X EDIZIONE

SMART PLASTICS
'TECNOPOLIMERI A CONVEGNO'

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MUSEO STORICO ALFA ROMEO

IL RISVEGLIO DEL PHA: IL GIGANTE CHE RIVOLUZIONERÀ IL MONDO DEI BIOPOLIMERI

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GREEN POLYMERS: BIOPLASTICS

BIO PLASTICS, as stated by European Bioplastics, is a term to describe two types of plastic that are completely different from each other:

1. Plastics based on renewable sources (the focus is the origin of the material being used)
2. Bio-degradable and compostable plastics in compliance with EN 13432 or ASTM D 6400 or similar standards (the focus is the compostability of the final product).

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1) MEANING OF «BIOPLASTIC» BIOBASED

Bio-based plastics use biomass as a raw material instead of oil or gas. If they are burned after use, the CO2 that develops is again converted into biomass by photosynthesis.

Therefore they are eco-friendly based on the concept of "carbon neutrality". It doesn't matter if they are biodegradable or not**. The basic concept is the ORIGIN of the raw material.**

BIO-BASED = from fossil oil

to renewable sources.

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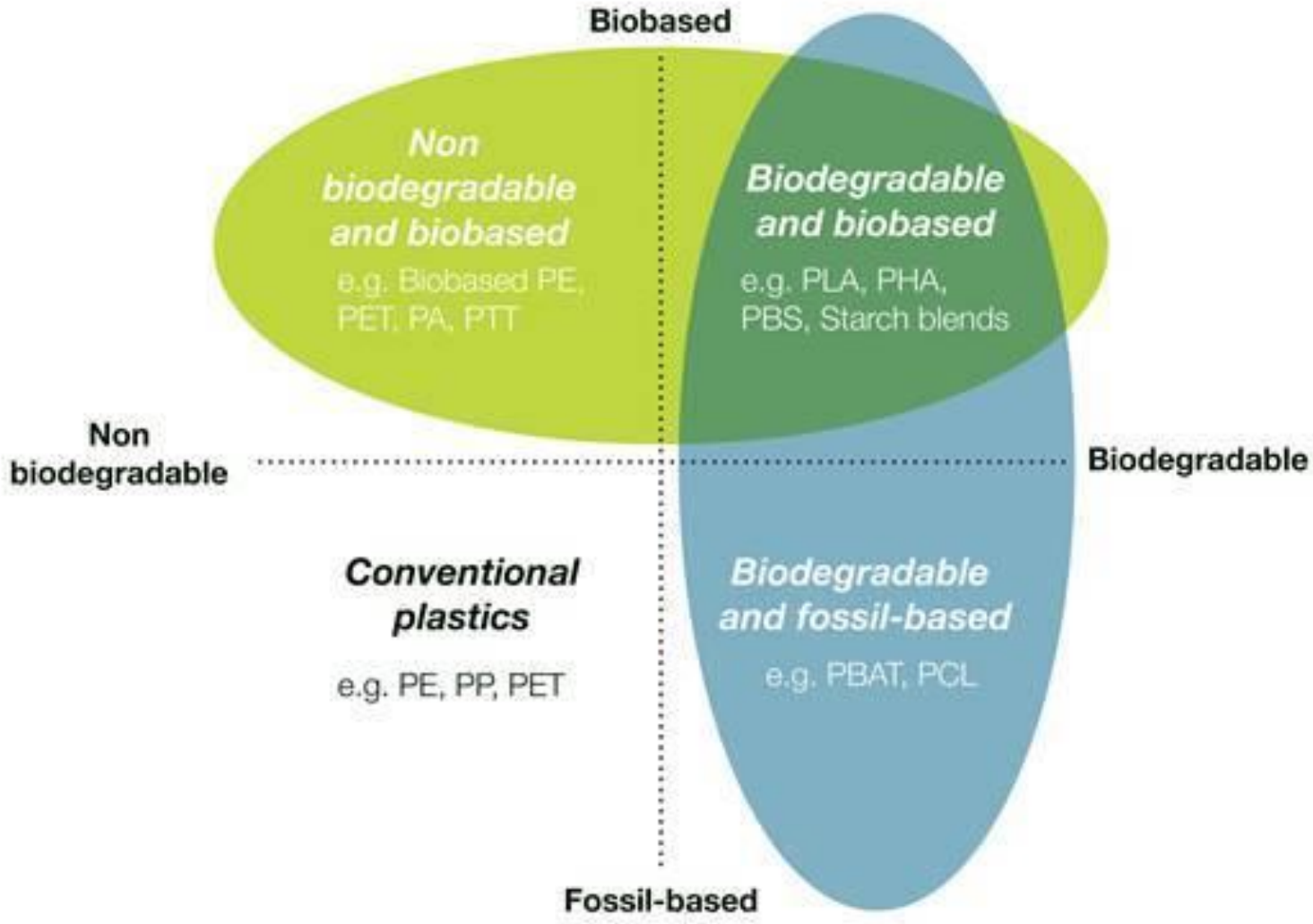
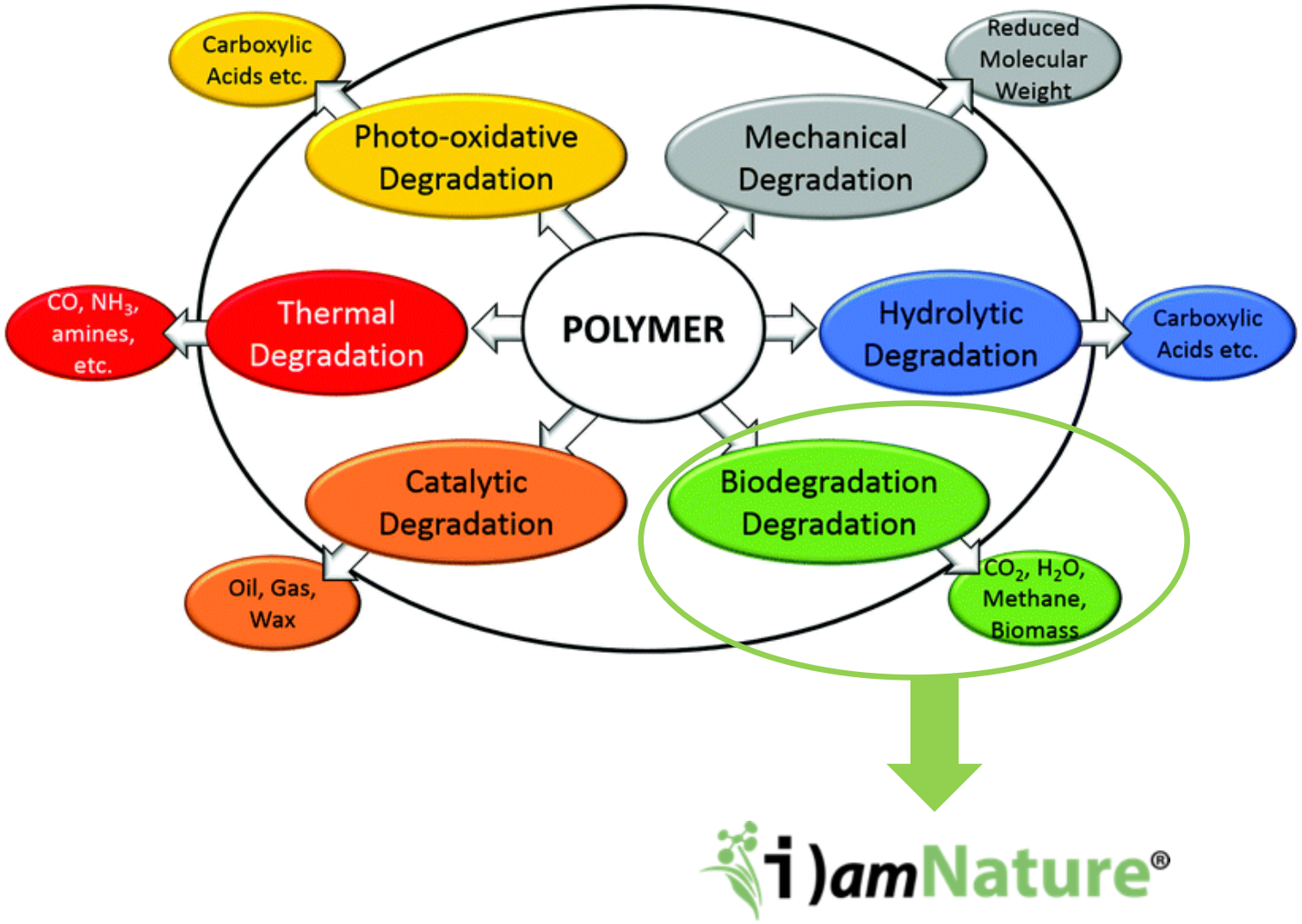
2) MEANING OF «BIOPLASTIC» BIODEGRADABLE

