

BIODEGRADABILITY & COMPOSTABILITY:  
WHAT IS THE DIFFERENCE ?  
STANDARDS - IMPACT ON USAGE OF  
BIODEGRADABLE POLYMERS

INNOBIOPLAST 2006

Bangkok, 21-24 September 2006

BRUNO DE WILDE - STEVEN VERSTICHEL  
ORGANIC WASTE SYSTEMS (OWS)  
GENT - BELGIUM

# TOPICS

- \* BIODEGRADABILITY vs COMPOSTABILITY
- \* STANDARDISATION vs CERTIFICATION
- \* OTHER ENVIRONMENTS

# ORGANIC WASTE SYSTEMS (OWS) nv

## 👉 ACTIVITIES/ SERVICES:

- \* DRANCO - SORDISEP TECHNOLOGY
- \* OPERATION OF BIOGASIFICATION PLANTS
- \* WASTE MANAGEMENT CONSULTING
- \* BIODEGRADABILITY - COMPOSTABILITY TESTING

## 👉 HEAD OFFICE

- \* GENT - BELGIUM

## 👉 AFFILIATE

- \* OWS Inc - DAYTON - OHIO - USA

## 👉 PARTNER

- \* DJK International Inc. - TOKYO - JAPAN

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- \* INDEPENDANT (no material or product development)
- \* QUALITY CONTROL : GLP - EN 45000
- \* RECOGNIZED LAB (Din-Certco, BPI, BPS, AIB-Vinçotte,)
- \* ACTIVE IN STANDARDIZATION : CEN - ISO - ASTM
- \* DIN-CERTCO certification committee

# OWS REFERENCES

Brecht 1 (B)	1992	20.000 t/yr biowaste & waste paper
Salzburg (A)	1993	20.000 t/yr biowaste
Bassum (D)	1997	13.500 t/yr grey waste
Aarberg (CH)	1998	11.000 t/yr biowaste
Kaiserslautern (D)	1999	20.000 t/yr grey waste
Villeneuve (CH)	1999	10.000 t/yr biowaste
Brecht 2 (B)	2000	50.000 t/yr biowaste & paper waste
Rome (I)	2003	40.000 t/yr mixed waste
Alicante (E)	2004	30.000 t/yr mixed waste
Leonberg (D)	2004	30.000 t/yr biowaste
Terrassa (E)	2005	25.000 t/yr biowaste
Pusan (S. Korea)	2005	75.000 t/yr biowaste
Pohlsche Heide (D)	2005	38.000 t/yr grey waste & dewatered sludge



## OWS ACTIVE MEMBERSHIP

- **ISO** TC 61/SC 5/WG 22 : Biodegradable Plastics **official Belgian delegate**
- **CEN** TC 261/SC 4/WG 2 : Packaging – Degradability  
TC 249/WG 9 : Biodegradable Plastics **official Belgian delegate**
- **ASTM** D 20.96 Biodegradable Plastics
- **DIN** FNK 103.2 Bioabbaubare Kunststoffe
  
- **DIN CERTCO** Certification Committee Biodegradable Materials
- **EBP** (Europe) European BioPlastics
- **BBP** (Belgium) Belgian BioPackaging
- **BEDPS** (USA) Bio/Environmentally Degradable Polymer Society
- **BCPN** (Netherlands) Belangenvereniging Composteerbare Producten Nederland

# COMPOSTABILITY NORMS

- \* STANDARD SPECIFICATIONS : TESTS AND CRITERIA
- \* EN 13432 : COMPOSTABLE PACKAGING
- \* ASTM D.6400-04 : COMPOSTABLE PLASTICS
- \* ASTM D.6868-03 : PAPER COATING
- \* ISO DIS 17088 : COMPOSTABLE PLASTICS

# COMPONENTS OF COMPOSTABILITY

C  
O  
M  
P  
O  
S  
T  
A  
B  
I  
L  
I  
T  
Y

1) BIODEGRADATION

(Degradation on chemical level)

2) DISINTEGRATION

(Degradation on physical level)

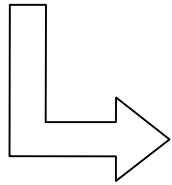
3) COMPOST QUALITY

3a) Material characteristics

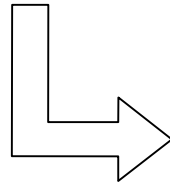
3b) Compost analyses

# BIODEGRADATION = MINERALISATION

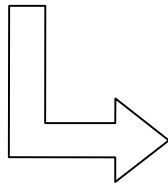
POLYMERS



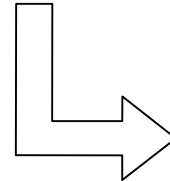
OLIGOMERS



MONOMERS



BIOCHEMICALS (alcohols, acids)



