

ECOBIOFOR

ECOpaint **BIO**-based FORmulations

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Solvents

almost **28 million metric tons** in 2012

Volatile petrochemical
compounds

Price fluctuation

growing concern on the
environmental impact

**Key driving factors
for global bio
solvents market**

life cycle of paints

In Europe, the **paint and coating sectors** are the areas where more solvents are consumed in their different formulations (50-70 wt. %)

European Directives
promote the
development of
greener solutions
and **resource
efficiency**

Bio-Solvents

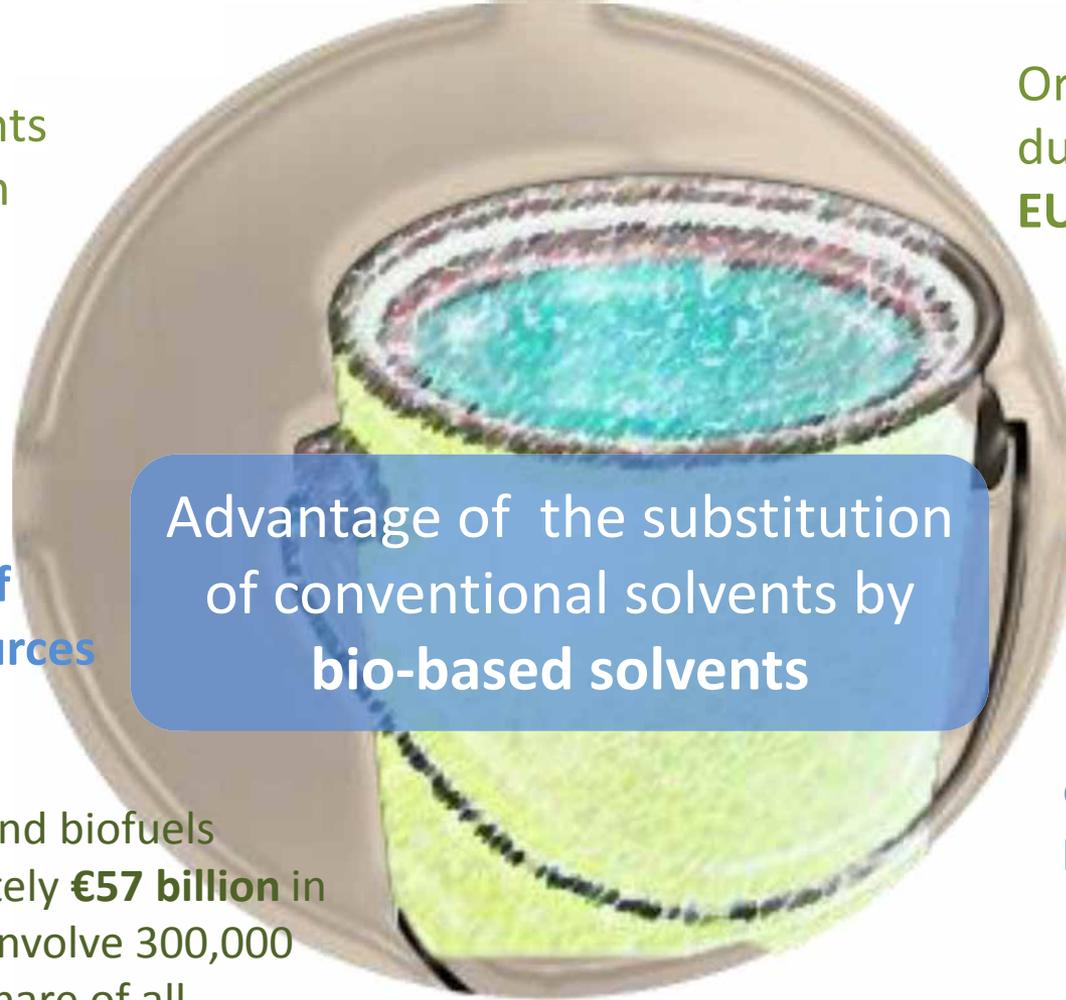
Estimated annual growth of **4.8%**
up to **1.1 million metric tons** by **2020**

Known green solvents
mainly derived from
bio-resources

Produced from
**renewable
building blocks**

**Replacement of
petrochemicals sources**

Bio-based products and biofuels
represent approximately **€57 billion** in
annual revenue and involve 300,000
jobs. The bio-based share of all
chemical will rise **22% by 2020**, with a
compounded annual growth rate of
close to 20%.



