
ENVIROCARE® :
a tool for lifetime control of agricultural
mulch films

Industry Segment Agriculture
OdB



ENVIROCARE® : Reducing Agricultural plastics waste

1. **Toward a plastic life control**
2. **Endorsements from academics**
3. **Steps to be taken for standardisation**

Toward a plastic life control : ENVIROCARE®



- Primary goal:
Avoid these permanent pollution !



Toward a plastic life control : ENVIROCARE®



- Degradation « in situ » as a viable alternative when disposal, recycling or incineration is not feasible
- Provided the following criteria are met :
 - *Technical*
 - *Environmental*
 - *Economical*
 - *Legal*

The offer for agriculture :

- A choice with 2 possibilities :
 - « **biopolymers** » : new polymers designed for biodegradability (positive answer to respirometric tests).In agriculture : mainly synthetic based with or w/o starch.
 - **Additivation of existing resin** : make sure that resin can show ability for biodegradation after use . Today synthetic based . .

The offer for agriculture :

Matériaux	« Bio-polymères »	Polyoléfines additivées
Origine	Synthétique et renouvelable	Aujourd'hui non renouvelable
Processus de dégradation	Hydrolise + bioassimilation	Oxydation, hydrolise, puis bioassimilation
Facteurs de dégradation	Eau, microorganismes, (lumière, froid)	Chaleur, lumière, microorganismes, (eau)
Biodégradation	« Per se »/Rapide	Acquise/Plus lente
Applications commerciales	Salade, Coton...	Salade, Melon, Pastèque, Tomate, Maïs, Coton...
Propriétés	$d = 1,3 / e > 15\mu$	$d = 0,9 / e > 10\mu$
Prix/ utilisateur <small>Industry Segment Agriculture OdB</small>	> prix film classique	= film classique ou <

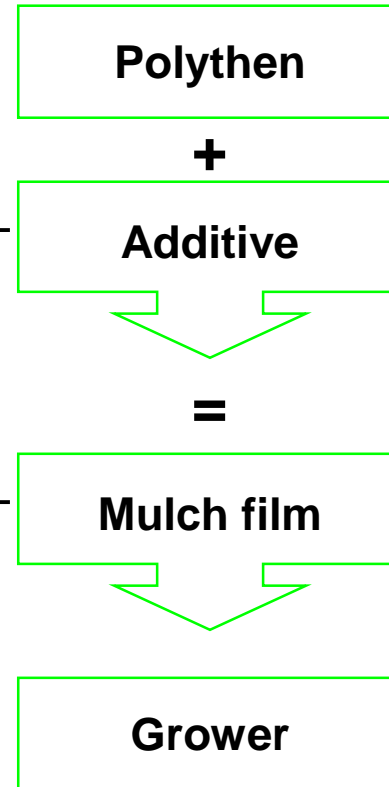


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The offer for agriculture : ENVIROCARE®

- ✓ **Supplier of additive** : Ciba
Additive : ENVIROCARE®
Functionality : complete degradation effect

- ✓ **Converter and distributor**
Oxo-biodegradable mulch film :



Toward a plastic life control : ENVIROCARE®



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Toward a plastic life control : ENVIROCARE®



- Left good emergence out of plastic

- Right too slow degradation due to bad combination resin and additive

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Applications : in Europe



Applications : out of Europe and overseas



Applications : potentially for ENVIROCARE®



Non-woven row-covers,
nettings, twines, clips,
forestry items...