BIODEGRADABLE = plastics end-of-life

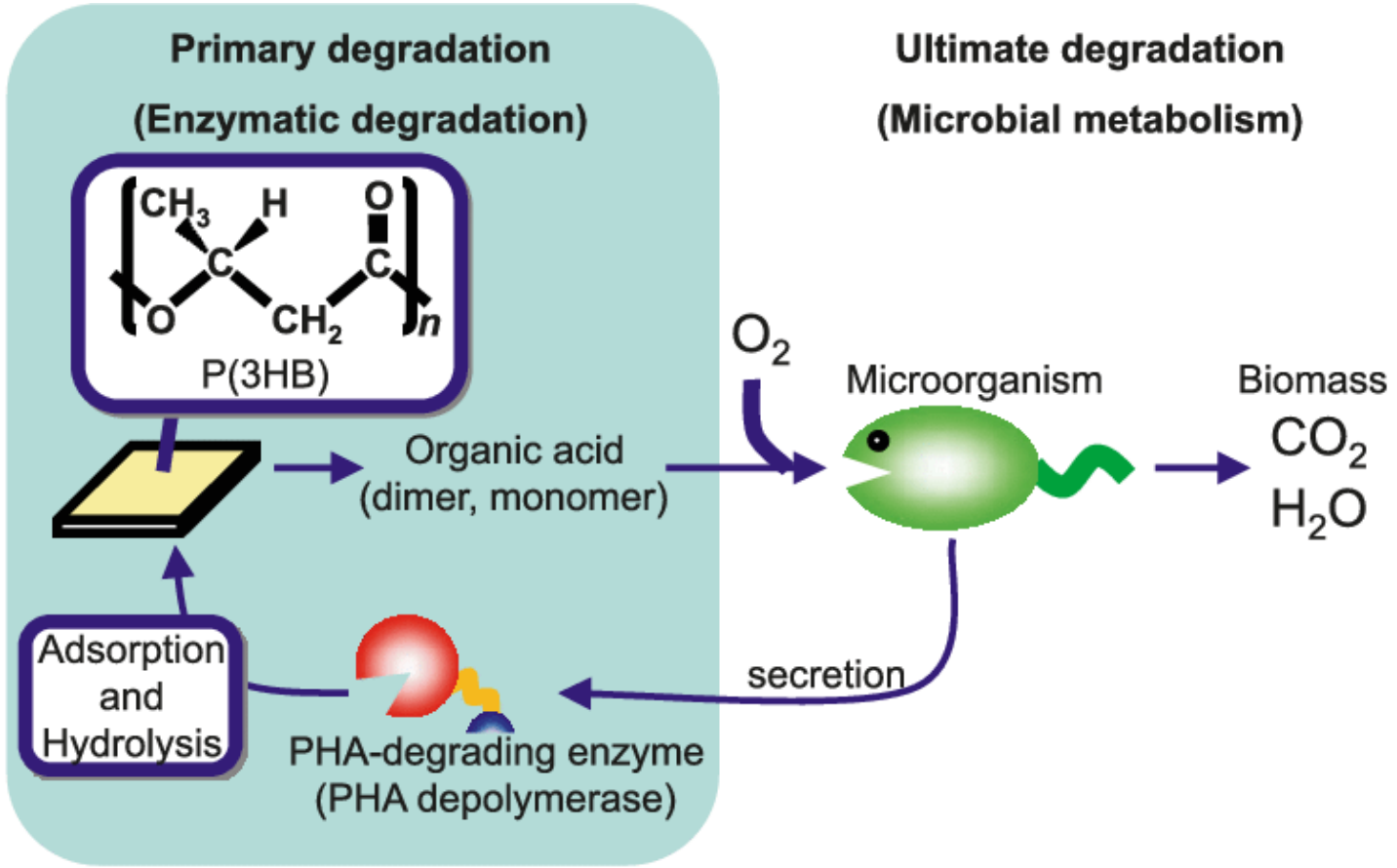
BIOPLASTICS FAMILIES



MEANING OF «DEGRADATION»



PROCESS OF «DEGRADATION»



GREEN POLYMERS: BIOPLASTIC FAMILIES

We have 3 families of materials:

- **KIOS : BIO BASED, f**rom renewable sources, partially or entirely, but **NOT BIODEGRADABLE.**
- **ORIOS:** From **fossil resources,** but **BIODEGRADABLE.**
- **BIOS : BIO BASED, f**rom renewable sources, partially or entirely, and **BIODEGRADABLE.**

BIOS

- **BIOS B1 - B2**
  Polymers produced by a classic chemical synthesis using monomers from renewable sources. PLA polylactic acid is a thermoplastic bio polyester polymerized by lactic acid. The monomers themselves can be produced via fermentation and distillation of starch-based raw material, mainly corn.

- **BIOS B3**
  Polymers directly extracted/removed from biomass: they differ in their origin and restructuring process. For example we have derived from starch or corn waste or potato peel, or from cereals without prior extraction of starch etc etc.

- **BIOS B5 - B6**
  Polymers produced by genetically modified microorganisms or bacteria. They consist mainly of polyhydroxyalkakaates (PHA, linear polyesters produced in nature by the bacterial fermentation of sugar or lipids).
  WE ARE SPECIALIZED IN THE DEVELOPMENT OF THIS FAMILY.

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POLYHYDROXYALKANOATES: PLASTIC THE WAY NATURE INTENDED?

INDUSTRIAL AND ENERGY

THE SLEEPING GIANT: PHA

(Cambridge Consultants)

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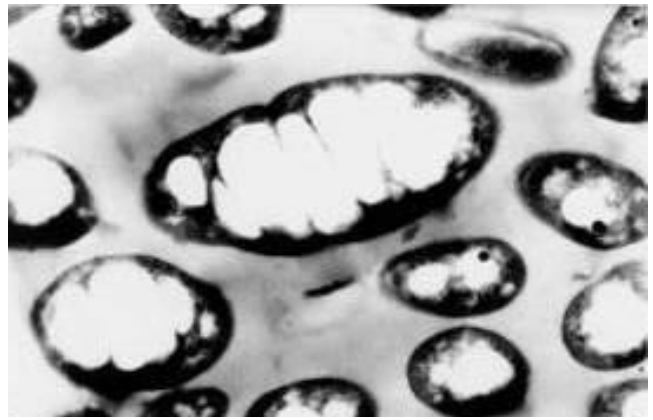
WHERE DOES PHA COME FROM?

