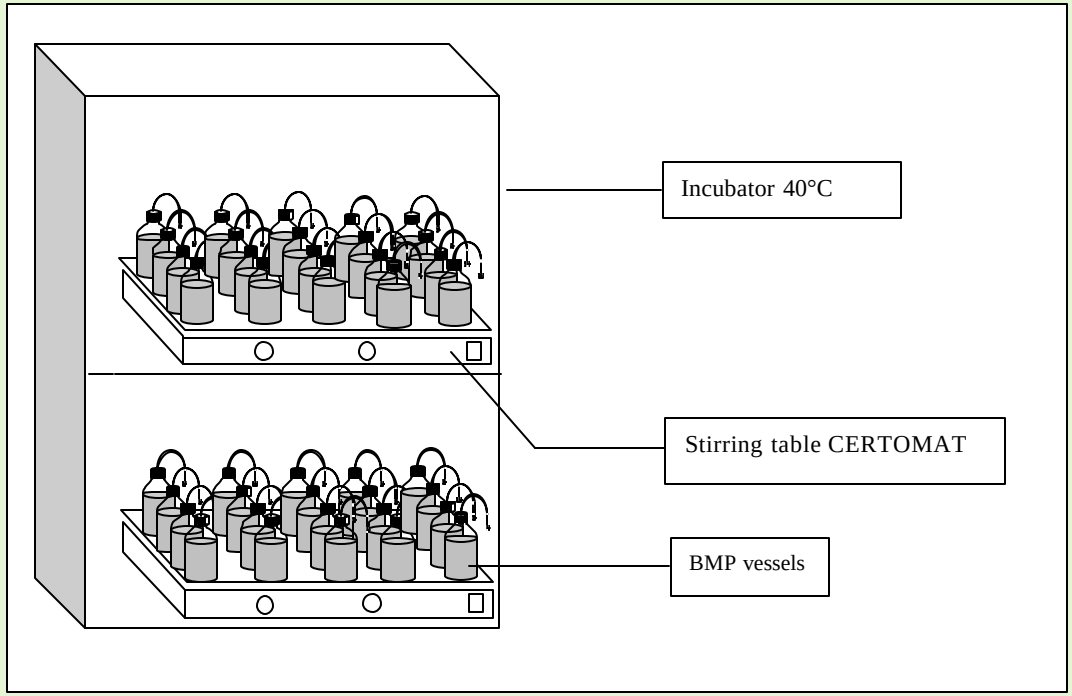


Assessing the biodegradation degree
R&D Programme

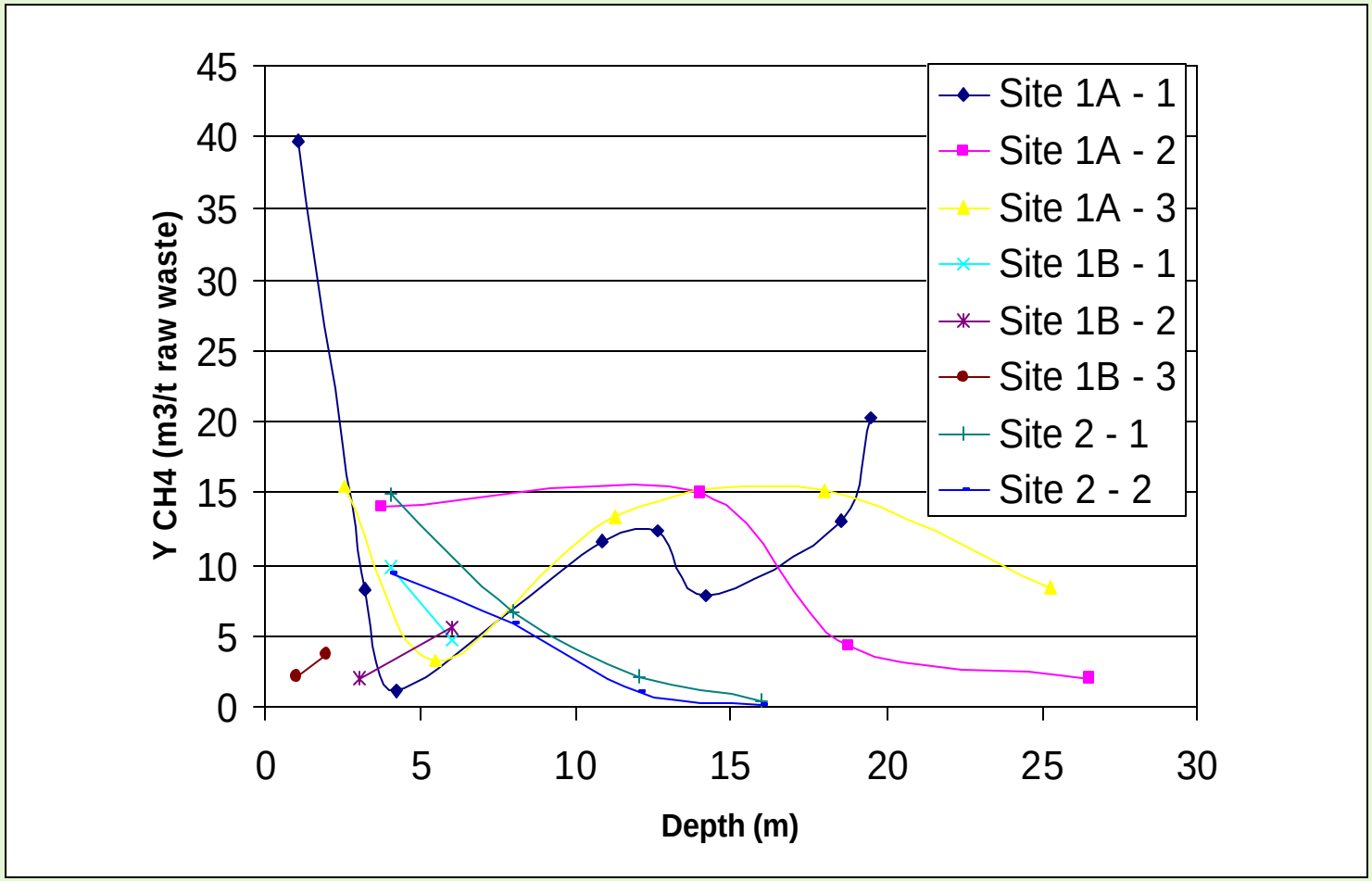

SITE	Mean thickness (m)	Age (yrs)	Treatment	Nb of boreholes	Nb of samples	Tests
1A, Italy	30	0-5	Leachate recirculation	3	17	BMP, lignin, cellulose, hemicellulose, water content, MSV,
1B, Italy	12	1-4	-	3	6	BMP, water content, MSV,
2, U.K.	20	3-11	-	2	8	BMP, lignin, cellulose, hemicellulose, water content, MSV,

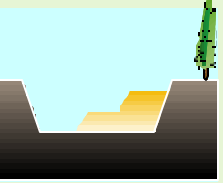
Assessing the biodegradation degree
Analytical protocol used for BMP tests



Assessing the biodegradation degree

BMP results

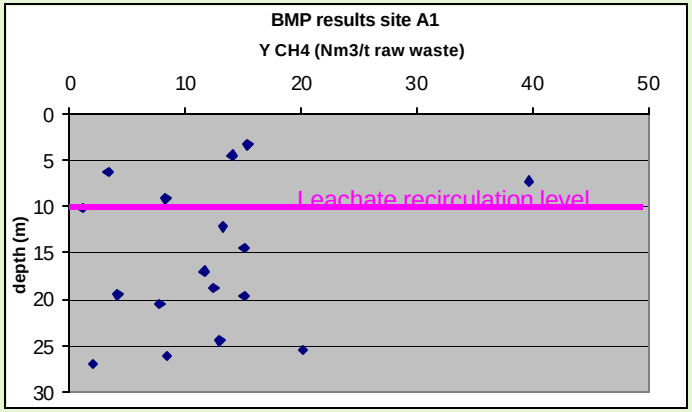


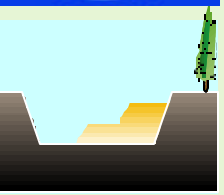

Assessing the biodegradation degree
BMP results

Laboratory results	Fresh MSW (Aguilar, 2000 Barlaz, 1997)	Pre treated residual waste (Binner, 1999)
in Nm^3 CH_4 /t raw waste		
5 - 14	50 - 60	1 - 2

- No real correlation between waste age (between 1 and 5 yrs) and BMP results



- No real impact of 2 years of leachate recirculation on the BMP results


Assessing the biodegradation degree

Evaluation of the biodegradation kinetics

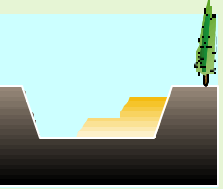
- Parameters measured in situ during the drillings : T°, Water content, density
- Raw waste sample put in a vessel in the “in situ” conditions Measurement of methane production during several months
- Undertaken samples from one of the drillings undertaken at the site 1A

Assessing the biodegradation degree

Results for borehole 2, site 1A, Italy

Depth m	Y_M (m^3CH_4/T ff sec)	Y_M (m^3CH_4/T row waste)	k (y^{-1})	Humidity ff (%)