MINERALS ( $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{CH}_4$ )

# EN 13432 : 1) MATERIAL CHARACTERISTICS

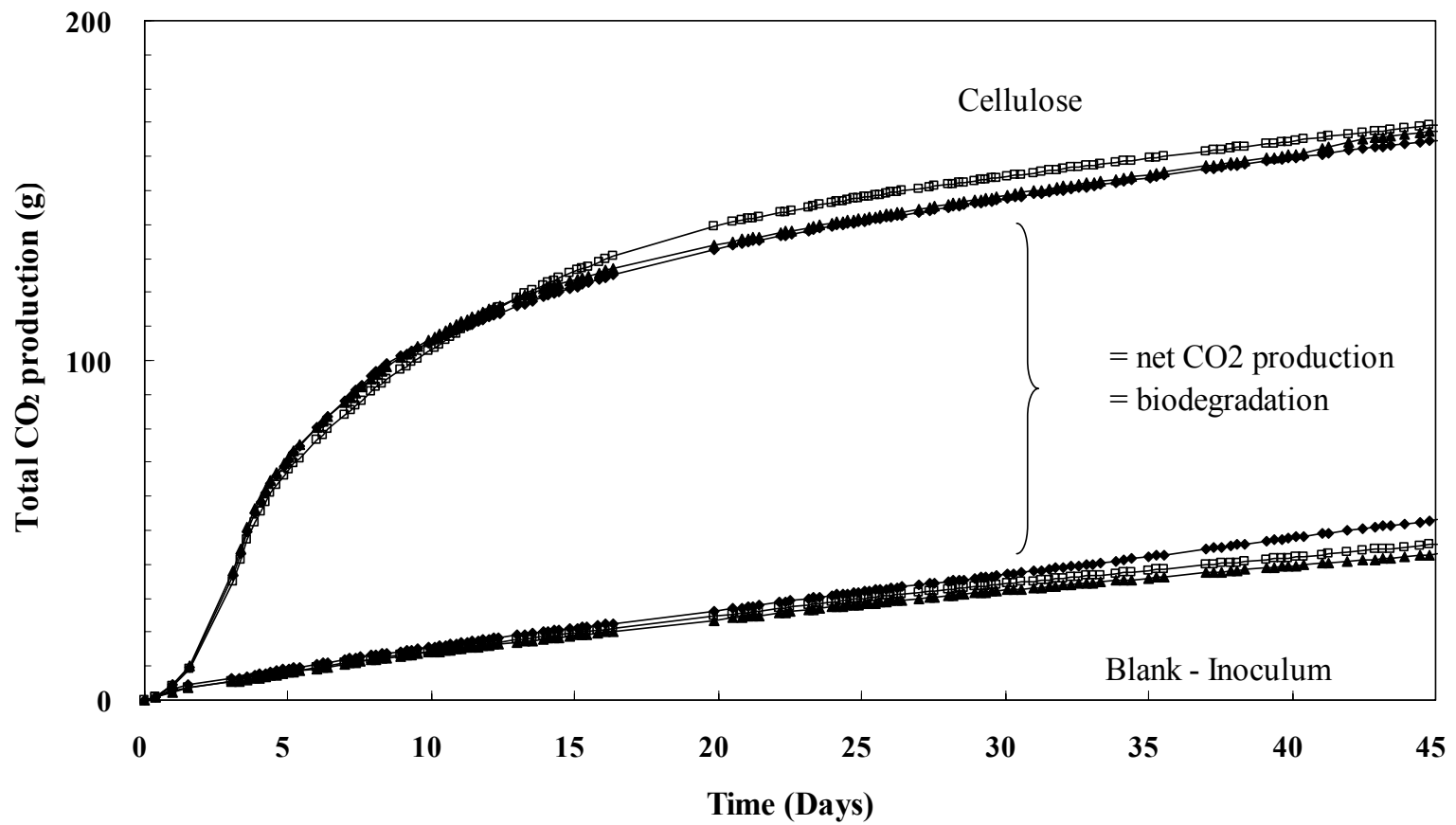
- \* ORGANIC MATERIAL : VS > 50% of TS
- \* HAZARDOUS SUBSTANCES, e.g. HEAVY METALS :  
MAXIMUM 50% OF NORM FOR COMPOST