The main basic polymer comes from the fermentation of some bacteria. The bacterial culture gets quickly multiplied with appropriate nourishment and this creates macromolecules that bacteria accumulate as a backup carbon source, becoming a sort of ‘inner fat’ of the bacterium (white part of the photo).

Once the bacterial population has reached a good biomass, the composition of the nourishment changes so that the microorganism can synthetize and accumulate PHA.



THIS SYNTHESISED FAT IS A REAL POLYESTER THAT GETS EXTRACTED AND REPRESENTS THE BASIC POLYMER OF OUR COMPOUNDS.

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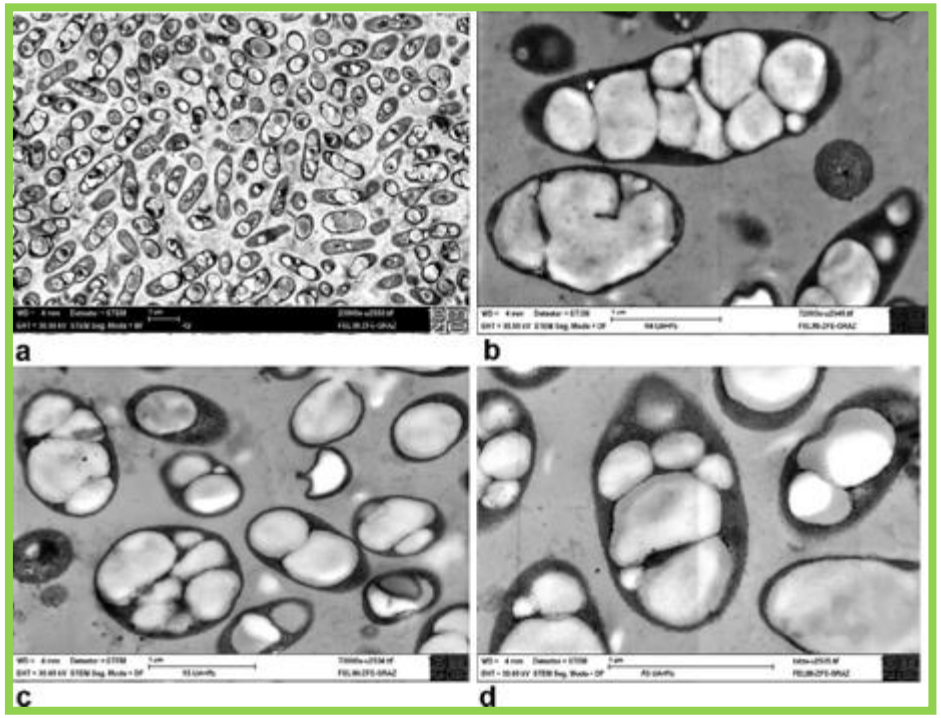
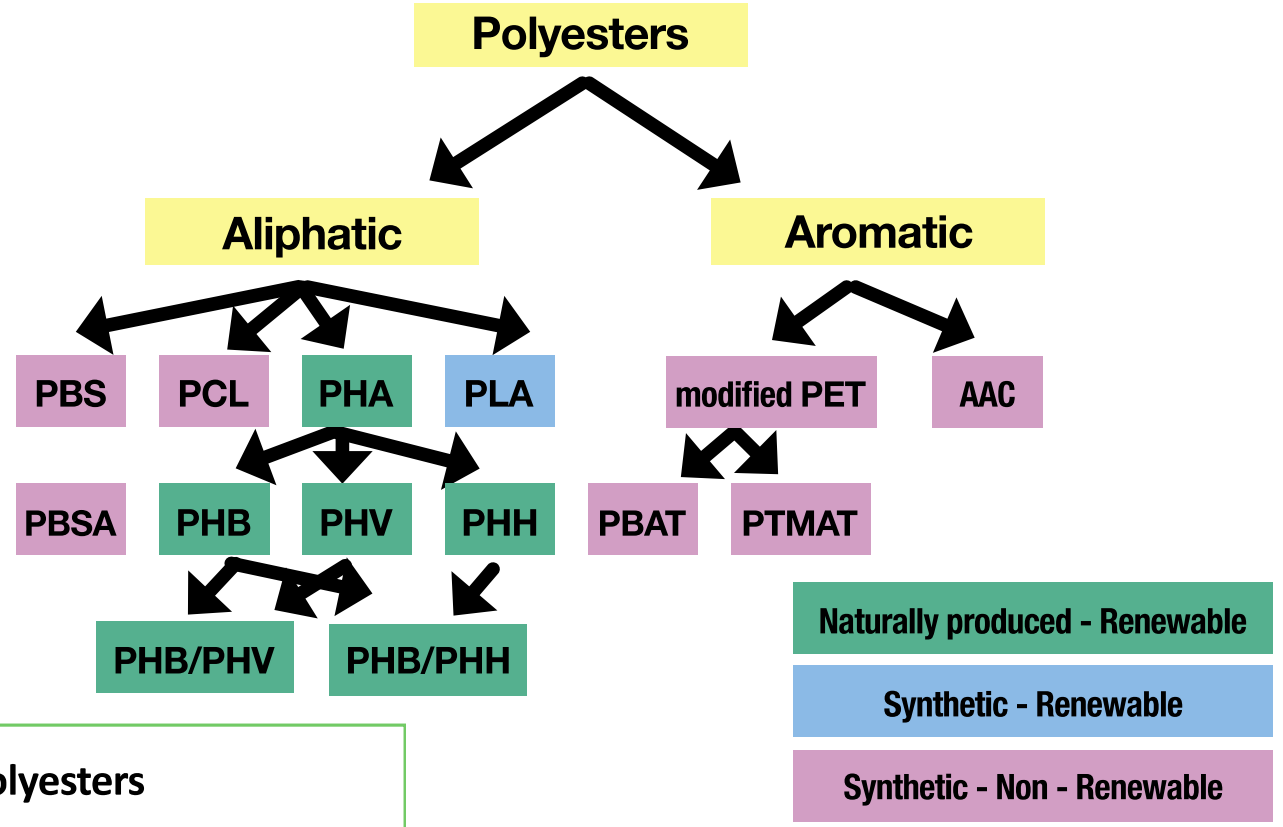
WHERE DOES PHA COME FROM?