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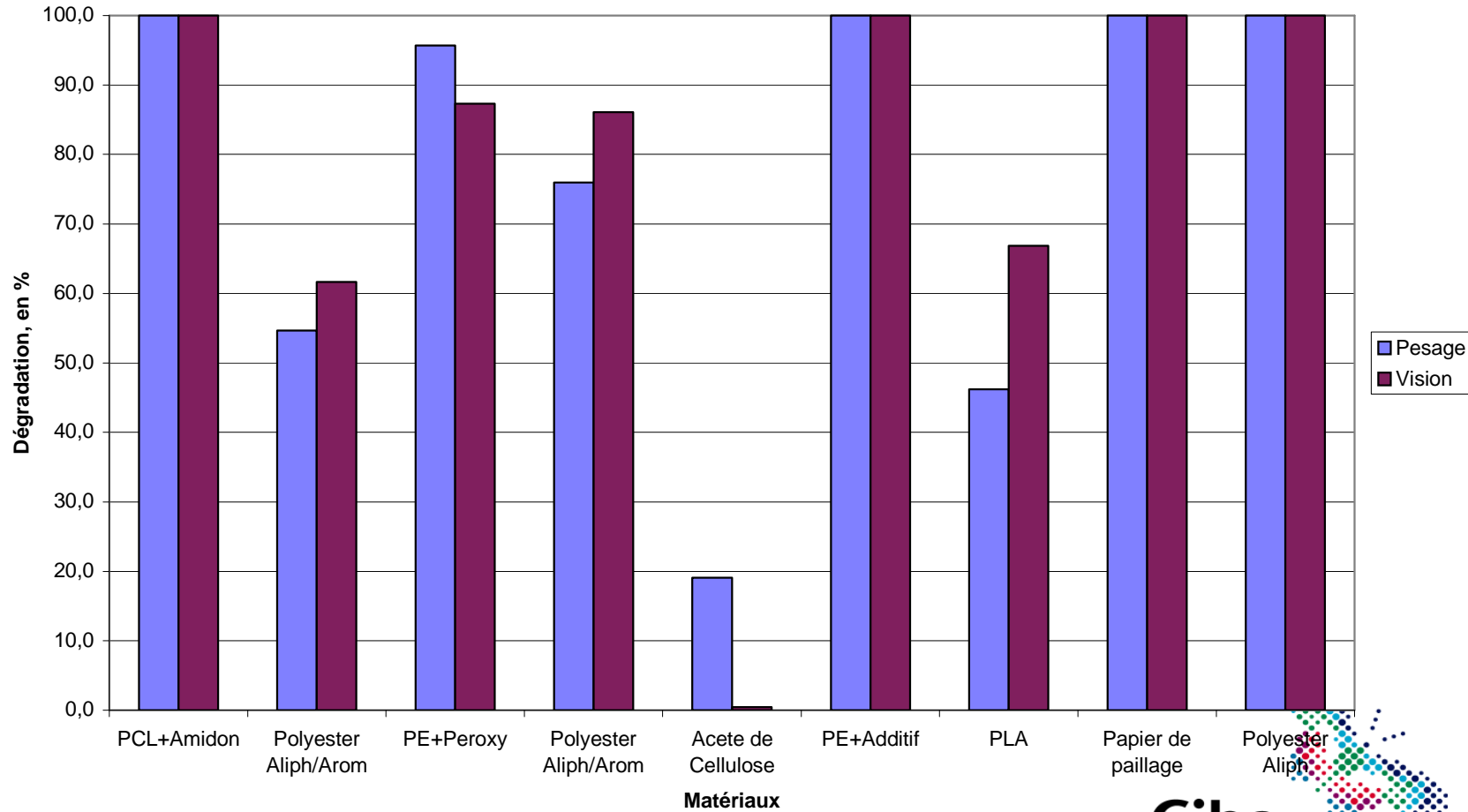
Official data : Cemagref (France)

Tests d'enfouissement du CEMAGREF, présenté au congrès d'Auray , juin 2001



Official Data: Cemagref (France)

Dégradation dans le sol, après 24 mois

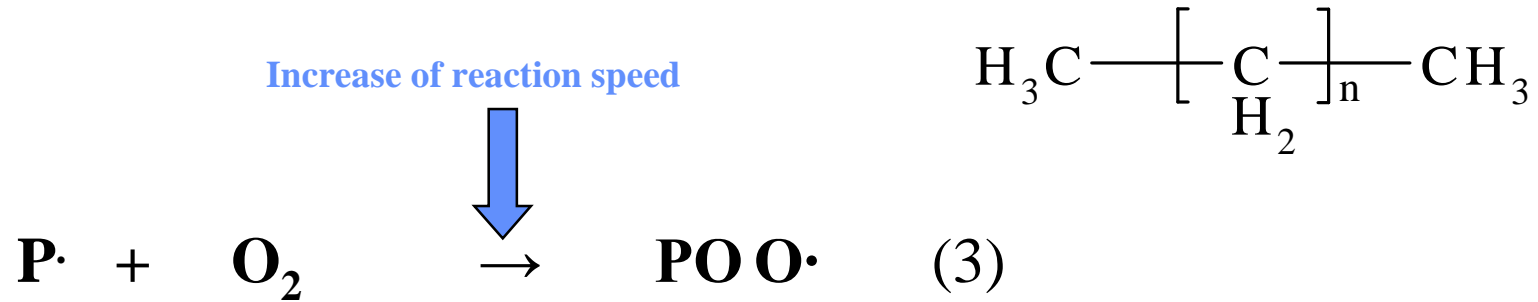


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Official data : University of Aston (UK)



« The following chain reaction is the essential peroxidation sequence, which continues as long as oxygen is present in the system ».

June 02. Sce : Scott. Science and standard . Pisa Congress

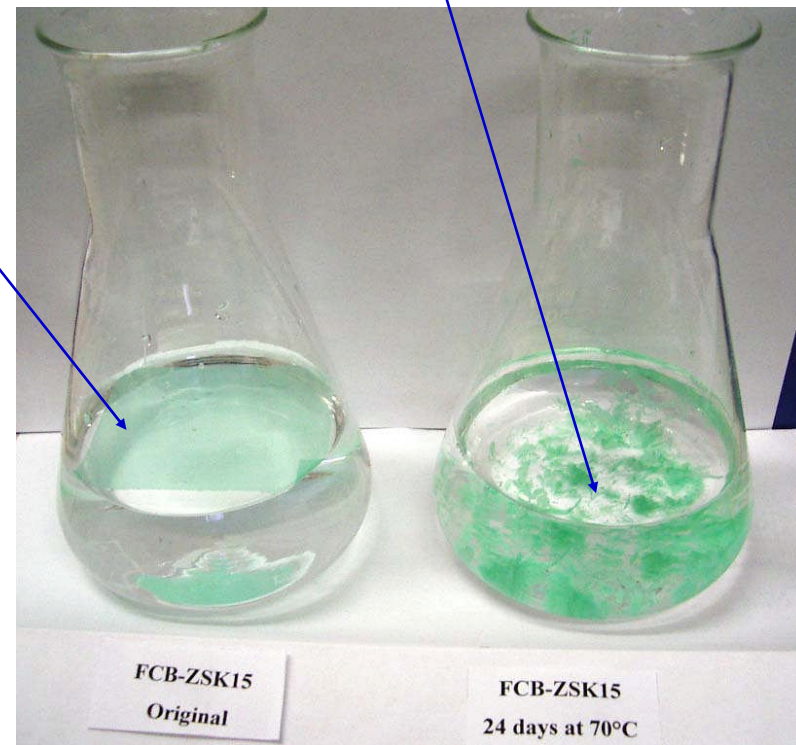
Official data : University of Pisa (Italy)