Zn	150	Cr	50
Cu	50	Mo	1
Ni	25	Se	0.75
Cd	0,5	As	5
Pb	50	F	100
Hg	0.5		

## EN 13432 : 2) BIODEGRADABILITY

- \* TESTS :           PREFERABLY ISO 14855 (CONTROLLED COMPOSTING = ASTM D.5338)  
                          ALSO ISO 14851 (RESPIROMETRIC),  
                          ISO 14852 (STURM) AND OTHER  
                          INTERNATIONAL STANDARD TESTS
- \* DURATION :        MAXIMUM 6 MONTHS
- \* PASS LEVEL :     90% (ABSOLUTE OR RELATIVE TO REFERENCE)

# EN 13432 : 2) BIODEGRADABILITY



## EN 13432 : 2) BIODEGRADABILITY

- \* APPLICABLE TO ALL ORGANIC CONSTITUENTS ABOVE 1%  
( $<1\%$  = IRRELEVANT, TOTAL MUST BE  $<5\%$ )
- \* EXEMPTED : CHEMICALLY UNMODIFIED PACKAGING  
MATERIAL OF NATURAL ORIGIN

## EN 13432 : 3) DISINTEGRATION

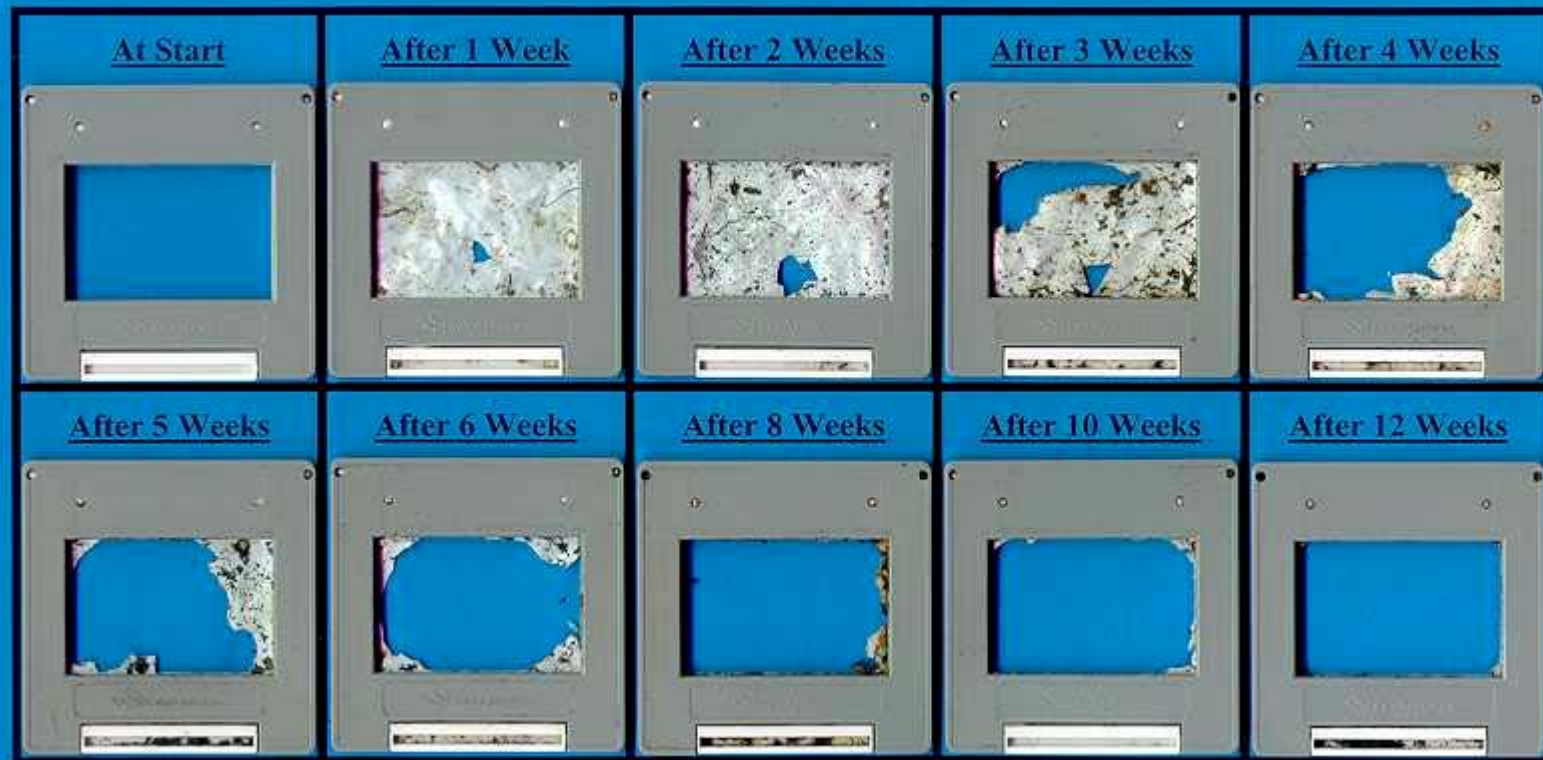
- \* TESTS :                    PREFERABLY PILOT-SCALE COMPOSTING  
                                  ALTERNATIVELY FULL-SCALE COMPOSTING
- \* DURATION :                12 WEEKS
- \* PASS LEVEL :             MAXIMUM OF 10% OF ORIGINAL DRY  
                                  WEIGHT IN >2 MM FRACTION
- \*RESULT :                    MAXIMUM THICKNESS