- **The PHA-family is produced via direct biosynthesis in microorganisms.**
- After the **fermentation** the microorganisms consist out of **up to 80 % polyester.**
- By using solvents, the accumulated **polyester is extracted and purified** for further processing.
- **PHA has the specific property of biodegrade either in aerobic and in anaerobic conditions**, practically in any controlled and uncontrolled envinroment.



PHA IS A POLYESTER



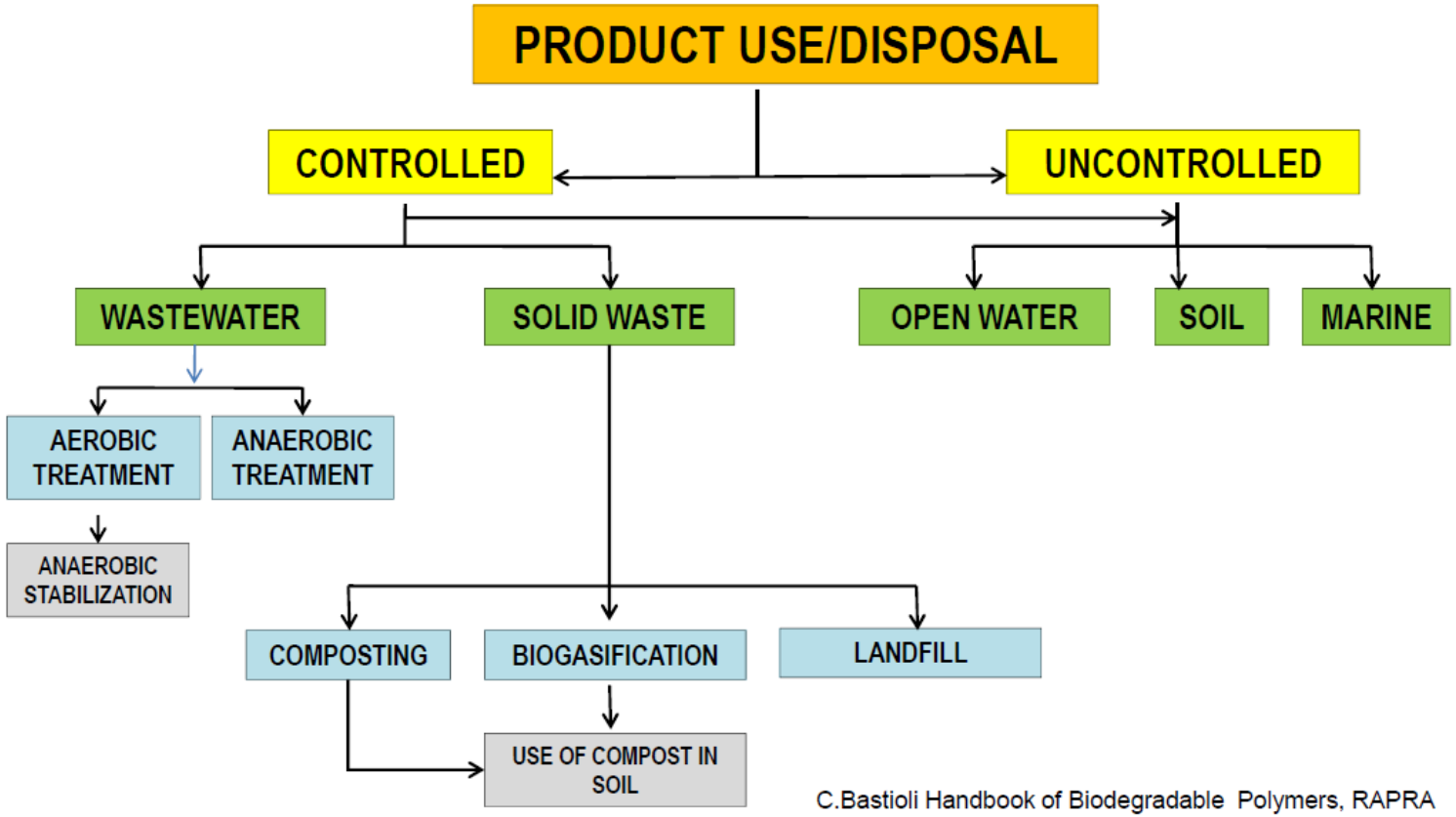
Polyesters

All these polymers are part of the polyester family that includes:

- products of natural origin and by renewable sources
- synthetic products but by renewable sources
- oil based synthetic products but biodegradable

IamNature® from natural origin and by renewable sources!

WHERE DEGRADATION HAPPENS?



C.Bastioli Handbook of Biodegradable Polymers, RAPRA

IamNature® IS BIODEGRADABLE IN ALL CONDITIONS

VARIOUS END-OF-LIFE OPTIONS:

HOME COMPOSTING

Temperature 28°C,
90% biodegradation within
a maximum of 12 months (Certification
TÜV AUSTRIA OK compost HOME; DIN
Certco DIN-Geprüft Home
Compostable)

LANDFILL

No standard specifications or
certification scheme available,
since this is not a preferred
end-of-life option

ANAEROBIC DIGESTION

Termophilic 52°C / mesophilic 37°C;
standard specification not yet
available, but 90% generally
considered as completely
biodegradable

