



MICRO POWDERS, INC.

ECOSCRUB and ECOSOFT BULLETIN

(Polylactic Acid Based Products)

INTRODUCTION

Ecoscrub® and Ecosoft® products are high molecular weight, high density powders. They are produced from 100% biodegradable polylactic acid polymers that are naturally derived from annually renewable resources. The Ecoscrub grades are designed for use as non-irritating scrub and exfoliating agents and they provide the same high performance of polyethylene scrubs. Ecosoft products are finely micronized powders designed to increase slip as well as enhance the texture of cosmetic and personal care formulations. These high density products provide the same high performance of polyethylene powders but are derived from a biodegradable and ecofriendly “green” polymer.

POLYLACTIC ACID BACKGROUND

Polylactic acid is a sustainable alternative to petrochemical derived products. It has been commonly used in many applications including food packaging, disposable utensils, biodegradable plastic cups, biomedical applications such as sutures, stents and drug delivery devices, disposable garments and upholstery. Ecoscrub and Ecosoft products are the first use of PLA in the cosmetic industry as a raw material in micronized form (Patent Pending.)

Polylactic acid is a thermoplastic aliphatic polyester derived from renewable resources such as corn starch through the following process:

- Lactic acid is derived from the bacterial fermentation of corn starch
- Lactic acid is catalytically converted to cyclic lactide monomer
- Polymerized using catalyst and heat
- Produces a high molecular weight bioplastic

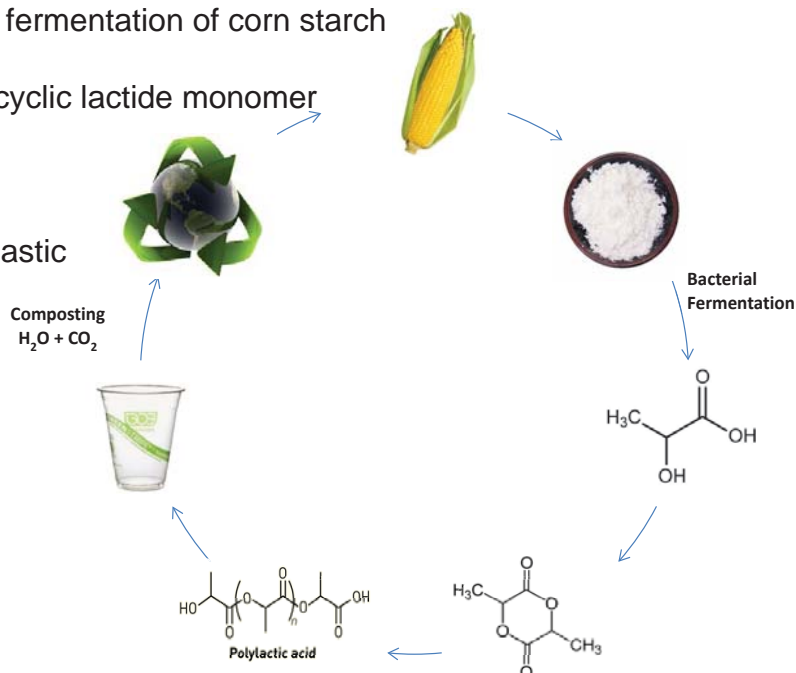


Fig A. - Life Cycle Process of PLA

BIODEGRADABILITY

Regulatory guidelines and standards revolve around four basic criteria: material characteristics, biodegradation, disintegration and ecotoxicity. Descriptions of the requirements can be found in the following geographic regulations:

- DIN V 54900-1 (Germany)
- EN 13432 (EU)
- ASTM D6400 (USA)
- GreenPla (Japan)

Both Ecoscrub and Ecosoft products meet the requirements of the above listed standards.