# EN 14045 - ISO 16929 PILOT-SCALE DISINTEGRATION TEST

- \* VESSELS OF 140-250 L
- \* MIXTURE : BIOWASTE + 1% FILM / FORM FOR DISINTEGRATION  
+ 9% POWDER FOR COMPOST QUALITY
- \* WEEKLY TO BI-WEEKLY TURNING
- \* SPONTANEOUS OR SEMI-CONTROLLED TEMPERATURE :  
MAXIMUM MUST BE  $< 75^{\circ}\text{C}$   
MINIMUM MUST BE  $>60^{\circ}\text{C}$  for 1 WEEK and  $>40^{\circ}\text{C}$  for 4 WEEKS
- \* SUFFICIENT AERATION :  $\text{O}_2$  MUST BE CONTINUOUSLY  $>10\%$
- \* COMPOST CAN BE USED FOR QUALITY ANALYSES

# EN 14045 - ISO 16929 PILOT-SCALE DISINTEGRATION TEST

EVOLUTION OF THE DISINTEGRATION OF BIOPACK FILM 506 (140 µm)



## EN 13432 : 4) COMPOST QUALITY

- \* FULFILL STANDARD REQUIREMENTS (PHYSICO-CHEMICAL)
- \* 2 PLANT TESTS (OECD #208 + SUMMER BARLEY) :  
GERMINATION + GROWTH
- \* (POSSIBLY IN FUTURE : ADDITIONAL ECOTOXICOLOGICAL  
TESTS, e.g.. DAPHNIA, EARTHWORM)

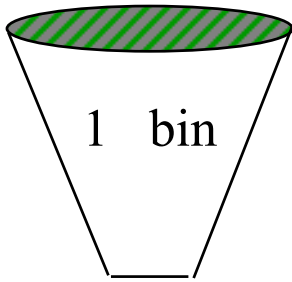
# EN 13432 : 4) COMPOST QUALITY



# QUALITY OF COMPOST

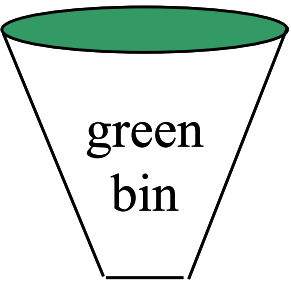
**PACKAGING**

MIXED WASTE

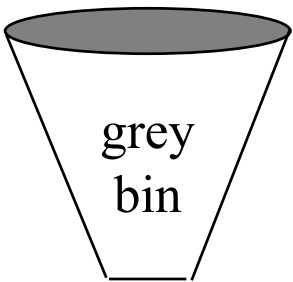


'COMPOST'

SOUP SEPARATION



HIGH QUALITY  
COMPOST



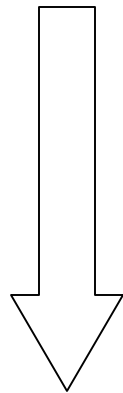
- LANDFILL
- INCINERATION
- BIO STABILISATION

# STANDARDS vs CERTIFICATION

## \* STANDARDS

= theory

= legislative








## \* CERTIFICATES/LOGOS

= praxis

= control - policing system

= standards + certification scheme

# COMPARISON OF CERTIFICATION SYSTEMS

Organisation	DIN-Certco/ IBAW	AIB Vinçotte	BPI/ USCC	Jätelaito- syhdistys	BPS
Location	Germany	Belgium	USA	Finland	Japan
Logo					
Standard	DIN V 54900 EN 13432 ASTM D6400	EN 13432	ASTM D6400	EN 13432	GreenPLA certification scheme

IN FUTURE : 1 GLOBAL SYSTEM ?