Film de poly-éthylène
neuf

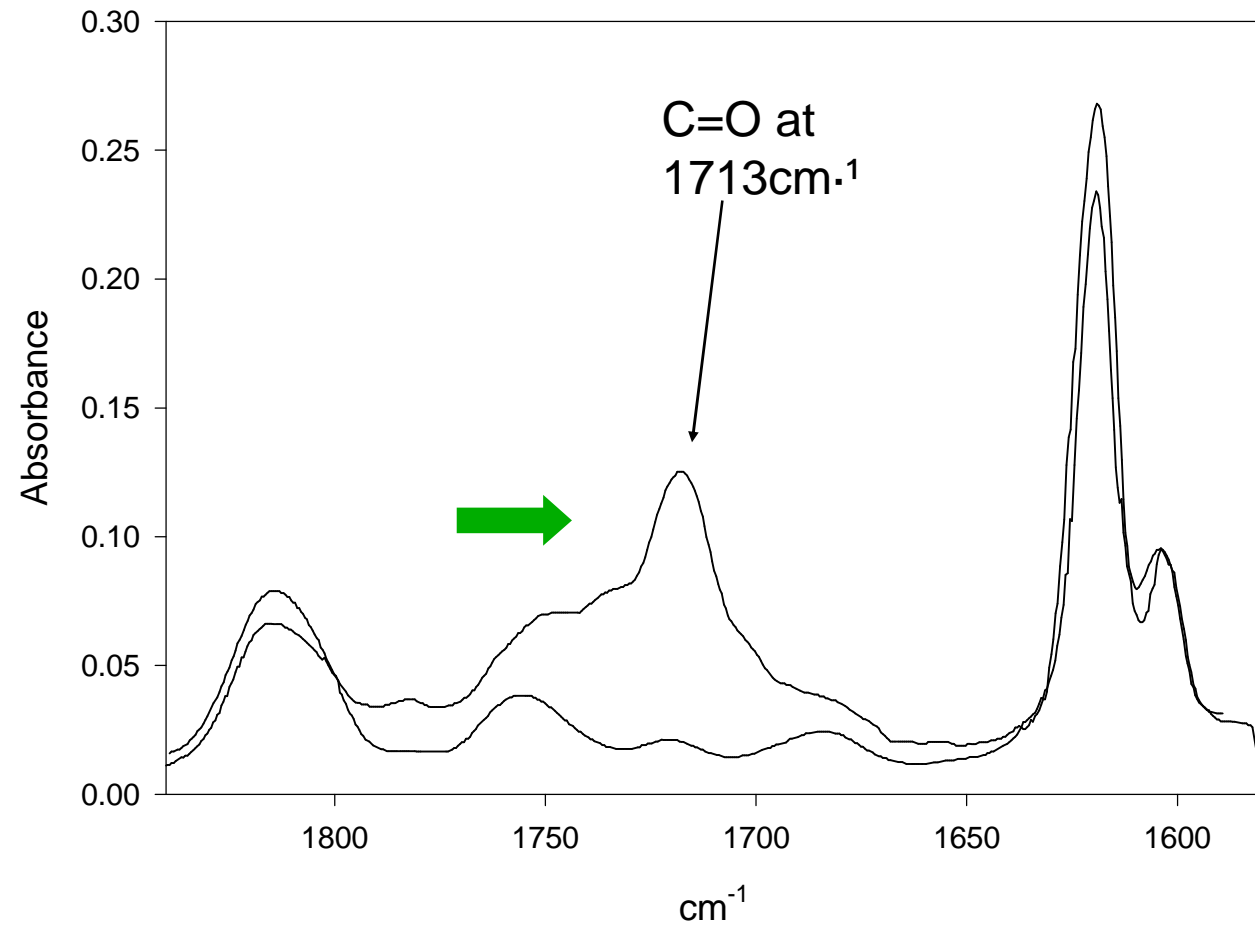


Poly-éthylène oxydé



Official data : University of Sussex (UK)

