

BIOPLASTICS : SENSE or NONSENSE ?

LATEST DEVELOPMENTS IN USE,
OPPORTUNITIES, LIMITATIONS AND
ACCEPTANCE

5TH RRB CONFERENCE

Gent, June 10-12 2009

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

TOPICS

- * OWS
- * MAJOR CATEGORIES
- * STANDARDISATION & MARKET DEVELOPMENT
- * MARKET DEVELOPMENT

ORGANIC WASTE SYSTEMS (OWS) nv

ACTIVITIES/ SERVICES:

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

* INDEPENDANT (no material or product development)

HEAD OFFICE

- * GENT BELGIUM
- * QUALITY CONTROL : GLP - ISO 17025

AFFILIATE

- * RECOGNIZED LAB (Din-Certco, BPI, BPS, AIB-Vinçotte,)
- * OWS Inc - DAYTON - OHIO - USA

PARTNER

- * ACTIVE IN STANDARDIZATION : CEN - ISO - ASTM
- * DJK International Inc - TOKYO - JAPAN
- * DIN-CERTCO certification committee

DRANCO REFERENCES



Brecht 2



Hille (Pohlsche Heide)

Brecht I (B)	1992	20.000 tpy	Biowaste / paper
Salzbourg (A)	1993	20.000 tpy	Biowaste
Bassum (D)	1997	105.000 tpy	Residual waste
Aarberg (CH)	1998	11.000 tpy	Biowaste
Kaiserslautern (D)	1999	25.000 tpy	Residual waste
Villeneuve (CH)	1999	10.000 tpy	Biowaste
Brecht II (B)	2000	50.000 tpy	Biowaste / paper
Rome (I)	2003	40.000 tpy	Biowaste
Leonberg (D)	2004	30.000 tpy	Biowaste
Hille (D)	2005	100.000 tpy	Residual waste + sludge
Pusan (S-K)	2005	70.000 tpy	Biowaste
Münster (D)	2005	80.000 tpy	Residual waste
Terrassa (E)	2006	25.000 tpy	Biowaste
Vitoria (E)	2007	120.000 tpy	Mixed waste
Alicante (E)	2008	180.000 tpy	Mixed waste
Hotaka (J)	2008	3.000 tpy	Biowaste
Tenneville (B)	2008	39.000 tpy	Biowaste
Kempton (D)	2008	18.000 tpy	Biowaste
Séoul (S-K)	2009	30.000 tpy	Biowaste / paper
Bourg-en-Bresse (F)	2010	90.000 tpy	Mixed waste
		15.000 tpy	Green waste
Nüstedt (D)	2006	12.500 tpy	Energy crops

OWS REFERENCES (CUSTOMERS) BIODEGRADABILITY TESTING

• 3M	USA	• FARDIS	BEL	• RECTICEL	BEL
• AETERNA	GER	• FIBERWEB	FRA	• RODENBURG	NETH
• AGRITECH	USA	• FINA	BEL	• SCA HYGIENE PROD.	NETH
• AIB-VINCOTTE	BEL	• FLUNTERA	SWIT	• SCOTT PAPER	USA
• AKZO NOBEL INKS	NETH	• FRANTSCHACH	SWE	• SHELL	UK
• ALKO	FIN	• GEORGET SUNSET CH.	FRA	• SHOWA DENKO	JAP
• AQUALON	FRA	• GILLETTE	USA	• SMITH & NEPHEW	UK
• ASSIDOMÄN	SWE	• GROENCREATIE	BEL	• SMITHERS-OASIS	USA
• AVERY-DENNISON	BEL	• HARTMANN	DENM	• SNPE	FRA
• BASF	GER	• H.B. FULLER	USA	• SOLVAY	BEL
• BATES CEPRO	NETH	• HENKEL	GER	• ST.LAWRENCE	CAN
• BAYER	GER	• HOUGHTON Int.	USA	• STOCKHAUSEN	GER
• BIOTEC	GER	• HUHTAMAKI	NETH	• STORA	SWE
• BUNA	GER	• KORSNÄS BATES	SWE	• SYMPHONY	UK
• CARGILL	USA	• KIMBERLY CLARK	USA	• TAMA PLASTIC	ISR
• CARREFOUR	BEL	• LOHMANN	GER	• TEEPAK	BEL
• CERESTAR	BEL	• MÖLNLYCKE	SWE	• TETRAPAK	SWE
• CIBA-GEIGY	SWIT	• MONSANTO	BEL	• TUBIZE PLASTIC	BEL
• CORN PRODUCTS	BRAZ	• NATIONAL STARCH	UK	• VERPAKKING MOONEN	BEL
• DEGUSSA	GER	• NOVAMONT	ITAL	• VINAMUL	NETH
• DJK International	JAP	• NOVON	USA	• VITO	BEL
• DU PONT DE NEMOURS	USA	• PLANET	USA	• WARNER-LAMBERT	USA
• EARTH GREEN	TAIW	• POLARCUP	DENM	• UCB	UK
• EASTMAN	USA	• POLAR GRUPPEN	NOR	• UPM	FIN
• ECOSYNTHETIX	USA	• POTENCY	FRA	• VERTIS	NETH
• EPI	UK	• POLYVAL	UK	• WELLS PLASTICS	UK
		• PVAXX	UK	• ZENECA	UK

And various other companies in EUROPE, JAPAN and the U.S.A.