INDUSTRIAL COMPOSTING

Temperature 58°C,
90% biodegradation within
a maximum of 6 months
(Standard: EN 13432)

MARINE ENVIRONMENT

Temperature 30°C,
90% biodegradation within
a maximum of 6 months
(Certification: TÜV AUSTRIA OK
biodegradable MARINE (ISO under
preparation))

FRESH WATER

Temperature 21°C,
90% biodegradation within
a maximum of 56 days
(Certification: TÜV AUSTRIA OK
biodegradable WATER)

SOIL

Temperature 25°C,
90% biodegradation within
a maximum of 2 years
(Certification: TÜV AUSTRIA OK
biodegradable SOIL; DIN Certco
DIN-Geprüft biodegradable in soil)

IamNature® IS BIODEGRADABLE IN ALL CONDITIONS

COMPARING MATERIALS IN THE VARIOUS ENVIRONMENTS OF DEGRADATION:

	Marine environment	Fresh water	Soil	Home composting	Landfill	Anaerobic digestion	Industrial composting
PHA	○	○	○	○	○	○	○
Starch and other natural Polymers	○	○	○	○	○	○	○
Cellulose (Lignin <5%)	○	○	○	○	○	○	○
Cellulose Acetate and others Derivatives	◌	◌	◌	◌	◌	◌	◌
Lignin Wood	◌	◌	◌	◌	◌	◌	◌
PBSA	×	×	○	○	×	×	○
PBAT	×	×	◌	◌	×	×	○
PBS	×	×	×	×	×	×	○
PLA	×	×	×	×	×	◌	○

○ proven biodegradability ◌ proven biodegradabilityunder certain conditions or for certain grades × biodegradability not proven

Degradation is very limited by the thickness of the components and generally bioplastics are tested for the normal thicknesses used in films, up to 100µ.

Instead IamNature® even disintegrates at 3mm thick.