PLA REGULATORY

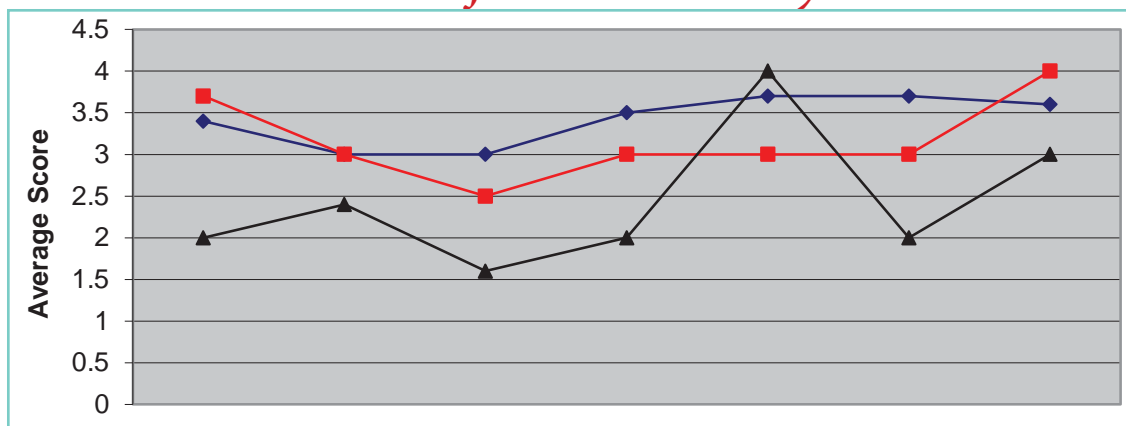
- 1) Toxicity Studies
 - Long Term Toxicity – Did not cause skin allergic reactions in skin sensitization studies.
 - Acute Toxicity: There were no target organ effects noted following ingestion or dermal exposure in animal studies.
 - Skin: LD50/dermal/rabbit > 2000 mg/kg
 - Ingestion: LD50/oral/rat > 5000 mg/kg
- 2) No Free Monomer
- 3) FDA regulations: Conform to FDA regulations such as 21 CFR 175.300. Permitted component of food packaging materials pursuant to section 201(s) of the Federal Drug and Cosmetic Act and Parts 182, 184 and 186 of the Food Additive regulations.

LAB STUDIES

ECOSCRUB STUDY

Polyethylene has historically provided a source of highly effective and economical exfoliating that is non-irritating to the skin. The data below demonstrates that the Ecoscrub polylactic acid is a viable green alternative to the widely used polyethylene scrubs.

Exfoliant Panel Study



Participants were asked to evaluate each sample and rate them in 7 categories on a scale of 1 to 5, with 5 being excellent and 1 being poor. The panel study indicated that the Ecoscrub polylactic acid

- ◆ Ecoscrub 50PC (PLA)
- Microscrub 50PC (Polyethylene)
- ▲ Control

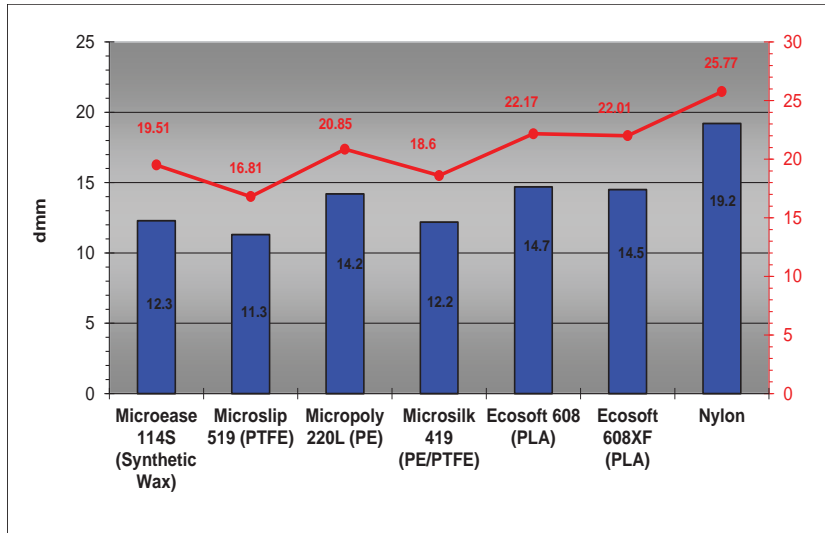
and Microscrub polyethylene exfoliants had similar effects. Polylactic acid is a biodegradable thermoplastic derived from renewable resources with similar properties to polyethylene. It is considered to be a sustainable alternative to petrochemical-derived products. The panel study

results support polylactic acid as an effective alternative to polyethylene based scrub agents.

ECOSOFT STUDY FOR PRESSED POWDERS

The data presented below illustrates their effectiveness as binders in pressed powder formulas as well as for improved texture in creams and lotions.