3-4,5	47,5	14	NA	49
Recirculation level				
13,5 – 14,5	36	15	16,42	58
18 –19,5	34	4,2	0,16-0,33	36
26 - 27	3,3	1,7	0,5-0,7	41

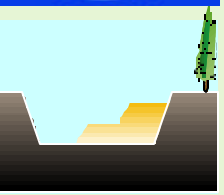
Waste thickness


Assessing the biodegradation degree
Results of the kinetic tests

- Assumption : leachate recirculation affect only 5 m below the recirculation trench
  - Correlation between waste water content and kinetic constants
  - Leachate recirculation could increase the biodegradation kinetic 100 times (from 0.2 yr^{-1} to 16 yr^{-1})
- Synegic information obtained by BMP and Kinetics analyses

BMP value	K value	comment
high	high	Good biodegradation of young waste
high	low	Young waste in not favourable conditions for biodegradation
low	high	Little biodegradable fraction but good conditions for fermentation
low	low	- Waste at the end of biodegradation process - Little biodegradable fraction but fair conditions for fermentation. - Degradation of low biodegradable fraction?


Assessing the biodegradation degree
Conclusions

- Biochemical tests : the most adapted to assess the biodegradation degree of MSW
- Physico chemical tests : easier to use, more rapid BUT
  - could not be correlated (quantitatively) with the results of biochemical tests
- Lignine/cellulose tests : not good parameter for MSW with [lignin] > 20 %
- 5 yrs old is not sufficient to get a significant change in results of BMP tests
- Assessment of the kinetic parameter of waste biodegradation : good to tool to manage waste treatment processes within a landfill

Assessing the biodegradation degree

BMP results