COMPARISON CHART FOR BIODEGRADABLE MATERIALS

Criteria	PLA based film	SUPERECO film	REMARKS AND REFERENCES
Type of product	Corn starch based material	BOPP (polypropylene) film based	
Source of material	Renewable vegetal material	Fossil based	
Type of biodegradability	Hydro biodegradable	Oxo-biodegradable	
Form of biodegradability	Intrinsic biodegradability	Acquired biodegradability	
Technology	Cargill , Mitsui ,Hycail ,Galactic	Totally Degradable Plastics Additive®	**Oxo-biodegradability technology** : already used in PE for biodegradable plastic bags for customers like TESCO
ECO ASSESMENT			
Base material	Corn (with question mark on non transgenic origin of corn culture)	Oil	**SUPERECO** : bearing in mind that oil consumption for plastics is only 2% of total **PLA film : Cargill Dow**, resin producer of PLA cannot guarantee that transgenic modified organisms cannot be present in production cycle.
Energy consumption to produce	**Important energy consumption for PLA** -require oil for PLA resin production (polymerization) ; -require oil for Film production (extrusion , biorientation ,heating)	Thermal valuation during PP production	
Energetic valuation of waste	**None**	88% of incinerated tonnage is subject to thermal and electric valuation	
Requested land surface to produce	**30.7 H per 100 tons of PLA**	**None**	**PLA** is requiring very large non food culture expansion
Yield	**2.5 kg of corn per kg of PLA**	**Yield very close to 100%**	
Water consumption	**4.45 m3 of water per ton of PLA**	**Neglicable**	**PLA :** very high water consumption , where some area are with water shortage
Pesticides consumption	**Assuminf corn is non transgenic :** **89 kg herbicides/100tons of PLA** **2,3 kg pesticides/100 tons of PLA**	**None**	source : http://www.ontariocorn.org/envt/envpest.html
Fertilizer consumption	**76.76 kg/tons of PLA** **50kg/h N,100kg/h P2O5 ,100 kg/h K2O**	**None**	**PLA** : water underground source pollution with nitrates source : www.fertilizer.org/ifa/publicat/html/pubman/maize.htm

ENVIRONMENTAL IMPACT INDICATORS			Source : ECOBILAN prepared for CARREFOUR « Evaluation des impacts environnementaux des sacs de sortie de caisse – fev 2004 »
Criteria	**PLA based film**	**SUPERECO film**	REMARKS AND REFERENCES
Green house effect in 100 years concerning :Air	**Gas emission for green house effect is 40% more**		Same source
Atmospheric acidification concerning : Air	**Acid gas emission is 60% more**		Same source
Initiation of photochemical oxidizing agent concerning : Air	**60% less gas emission contributing to photo oxidant oxidizing production**		Same source
Eutrophisation of water : concerning : water	**Contribution is 11 times more to surface water eutrophisation**		Same source
BIODEGRADABILITY			
% Waste treatment method (concerning France only)	**In industrial landfill : 50%** **In composting : 8%** **Incineration and energy recovery: 29%** **Sorting and recovery stations: 13%**		Source : ECOBILAN prepared for CARREFOUR « Evaluation des impacts environnementaux des sacs de sortie de caisse – fev 2004 – données moyenne ADEME ,2000 »
Norms and test method	**There is no norm concerning biodegradability of plastics , only :** **ASTM 6400/6868 , ASTM D5338 à 58°c et EN 13 432** - Pass/no pass tests on compostability **ASTM 6954 04** - Standard guide tests that recognize oxo-biodegradability as two step process (degradation then biodegradation)		
Compostability (4 Criteria to be satisfied) EN 13432			
Composition : Establish a maximum level of volatil solids , heavy metals and acceptable Fluor in initial material	**Ok**	**ok**	**For Supereco :** Reference Call recovery Europe Ltd Composting of Homo-polymer film in a full scale windrow composting plant
Disintegration : this is the ability of product to be fragmented under composting condition , with a **refuse** limit level of 10% of mass above a screen of 2 mm	**Ok**	**ok**	Same

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Quality of final compost and ecotoxicity : quality of compost should not be modified by packaging material added to compost and should not be dangerous for environment .Norm ask to make eco toxicological tests on final compost and require a performance superior to 90% of the one with virgin compost .	**Ok**	**ok**	Same
Conversion of CO2 : 90% of material should be converted in CO2 in max 180 days	**Ok**	**Non** ***The film has a conversion in CO2 that is slower than hydro-biodegradable material , this is the only difference***	The PLA plastic based material has emission of CO2 in atmosphere that concure more to the green house effect than oxo- biodegradable, which is more slowly to release CO2; plants are preferably absorbing this slow release CO2 to promote the biosynthesis.

Biodegradability (in landfill)

No norm at the moment : *study are made within three important laboratories to establish test method to measure and then to set up a Norm*

Conditions : *Abiotic chemical degradation in landfill and subsequent biodegradation by microorganisms*

Is the film biodegradable	Yes	Yes	
Film stability before discarding	Very sensitive to high humidity	12 months	**SUPERECO:** Stable material whatever humidity level!
Film stability after discarding (landfill) base 35µ		4 to 6 months	
Degradation	6 month	18 to 24 months	For PLA :Hydro degradation For Supereco : chemical Abiotic degradation
Biodegradation		Start in the same time as degradation allow to reach small hydrophilic material chains of disintegrated film Final components are : CO2, Water and biomass	**SUPERECO**: the biodegradation speed is depending from density and nature of micro organisms.

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Film properties			
Density	**1.24**	**0.91**	
Yield (for 30µ in m2/kg)	**26.88 m2/kg**	**36.63 m2/kg**	**Le SUPERECO has 36% more yield than PLA**
Film behavior during handling	Film get marks when handled an this very crispy and noisy as final packaging	Very flexible and soft film , does not mark and not crispy	
Film stability before discarding	Very sensitive to high humidity	Film is designed to be stable from production up to the discard in landfill (see above)	**SUPERECO** has been designed with a determined shelf life compatible with application
Thickness range	20 to 40µ	Wide thickness range 10µ to 80µ	
Mechanical resistance	medium	Excellent	
Perforation resistance	weak	Excellent	
Printability	Difficult	Excellent ,same as BOPP	**PLA** is sensitive to temperature, therefore drying ink temperature should be as low as possible; film is also sensitive to Ethyl acetate Solvent.
Range of products available	- **Plain film** - **Heat sealable film**	- **Heat sealable film (20 to 50µ)** - **Antifog heat sealable film (25 to 35µ)** - **Plain film** - **Wrap around label film** - **Laminating film (12µ)** - **CPP film** - **Perlized and white film (under development)** - **Metallized film (under development)** - **Low heat sealing temperature film**	
Water vapor barrier properties (30µ film at 23°c et 85%HR)	**55 g/m2.day**	**1 g/m2.day**	**Supereco :** excellent water vapor barrier properties
Oxygen permeability (30µ at 23°c et 50% HR)	**500 cc/m2.day**	**1 500 cc/m2.day**	
Processability	Special adjustment are required Narrower operating window	Same as regular BOPP No change in process parameters including on converting machines	
Haze	**<3**	**2**	

ECONOMICAL COMPARISON			
Average price per Kg	**4.5 €**	**3.00 €**	
Average price per 100m2 (base 30µ)	**16.74 €**	**8.19 €**	**SUPERECO is 50% less expensive than PLA**
Transport cost		**SUPERECO, with same thickness has 36% weight advantage versus PLA, therefore for transport of both virgin films to converter and from converter to end user will be at least 30% more; those cots should be also to Eco assessment!**	