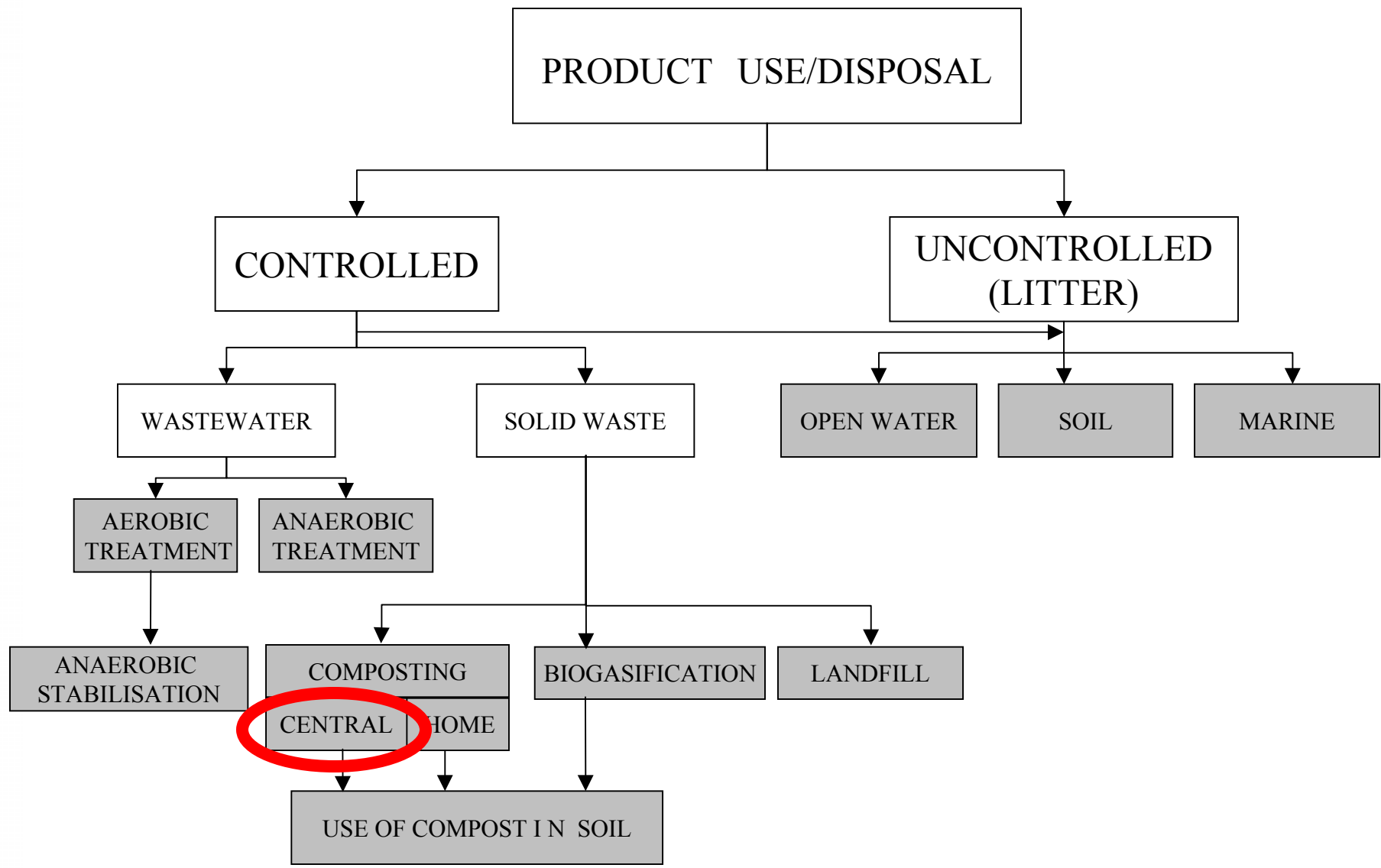
## LEGAL ASPECTS

- \* EU : DRAFT BIOWASTE DIRECTIVE : POSITIVE...  
BUT CANCELLED FOR TIME BEING  
INCLUDED SOURCE SEPARATION (mandatory) +  
COMPOSTABLE PACKAGING ON POSITIVE LIST
- \* EU : PACKAGING DIRECTIVE :  
COMPOSTING IS FORM OF RECYCLING
- \* IN GENERAL : NOT POSSIBLE TO ADD TO  
COMPOSTABLE WASTE STREAM, REASONS :  
LITTLE AMOUNT, NOT KNOWN  
BUT... CHANGING (IMPACT OF RETAILERS)