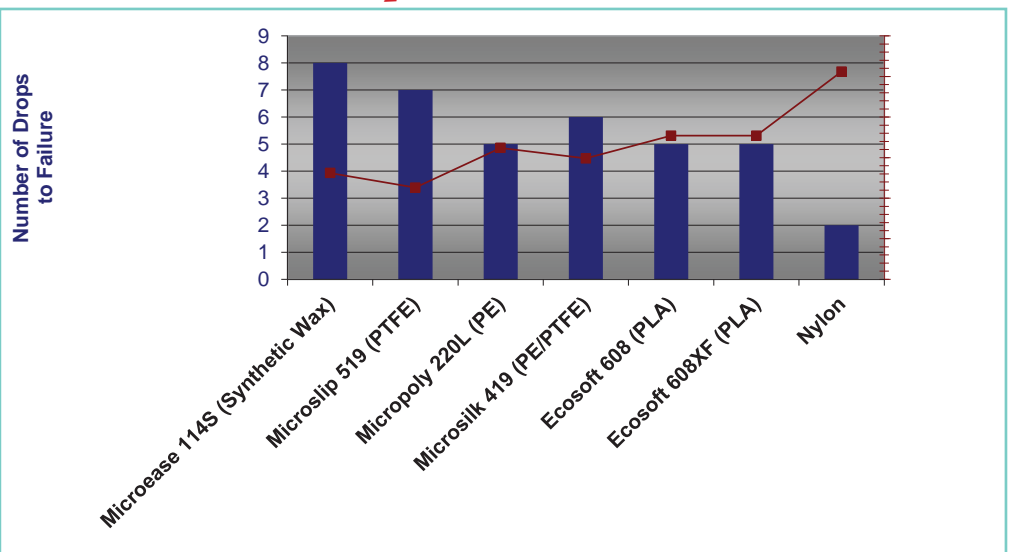
Penetration and Payoff



ASTM D-1321 was used to measure needle penetration with a penetrometer in order to demonstrate which powders are effective binders without creating an extremely hard cake. The Ecosoft 608 and 608XF had comparable results to the Micropoly 220L polyethylene powder. The samples were evaluated for pay-off using a BYK-Gardner Color Guide 45/0 Spectrophotometer. The $\Delta E_{l,a,b}$ of the coated sub-

strate compared to the uncoated substrate was measured to quantify the "pay-off". The Ecosoft samples had a high amount of "pay-off" with acceptable penetration values similar to polyethylene allowing it to maintain its durability. The impact resistance values further support this conclusion.

Impact Resistance

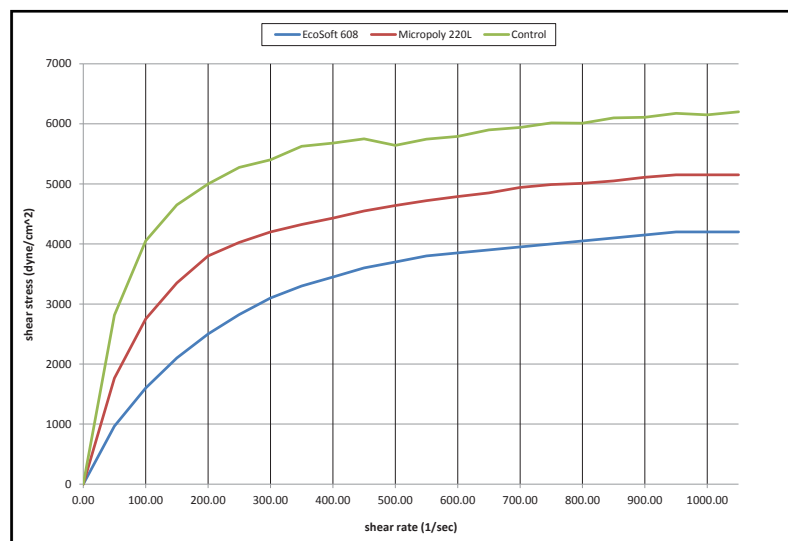


Drop tests were performed at a height of 30 cm on a hard rubber mat. The number of drops to failure are reported. The percent weight loss was recorded by weighing samples before and after failure. The impact resistance of the Ecosoft PLA samples were equal to that of the Micropoly 220L polyethylene powder. The result of 5 drops

to failure is considered to be an acceptable result. The Ecosoft samples had an effective combination of hardness, impact resistance and payoff.