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
- **EB** European Bioplastics
- **BEDPS** (*USA*) Bio/Environmentally Degradable Polymer Society
- **BCPN** (*Netherlands*) Belangenvereniging Composteerbare Producten Nederland
- **BBP** (*Belgium*) Belgian Bio Packaging

TOPICS

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- * **MAJOR CATEGORIES**
- * STANDARDISATION & MARKET DEVELOPMENT
- * MARKET DEVELOPMENT

OVERVIEW BIOPLASTICS

* WHAT IS A BIOPLASTIC ???

- coming FROM Bio

or - going TO Bio

or - coming FROM AND going TO Bio

* BIO-BASED = NOT equal to BIODEGRADABLE

* PETRO-BASED = NOT equal to NON-BIODEGRADABLE

DIFFERENT TYPES OF BIOPLASTICS

I. BIO-BASED

- on basis of FIBRES
- on basis of STARCH
- on basis of CELLULOSE
- CHEMICAL SYNTHESIS
- BACTERIAL SYNTHESIS

II. PETRO-BASED

- Polyesters

1. FIBER : DIFFERENT BASIC MATERIALS

- Bagasse (sugar cane)
- Miscanthus
- Palm fiber
- Reed
- Paper/(card)board : moulded fibers
- Blends (with e.g. PLA, PP, HDPE)
- Other fibers : hennep, flax, bamboo, jute

1. FIBER

+	-
<ul style="list-style-type: none">- RENEWABLE- NATURAL LOOK- BIODEGRADABLE- NON-FOOD CROP- RIGID	<ul style="list-style-type: none">- NO FLEXIBLES- POOR BARRIER- STRENGTH

2. STARCH

- Starch from corn, potato, tapioca, rice :
 - Pure starch (as filler)
 - TPS (= Thermo Plastic Starch)
 - Starch acetate
- Blends (with e.g. polyesters)

2. STARCH

+	-
<ul style="list-style-type: none">- FLEXIBLE- BIODEGRADABLE- STRONG NICHES- PRICE	<ul style="list-style-type: none">- FOOD CROP- RENEWABILITY

3. CELLULOSE

- Cellophane (= regenerated cellulose)
- Cellulose-acetate (= modified cellulose)

3. CELLULOSE

+	-
<ul style="list-style-type: none">- BIODEGRADABLE- NON-FOOD CROP- RENEWABLE	<ul style="list-style-type: none">- PRODUCTION PROCESS (LCA)

4. CHEMICAL SYNTHESIS

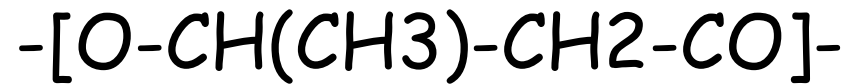
- PLA (polylactide)
- PDO (1,3-propanediol, Bio-PDO)
- PE/PVC ("green" type)

4. CHEMICAL SYNTHESIS

+	-
<ul style="list-style-type: none">- RENEWABLE- INDUSTRIAL COMPOSTING	<ul style="list-style-type: none">- BIODEGRADABILITY- FOOD CROPS
<ul style="list-style-type: none">- RENEWABLE	<ul style="list-style-type: none">- SAME AS PETRO-POLYOLEFINS

5. BACTERIAL SYNTHESIS

- PHA (polyhydroxy-alkanoaat)
 - PHB (polyhydroxybutyrate)



- PHB-HV (polyhydroxybutyrate-valerate)
= co-polymer

5. BACTERIAL SYNTHESIS

+	-
<ul style="list-style-type: none">- BIODEGRADABLE- RENEWABLE	<ul style="list-style-type: none">- FOOD CROP- ENERGY CONSUMPTION (LCA)

PETRO-BASED : COMPOSTABLE

*PETROCHEMICAL POLYESTERS :