## LEGAL ASPECTS

- \* NETHERLANDS: APPROVAL ON MINISTERIAL LEVEL, DEPENDING ON LOCAL ACCEPTANCE (90% COVERAGE)
- \* GERMANY : EXEMPT FROM GREEN DOT FEE
- \* FRANCE : LITTLE BIOWASTE, LITTLE COMPOSTING BUT LOWEST GREEN DOT FEE; NEW LAW BANNING PETRO-PLASTIC PACKAGING OR SHOPPER BAGS BY 2010??
- \* BELGIUM : REGIONAL - NOT IN BIOWASTE, HOME COMPOSTING - GREEN DOT FEE

# END OF LIFE : ENVIRONMENTAL NICHES



# AGGRESSIVENESS OF ENVIRONMENT

60 °C

20 °C

COMPOST > SOIL > FRESH WATER > MARINE WATER

ANAEROBIC DIGESTION

# AGGRESSIVENESS OF ENVIRONMENT

Fungi + Bacteria

Bacteria only

COMPOST > SOIL > FRESH WATER > MARINE WATER

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## ANAEROBIC DIGESTION

# HOME COMPOSTING

- \* DIFFERENCE WITH CENTRALIZED COMPOSTING =  
TEMPERATURE PROFILE
  - ➡ HOME : AMBIENT °T or 10-20°C above ambient  
(STUDY OVAM : 280 measurements)
  - ➡ CENTRAL : at least 1 week above 60°C  
(= requirement for hygienisation)
  
- \* WASTE STRATEGY IN UK, SWEDEN, BELGIUM, EU

## TYPICAL CHARACTERISTICS SOIL

- \* TEMPERATURE : AMBIENT,  $< 40^{\circ}\text{C}$   
(no thermal hydrolysis)
- \* MICRO-ORGANISMS : BACTERIA + FUNGI  
+ ACTINOMYCETES  
(different from aqueous conditions)

# SOIL DEGRADATION : CRITERIA

MULCHING FILM

CEN TC 249 - WG 9

LAYOUT DRAFT :

- 1) DEGRADATION : WEATHERING + MINERALIZATION
- 2) ENVIRONMENTAL SAFETY : HEAVY METALS + ECOTOXICITY

NO CONSENSUS POSSIBLE (MAINLY ON WEATHERING)

⇒ DEADLOCK AT CEN LEVEL

# AFNOR - FRANCE : NF U 52-001 BIODEGRADABLE MULCHING FILM : TEST METHODS AND CRITERIA (1/2)

## \* MATERIAL CHARACTERISTICS :

HEAVY METALS

ORGANIC SUBSTANCES : carbamates

aromatic amines

phthalates

## \* ECOTOXICITY : after 3 months (\*100) or immediate (\*10)

PLANTS : 2 SPECIES : monocotyl + dicotyl

EARTHWORMS

ALGAE (with eluate)

# AFNOR - FRANCE : NF U 52-001 BIODEGRADABLE MULCHING FILM : TEST METHODS AND CRITERIA (2/2)

## \* BIODEGRADATION :

2 POSITIVE RESULTS REQUIRED, 3 OPTIONS :

- 1) AQUATIC (STURM) : 90% relative in 6 m
- 2) SOIL TEST : 70% relative in 12 m
- 3) CONTROLLED COMPOSTING TEST : 90% rel. in 6 m

# BIODEGRADABILITY IN WATER

## \* OECD Guidelines for Testing of Chemicals

- Ready biodegradability :

  - 60/70% in 28 days

  - from 10% to 60% in <10 days

- Inherent (ultimate) biodegradability :

  - 60/70%; adaptation permitted

## \* CEN TC249 WG9: Plastics

- Biodegradability :

  - 90% (absolute or relative) in 56 days

- Also definition of water solubility

  - water dispersibility

# OVS LABORATORY

THANK YOU!

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