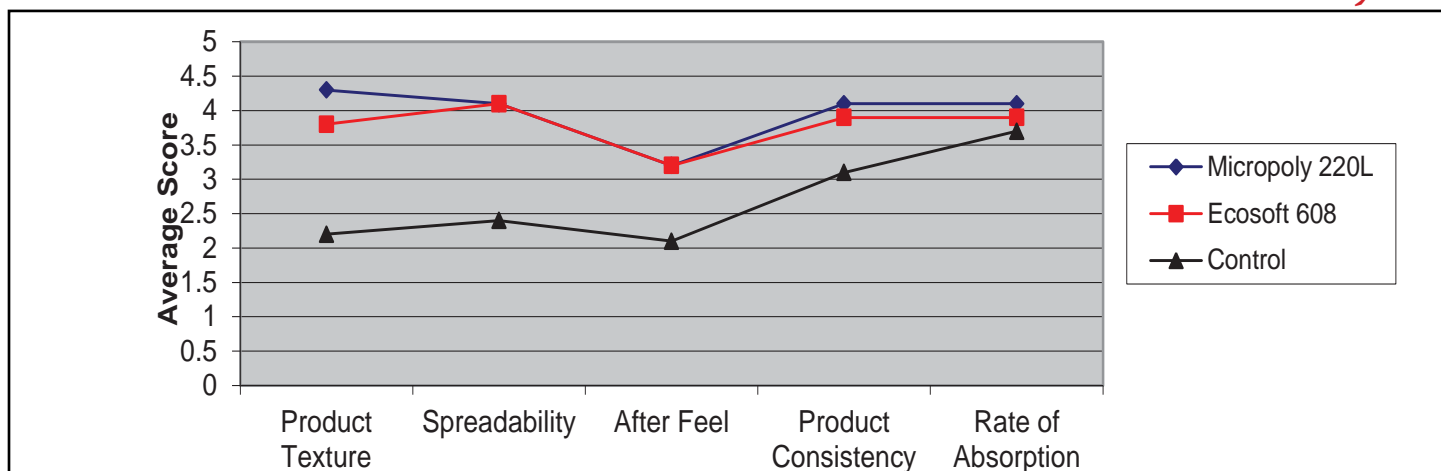
ECOSOFT STUDY FOR CREAMS & LOTIONS

Shear Stress Curve Hand Cream Chart Study



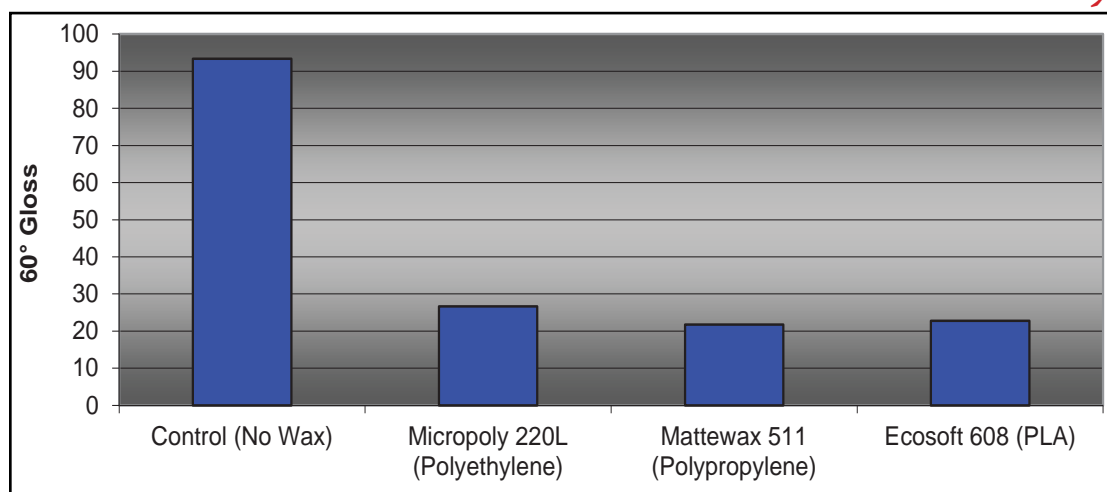
The shear stress curves represent the yield point in flow or stability of the three hand creams. It also represents the behavior of the "first break" as it is rubbed onto the skin. The yield point in flow and break is similar for all three formulas. The three formulas are stable and similar in chemical structure even at elevated temperatures. The inconsistency in the slope of the control samples designates it as the least stable of the three. The control and Micropoly 220L polyethylene curves will also have more resistance at initial break on the skin. Therefore they will feel heavier and have more drag than the EcoSoft 608 PLA. The EcoSoft 608 has a better flow and will have a better spread on the skin.