Identification of carbonyl groups on oxydised additivated LDPE



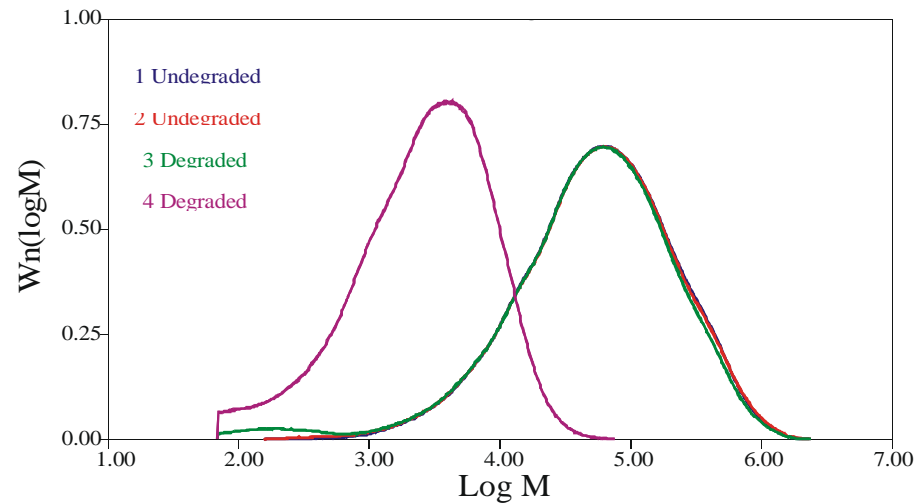
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Official data : University of Sussex (UK)

Even in soil...

**Molecular weight of PE after 10 months soil burial
with and without TDPA additive**



Arrhenius plot : university of B oras (Sweden)

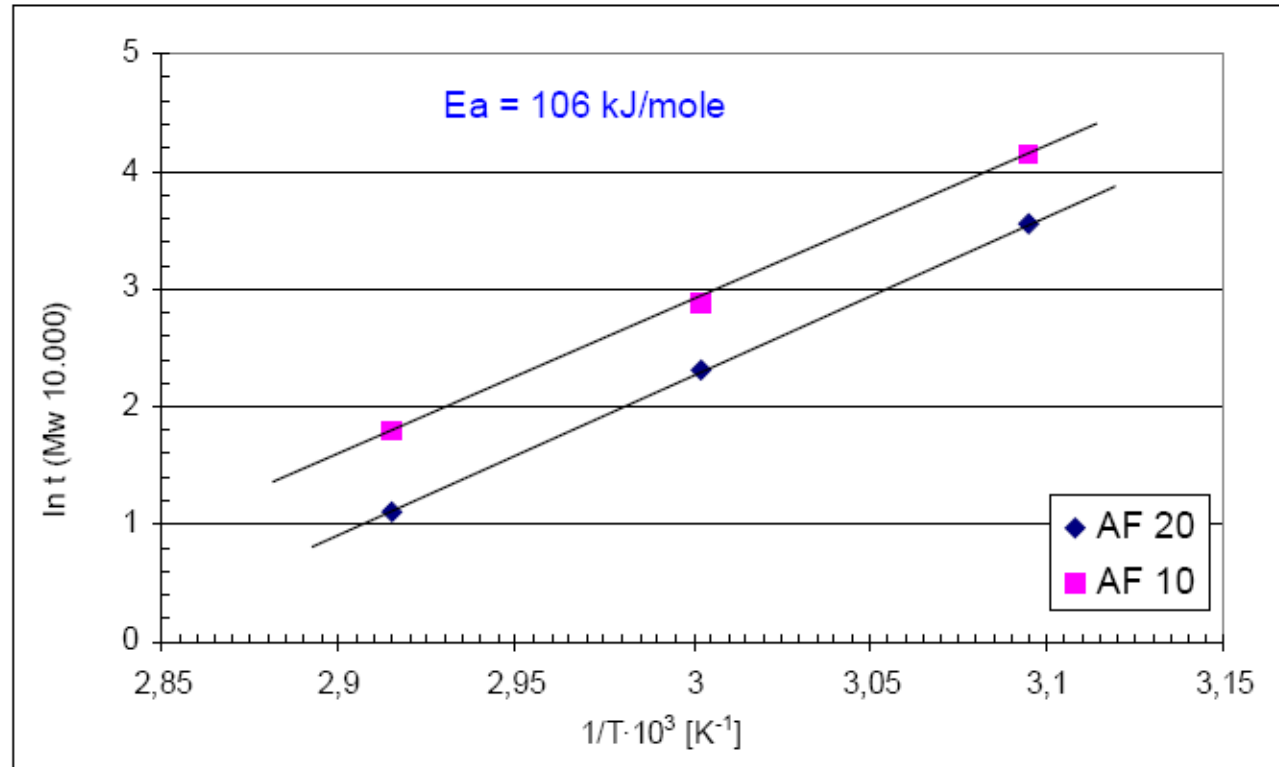
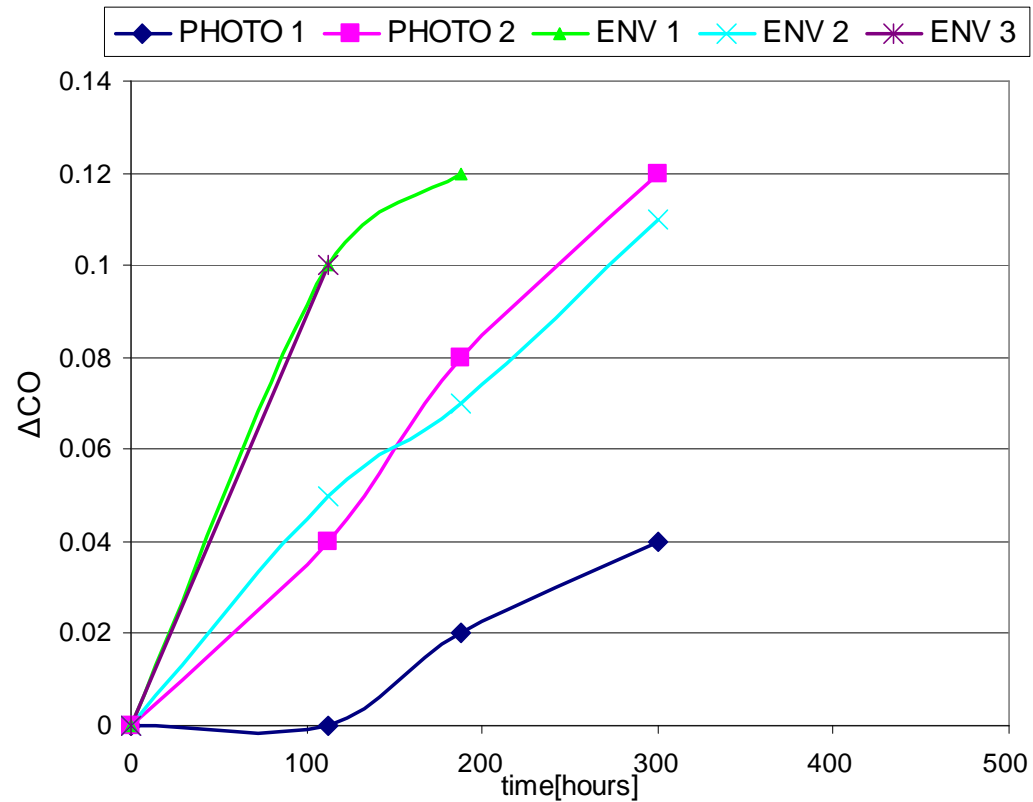