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bio-on
THE MAIP GROUP FOR THE RELAUNCH OF AN ITALIAN EXCELLENCE
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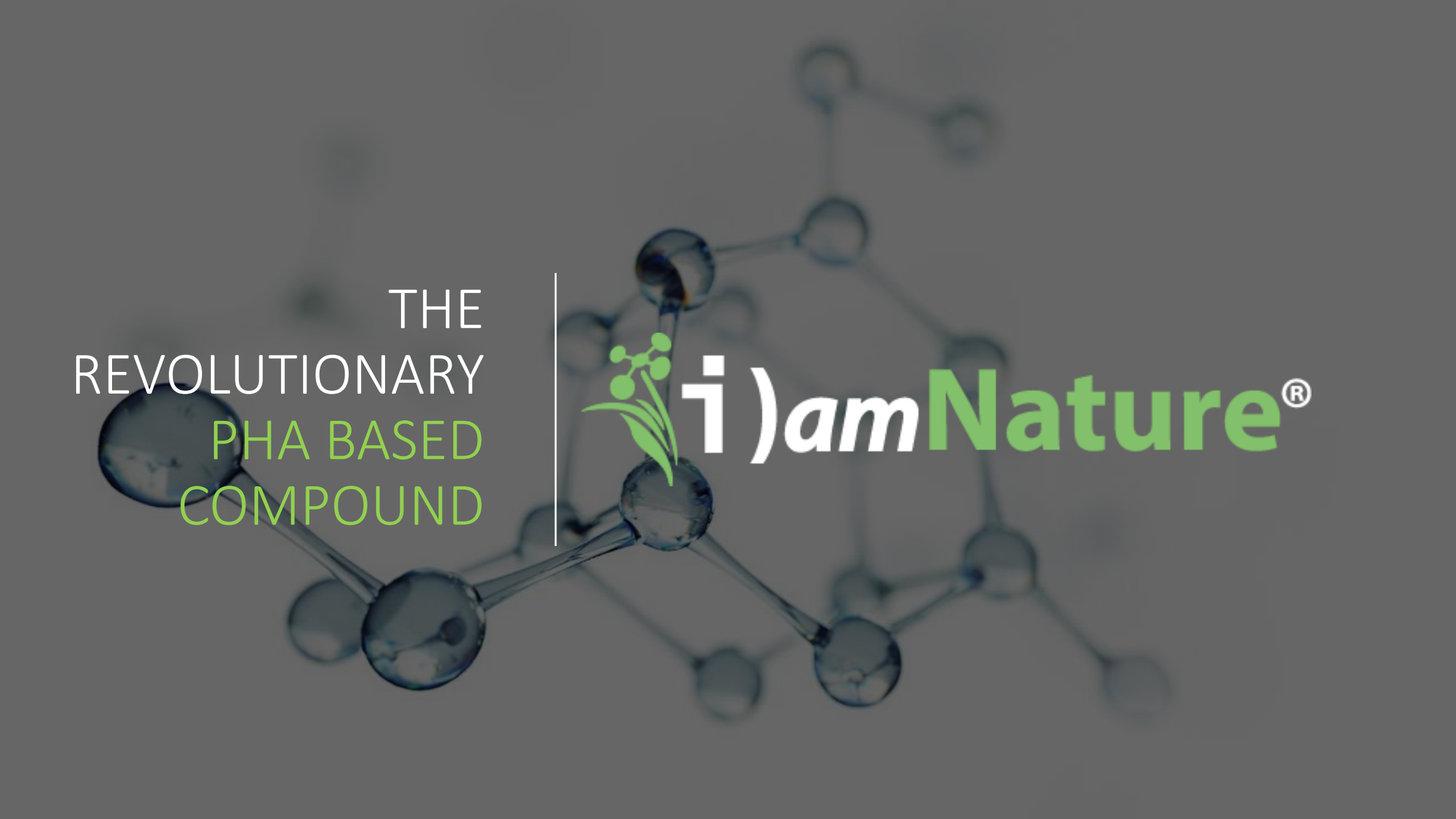
THE REVOLUTIONARY PHA BASED COMPOUND



i)amNature®

IamNature®
IS A NATURAL COMPOUND

All formulation have this composition:

- **BIOPOLYMER**

- PHA

- Mix of PHA:
  PHA + PLA, o PBS, PBSA, PBAT, PCL etc.

- **VEGETAL FIBERS AND FILLERS**

- Vegetable fibers (jute, hemp, linen etc)

- Vegetable fillers (corn, peels, coffee etc)

- **MINERAL FILLERS**

- Minerals from extraction

- Minerals from renewable sources

- **NATURAL ADDITIVES**

- Plasticizers (glycerin, sorbitol etc)

- Release agents (vegetable waxes)

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THE FEATURES OF IamNature®

Specific formulations have been studied to meet particular requests of the customers, such as higher UV resistance, higher resilience, water resistance etc.

In particular, we have studied some specific grades with higher scratch resistance, combined with very good tactile experience.

- **> 500 different formulations PHA based**
- **Shrinkage from 0,3% to 1,8%**
- **Elastic modulus from 300 Mpa to 6.000 Mpa**
- **Thermal resistance until 130°C**
- **Improved barrier properties**
- **Weather and UV resistance**

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BIOPLASTICS AWARD

- The Maip Group won the prestigious BIOPLASTICS AWARD in Berlin, during the European Bioplastics Conference.
- **IamNature® was selected from among 5 finalists, by an international jury from America, Europe and Asia.** The 100% Italian victory is the result of a **collaboration between MAIP, the printer (SP PLAST) and the end user (ABB).**

APPLICATIONS

- PHA is NOT a thermoplastic, but it allows the use of several plastic technologies.
- We supply specific grades for injection, extrusion, spinning, 3D printing, rotational molding…

THE MATERIAL OF THE FUTURE: IamNature®

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APPLICATIONS: Furniture

RAL 9005
RAL 9003
NCS-S-6502-B
NCS-S-4005-Y20R
NCS 2005-Y20R
RAL 3009
NCS-5030-Y70R
NCS-3010-G30Y
NCS-2010-R90B
NCS-4020-Y20R

COMPETITOR: POLYPROPYLENE GLASS FIBERS

IamNature® Advantages:

- The biggest BIO Component ever molded in the world: 12 kg each molding
- Special additive package to allow a molding in a 2.500 tons injection molding press with long residence time.
- Several colors