Hand Cream Panel Study



Participants were asked to evaluate each sample and rate them in 5 categories on a scale of 1 to 5, with 5 being excellent and 1 being poor. The panel study results indicated that the PLA and polyethylene had very similar effects. Both products greatly improved the texture, spreadability and after feel of the hand cream.

Gloss Study



EcoSoft 608 can also be used as an effective matting agent. Polypropylene has been established as an effective matting agent. The data listed in Fig. 5 demonstrates that the polylactic acid powder is an effective alternative to polypropylene when matte properties are desired.

ECOSCRUB TYPICAL PROPERTIES

PROPERTIES	TEST METHOD	*ECOSCRUB 1435PC	*ECOSCRUB 20PC	*ECOSCRUB 50PC
Composition (INCI Name)	IR	Polylactic Acid	Polylactic Acid	Polylactic Acid
CAS No(s).		9051-89-2	9051-89-2	9051-89-2
EINECS No(s).		618-575-7	618-575-7	618-575-7
Appearance	Visual	White Powder	White Powder	White Powder
Odor		Wax-Like Odor	Wax-Like Odor	Wax-Like Odor
Melting Point (°F) Melting Point (°C)	ASTM D4591 ASTM D4591	284-302 140-150	284-302 140-150	284-302 140-150
Density @25°C (g/cc)	ASTM D 792	1.23-1.25	1.23-1.25	1.23-1.25
Particle Size Analysis Mesh Size - Maximum Maximum Particle Size (microns)	ASTM E11	14 1410	20 840	50 297

PROPERTIES	TEST METHOD	*ECOSCRUB 100PC	ECOBBLUE 5025	ECOGREEN 5025
Composition (INCI Name)	IR	Polylactic Acid	Polylactic Acid Ultramarines	Polylactic Acid Ultramarines Iron Oxides
CAS No(s).		9051-89-2	9051-89-2 57455-37-5	9051-89-2 57455-37-5 20344-49-4
EINECS No(s).		618-575-7	618-575-7 611-533-9	618-575-7 611-533-9 243-746-4
Appearance	Visual	White Powder	Blue Powder	Green Powder
Odor		Wax-Like Odor	Wax-Like Odor	Wax-Like Odor
Melting Point (°F) Melting Point (°C)	ASTM D4591 ASTM D4591	284-302 140-150	284-302 140-150	284-302 140-150
Density @25°C (g/cc)	ASTM D 792	1.23-1.25	1.23-1.25	1.23-1.25
Particle Size Analysis Mesh Size - Maximum Maximum Particle Size (microns)	ASTM E11	100 150	50 297	50 297

REGULATORY INFORMATION

TSCA Registered

Heavy Metals: Pb < 20.0 ppm As < 3.0 ppm

Conforms to CONEG Regulations

* Ecocert Approved

ECOSOFT TYPICAL PROPERTIES

PROPERTIES	TEST METHOD	ECOSOFT 608	ECOSOFT 608XF	ECOSOFT 611
Composition (INCI Name)	IR	Polylactic Acid	Polylactic Acid	Polylactic Acid Copernicia Cerifera (Carnauba) Wax
CAS No(s).		9051-89-2	9051-89-2	9051-89-2 8015-86-9
EINECS No(s).		618-575-7	618-575-7	618-575-7 232-399-4
Appearance	Visual	White Powder	White Powder	Slightly Yellow Powder
Odor		Odorless	Odorless	Wax-Like Odor
Melting Point (°F) Melting Point (°C)	ASTM D 4591 ASTM D 4591	284-302 140-150	284-302 140-150	284-302 140-150
Density @25°C (g/cc)	ASTM D 792	1.23-1.25	1.23-1.25	1.09-1.11
Particle Size Analysis (Microtrac) Mean Particle size (microns)	ASTM D 4464	16.0-20.0	8.0-12.0	8.0-12.0

REGULATORY INFORMATION

TSCA Registered

Heavy Metals: Pb < 20.0 ppm As < 3.0 ppm

Conforms to CONEG Regulations

Ecocert Approved

Turn to **MICRO POWDERS** for your “green” solutions.

*Eco-Friendly Biodegradable Polymers
for Exfoliants and Fine Powders*



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