Figure 4. Arrhenius plot

Sc: Pr Ignacy Jacobovsky
(EMPA report N°422809)

Comparison between ENVIROCARE et Photodegradable films :

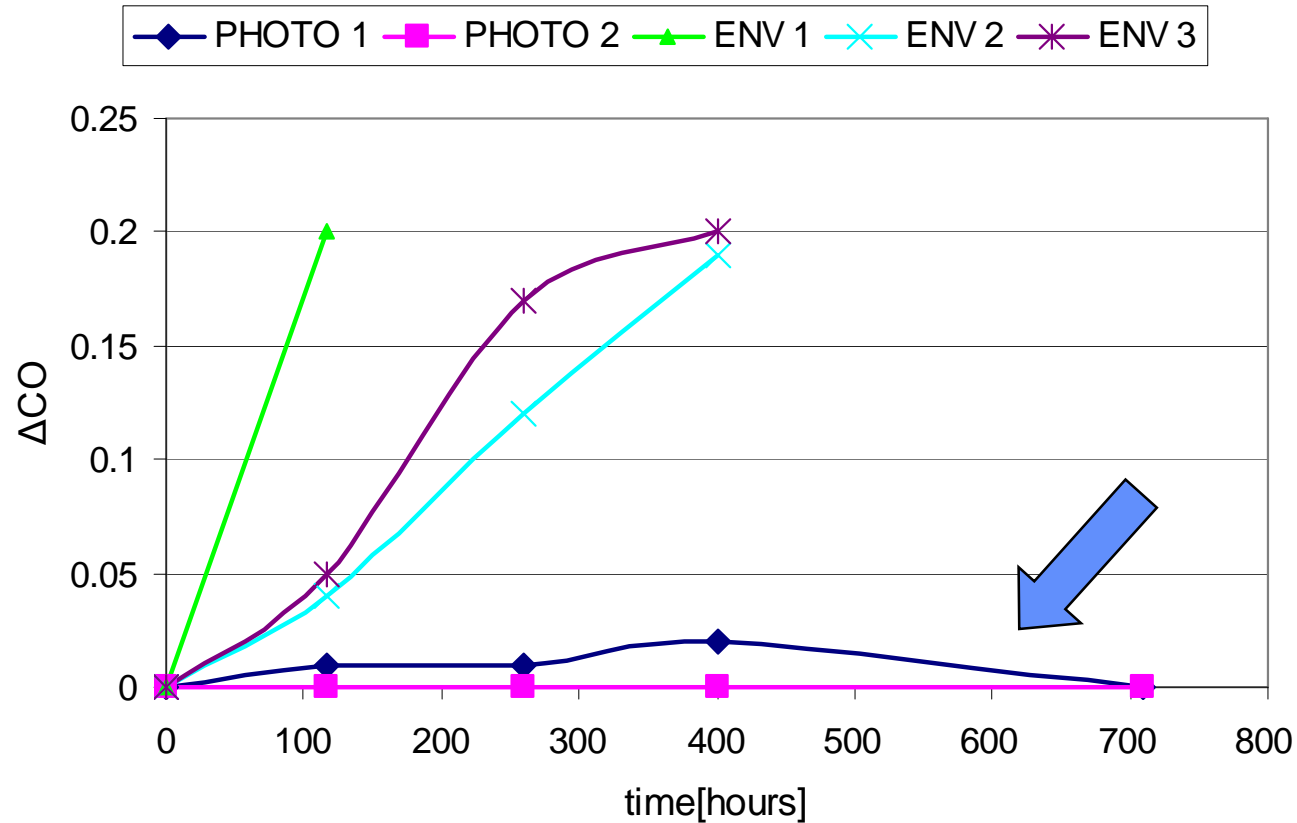


Variation of carbonyl groups in artificial light ageing (WHOM)