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THE REVOLUTIONARY & FIRST BIO-TECHNOPOLYMER

i)amNature®

NEW PATENT Pending:
NET formulae

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APPLICATIONS: NETS

- Excellent elongation at break
- Same production plant suitable for polyolefines
- Biodegradable in controlled and uncontrolled ambient

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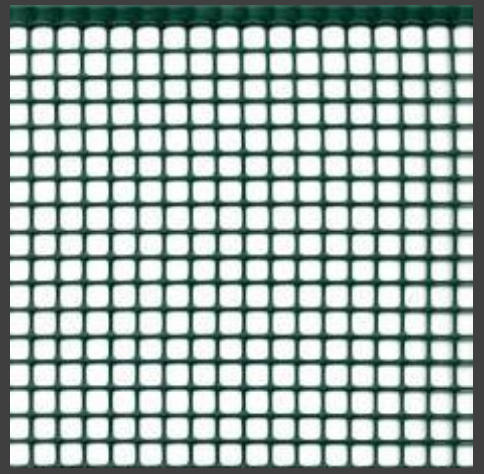
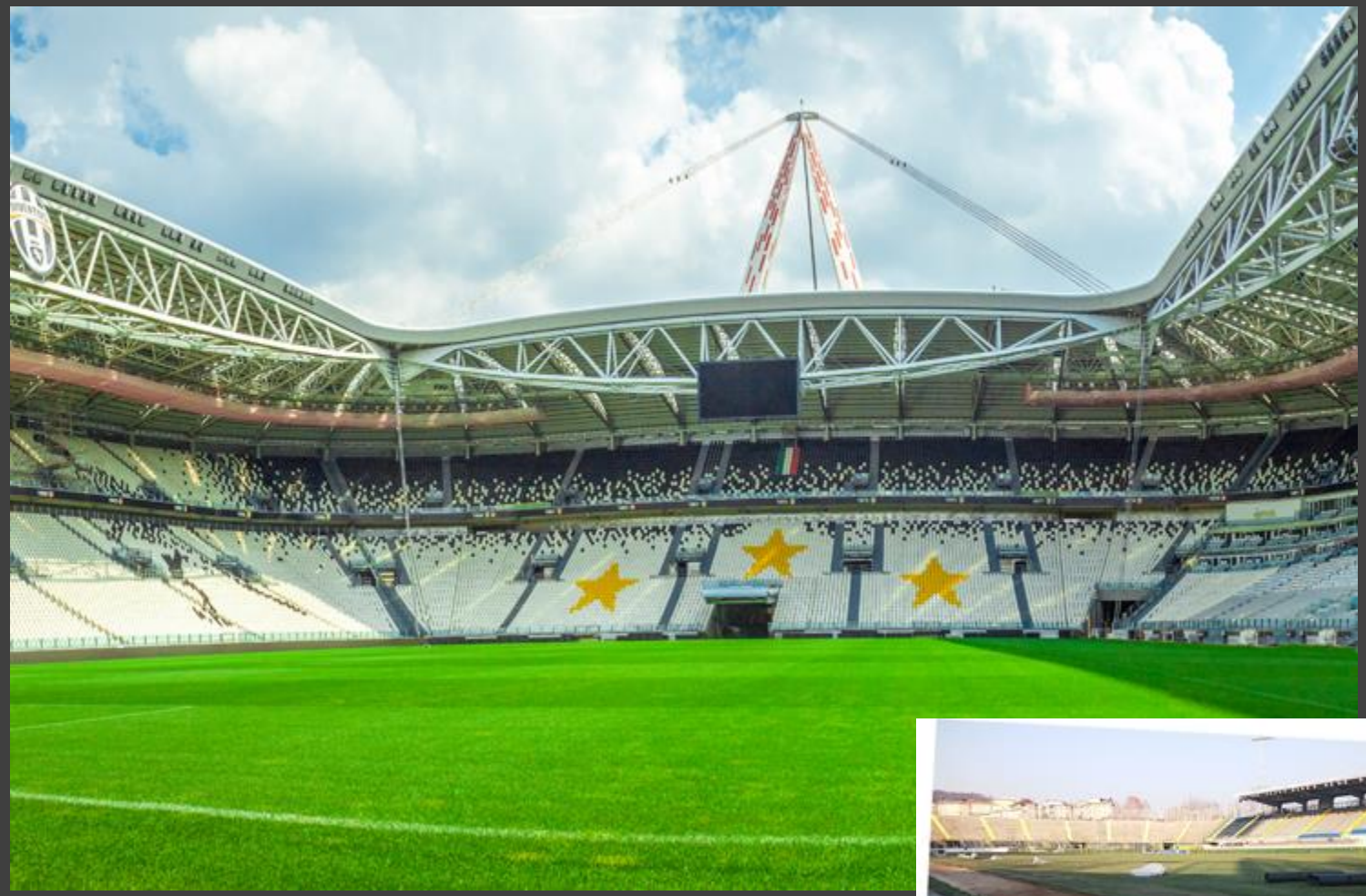


APPLICATIONS: Nets

APPLICATION



The whole turf of a football field costs about 600.000 €…..


GRUPPO
MAIP
PLASTIC FROM THE FUTURE