- PBAT
- PBAST
- PVOH
- PCL

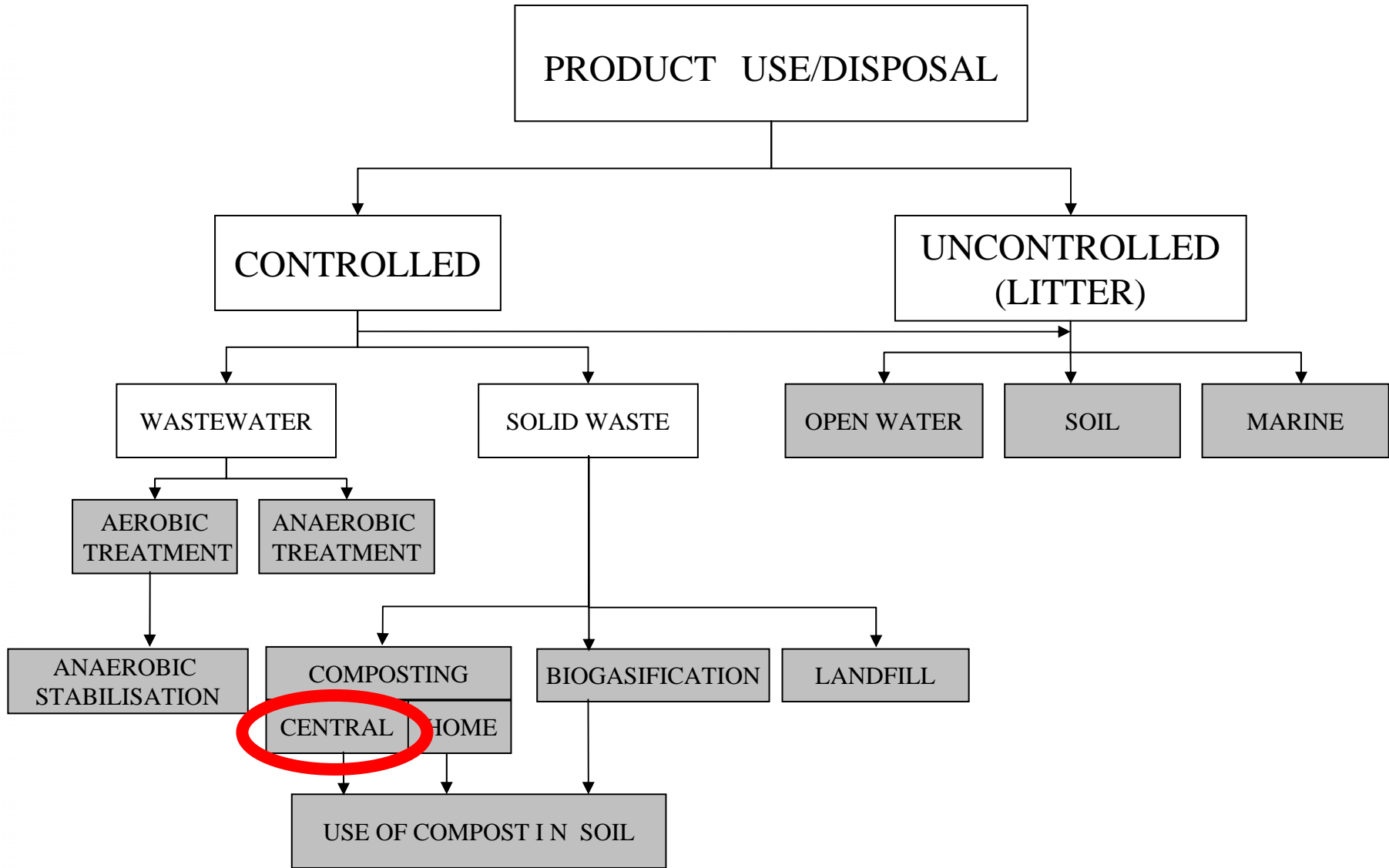
5. PETRO-BASED COMPOSTABLE PLASTICS

+	-
<ul style="list-style-type: none">- BIODEGRADABLE (INDUSTRIAL COMPOSTING)- TECHNICAL CHARACTERISTICS	<ul style="list-style-type: none">- PETRO-BASED

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END OF LIFE : ENVIRONMENTAL NICHES



COMPOSTABILITY - EN 13432

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1) BIODEGRADATION

(Degradation on chemical level)

2) DISINTEGRATION

(Degradation on physical level)

3) COMPOST QUALITY

3a) Material characteristics

3b) Compost analyses

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

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

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

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

COMPARISON OF CERTIFICATION SYSTEMS

Organisation	DIN-Certco	Vinçotte	BPI	JBPA
Location	Germany	Belgium	USA	Japan
Logo				
Standard	DIN V 54900 EN 13432 ASTM D6400	EN 13432	ASTM D6400	GreenPLA certification scheme
Number of certified products	92 materials 2 additives 210 products	87 materials 45 additives 119 products	>19 materials >47 products	967 materials and products

IN FUTURE : 1 GLOBAL SYSTEM ?

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MARKET DEVELOPMENT

- * NICHE MARKETS : biowaste collection bags, mulch film, body bags, ... : biodegradability is major asset
- * ORGANIC FOOD PACKAGING : image
- * WET, ORGANIC, INDUSTRIAL WASTE : catering, fastfood, festivals, sport events... : asset + image
- * WET, ORGANIC HOUSEHOLD WASTE : pizza boxes, frozen food, yoghurt cups, ...
- * ALL KINDS OF SHORT-LIFE PACKAGING

OWS LABORATORY

THANK YOU!

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