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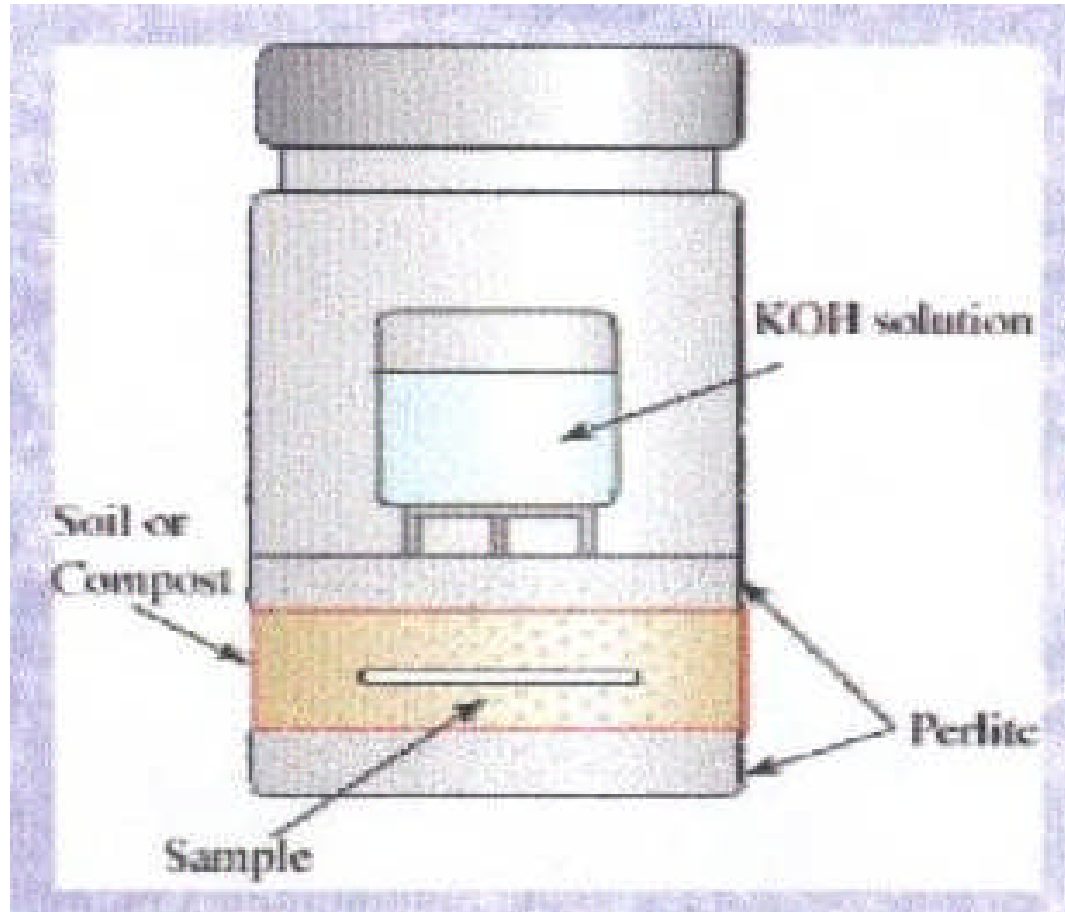


Comparison entre ENVIROCARE et Photodegradable films :



Variation of carbonyl groups in dark oven (Ageing at 60°C)

Official data : University of Pisa (Italy)



- Evaluation of biodegradation = proportion of carbon emitted as CO² by microorganisms on carbon initially contained in the sample

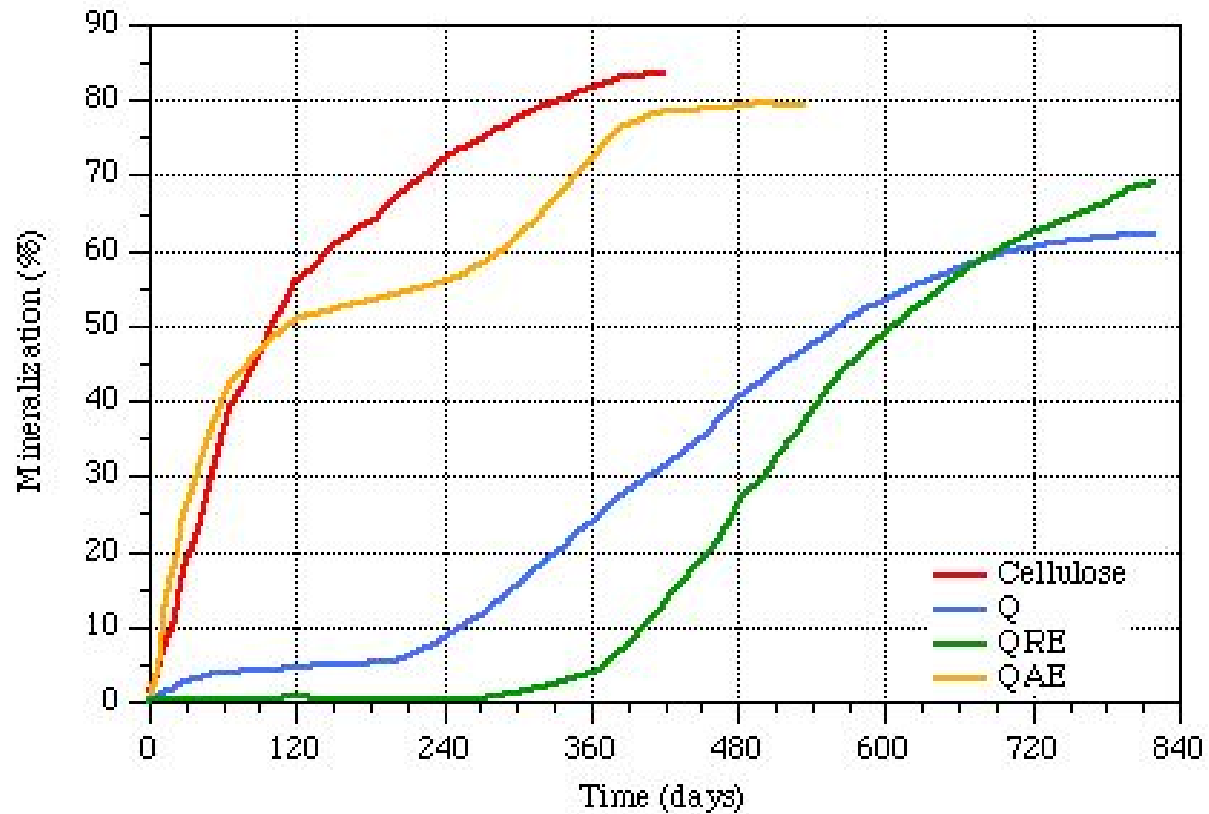
Reference: Chielline, Emo, Andrea Corti (University of Pisa, Italy) and Graham Swift (EPI inc., Canada)

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Official data : University of Pisa (Italy)

Soil Burial Respirometric Tests



Official data : University of Bõras

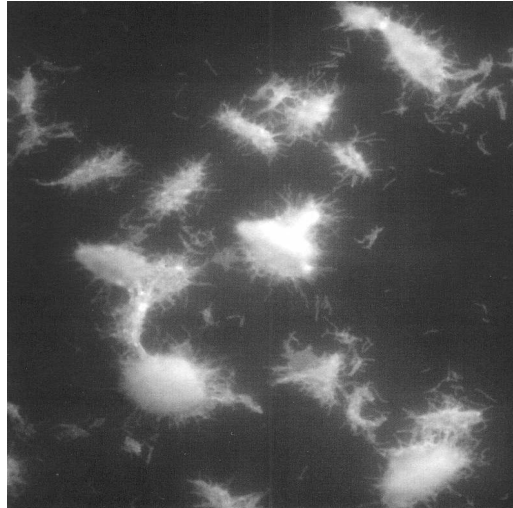
Conclusions of trials (EMPA report p11-12 N°422809)

« ... After 180 days of incubation 57.9 % of the carbon were mineralized. A mineralization rate of < 60 % was reached after 200 days of incubation. However, after this incubation period the mineralization of both materials was still continuing. Therefore, it can be predicted that the both materials can be completely mineralized to carbon dioxide. »

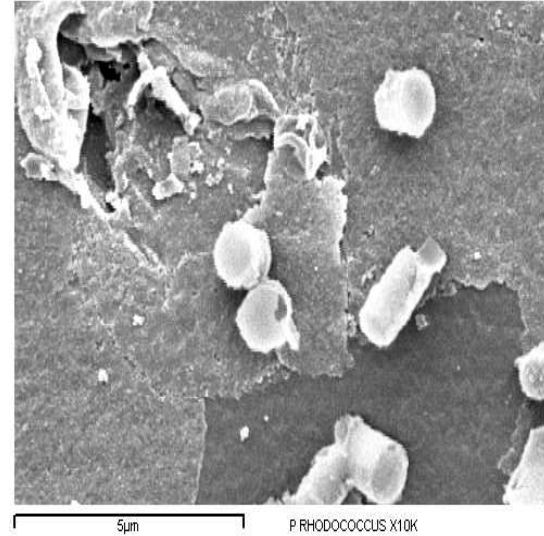
Ignacy Jakubovsky

Official data : University of Clermont-Ferrand

Shows peroxidised PE being attacked by micro-organisms



a) *Nocardia asteroides* (15 min) Colonisation of peroxidised degradable PE (EPI TDPA™) observed by epifluorescence microscopy.



b) Bio-erosion of the surface of peroxidised PE and the growth of *Rhodococcus rhodochrous* observed by SEM after 1 month

Reference A., Delort, A-M, Lemaire and co-workers (University of Clermont-Ferrand) presented by G.Scott at the 7th International Biopolymer Conference in Pisa June 2002

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A few standardised words CEN/TR 15351

- **Dégradation** = deleterious change in initial properties due to chemical cleavage of the macromolecules forming a polymeric item, regardless of the mechanism of chain cleavage.
- **Fragmentation** = breakdown of a polymeric item to tiny particles regardless of the mechanism
- **Biodegradation** = degradation of a polymeric item due to cell-mediated phenomena
- **Oxo-biodegradation** = Degradation identified as resulting from oxydative and cell-mediated phenomena, either simultaneously or sucessively.
- **Ecocompatibility** : the compatibility with the various forms of outdoor life. It reflects the absence of deleterious alteration of the outdoor life caused by a polymeric item or its degradation by-products (M. Vert)

Steps to be taken for standardisation

Published standards :

- ASTM D 6954-04 : guide line for oxo-biodegradation ;
emergence of oxo-biodegradation concept
 - « Exposing and testing plastics that degrade in the environment by a combination of oxydation and biodegradation »

- CEN/TR 15351: Vocabulary to be used regarding polymer degradation (from CEN TC249 WG9)

- XPT 54 980-1 : « Degradable mulch film in the environment »
 - First part achieved and difused by AFNOR/BNPP june 07
 - Second part concerns bio-assimilation

Steps to be taken for standardisation...

At work :

- CEN TC 249 WG 9 : biodégradation dans le sol
No consensus ; technical report to be published...
- BS 8472 (draft) : Determination of the compostability (including ecotoxicity and biodegradability) of the packaging material based on oxo-biodegradable plastics...

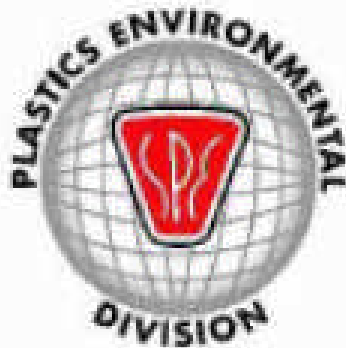
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Reduce scraps at bestcost

Ciba GANADORA DEL PREMIO

NEW TECHNOLOGIES IN MATERIALS

for ENVIROCARE®



Society of Plastics Engineers, Inc.

Promoting the Scientific and Engineering Knowledge of Plastics

SPE Plastics Environmental Division

Awarded by GPEC 2006 (USA)

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ENVIROCARE®, Reduce scraps at best cost

PREMIOS THANIT



PATROCINAN:



Consejería de Agricultura, Agua y Medio Ambiente de la Región de Murcia



CAJAMURCIA

Premios Thanit 2006 al desarrollo tecnológico agrícola en la región de Murcia

Ciba® ENVIROCARE®

Mención especial al desarrollo tecnológico agrícola en beneficio del medio ambiente 2006

Application of oxo-biodegradable mulch is selected by Ministry of Agriculture in Spain to be eligible for European fundings via OPFH (January 08)

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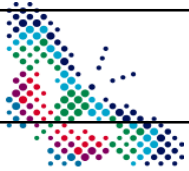


Conclusion


ENVIROCARE® is the additive that promotes degradation of plastic items for agriculture

- This is a help to allow growers to eliminate scraps
- The solution is quite affordable.
- Priority remains « ecocompatibility » and protection of the environment.

Appendix 1: Comparison Jeantil and Samco systems

Features	Jeantil system	Samco system
Machine conception	30 years old/ 4 rows	Modern with electronics/up to 6 rows
Availibility of machines	Only second-hand	New machines available
Film type	10-12 μ oxo-bio	8 μ oxo-bio
Working speed	5-6 km /h	8-10 km/h
Machine capacity	200 ha /season	350 ha/season
Cost for growers	250-300€/ha	220-250€/ha
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Appendix1: Comparison Jeantil and Samco systems

Agronomic features	Jeantil system	Samco system
Sowing date	From 1st april to 10th may	15th march to 1st may
Risk against frost	reduced	Highest protection
Water management	Reduced need for irrigation	Need for irrigation for late sowing
Seeds variety	+50-80 FAO index (all suppliers approved)	+50-100 FAO index only Pioneer approved
Post emergence herbicide	Yes, if required	Only possible on the row
Pre-emergence herbicide	Yes	Only possible
Extra-yield	+3-5 t DM/ha	+3-5 t DM/ha
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Conclusion

- Bonne corrélation entre les résultats en laboratoire et les résultats obtenus en conditions réelles
- La vitesse de l'oxydation apparaît dépendante des conditions de milieu

Appendix 3: Economical evaluation

CIBA® ENVIROCARE® Etude économique applicable pour la France

	Avec Paillage ENVIROCARE®	Soi nu
EPAISSEUR (micron)	10	0
LONGUEUR DE FILM / HA (meter)	6200	0
LARGEUR DU FILM (meter)	1,35	0
POIDS DE FILM PAR HA (kg)	77,00	0
PRIX € / KG	2,65	0,00
COUT DU FILM € / HA	204,06	0,00

TABLEAU PRODUITS ET COUTS € / HA			Prix du Maïs aux normes €/Tn
	AVEC PAILLAGE ENVIROCARE	SOL NU	
VALEUR DE LA RECOLTE	1440	1200	120,00
SEMENCES	150	150	
ENGRAIS	162	162	
PESTICIDES	92	92	
MECANISATION	110	110	
COUTS DE SECHAGE	180	230	
COUT D'IRRIGATION	0	200	
SURCOUT DU PAILLAGE (FILM + 50 €/HA de POSE)	254	0	
TOTAL DES COUTS DIRECTS	948	944	