Advantage of the substitution
of conventional solvents by
bio-based solvents

Or developed
during **SOLVSAFE
EU project**

They can be
**biodegradable,
easy to recycle and
non-carcinogenic**

Not dependent
on the **petroleum
price fluctuation**

**Reduction on
carbon footprint**

**Optimizing the prices of
process methodology**

Boosting the transition of European solvent, paints and coatings industry from petrochemicals to bio-based products.

1
To **synthesize** the **most commonly** used **solvents** in the paint/coating industry by using synthons **from biomass**

2
To **develop** and **optimize** the **enzymatic synthesis** of reactive solvents to replace aromatic and aliphatic solvents in oxidative drying paints

3
To **validate** bio-based solvents **in coatings**



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Raw materials

Process Technology

Solvents

Final product

Petrochemicals



Refinery



Conventional solvents



Paints and coatings

NEW APPROACH



BIOMASS



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Solvents for coatings with 3 characteristics:

- ✓ **Bio-based** (derived from renewable resources),
- ✓ Synthesized according to **Green Chemistry Principles**,
- ✓ New formulations with **lower VOC emissions**



Advantages of the substitution of conventional solvents by bio-based solvents:

- They are produced from **renewable building blocks**.
- Replacement of solvents from **petrochemicals sources**. Carbon footprint is reduced.
- They can be biodegradable, easy to recycle and non-carcinogenic.
- **Optimizing the prices of process methodology**. No depending on the petroleum price fluctuation.





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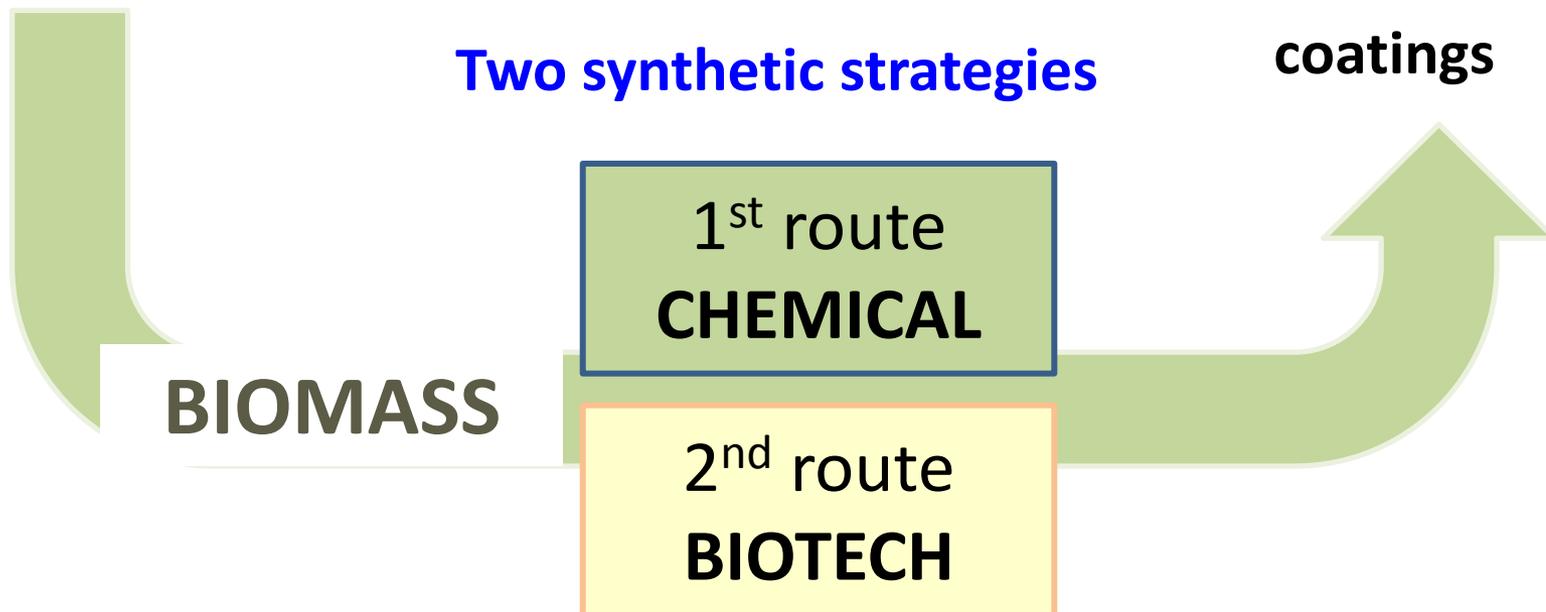
Solvents for coatings with 3 characteristics:

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Paints and coatings

Two synthetic strategies



Raw materials

Process Technology

Solvents

Final product

1st route
CHEMICAL

using less toxic and safer starting materials



*Biomass-based
building blocks*

BIOMASS

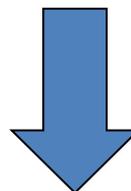
Retrosynthetic analysis



Easier and greener
chemical transformation



*Bio-based solvents (traditional
green versions)*



Acetates

Ketones

Glycol Ethers

**Solvent-
borne
coatings**

**Water-borne
coatings**

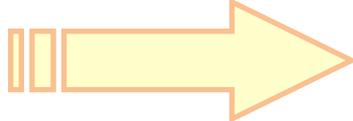
**Paints and
coatings**

2nd route
BIOTECH

Allyl Reactive diluent

Alkyd paints

Enzymatic
transformation



3.5% of harmful petrochemical solvent
has been replaced
by a non-VOC SOLVENT



Vegetable oils



**No additional petrochemical solvent is included at
the paint manufacturer's facilities**

Synthesis

Technical approach

1st route **CHEMICAL**

2nd route **BIOTECH**

WP1

- Coordination & Management

WP2

- Selection of objective molecules and Solvsafe solvents

WP3

- Chemical synthesis of bio-solvents

WP4

- Biotech synthesis of reactive solvents

WP5

- Physical and chemical characterization of biosolvents

WP6

- Validation of bio-based solvents in coatings

WP7

- Revalorisation of co-products

WP8

- Economic feasibility of bio-based solvents

WP9

- Life cycle analysis of bio-based solvents

WP10

- Demonstration activities

WP11

- Exploitation, Dissemination & Training

Results

- The development of **green versions** of some traditional organic solvents, which are very used in coatings :
 - ❖ **Bio-ethyl acetate**
 - ❖ **Bio-butyl acetate**
 - ❖ **Bio-butyl glycol**

- The development of a **new reactive solvent** by **100% biotech** synthesis, to replace aromatic and aliphatic solvents in **oxidative drying paints**:
 - ❖ **Allyl Reactive diluent**



Composition – Useful for

❖ **Bio-ethyl acetate** 99.93% ethyl acetate
0.07% water

Suitable for any SB coatings

❖ **Bio-butyl acetate** 94.2% butyl acetate
0.2% ethyl acetate
5.5% butanol
0.03% water

Suitable for some SB coatings

❖ **Bio-butyl glycol** 90% butyl glycol
4.9% ethyl glycol
4.0% butanol
0.4% BuOBu

**Suitable for any WB coatings
as coalescent**

Assessment of the eco-compatibility GREEN METRICS for bio-acetates

Process	Atom Economy AE (%)	Environmental Factor E-factor	Percentage of Renewable Matter PMR (%)
Petro-acetates Traditional processes	85.01	14.71	0.00
Bio-acetates ECOBIOFOR coproduction process	91.90 Less loss of carbon	0.31 Less waste generated	57.90 Higher bio-based content

All the metrics presented show the **greenness of ECOBIOFOR process**, compared to the traditional ones.



Results

❖ **Allyl Reactive diluent**

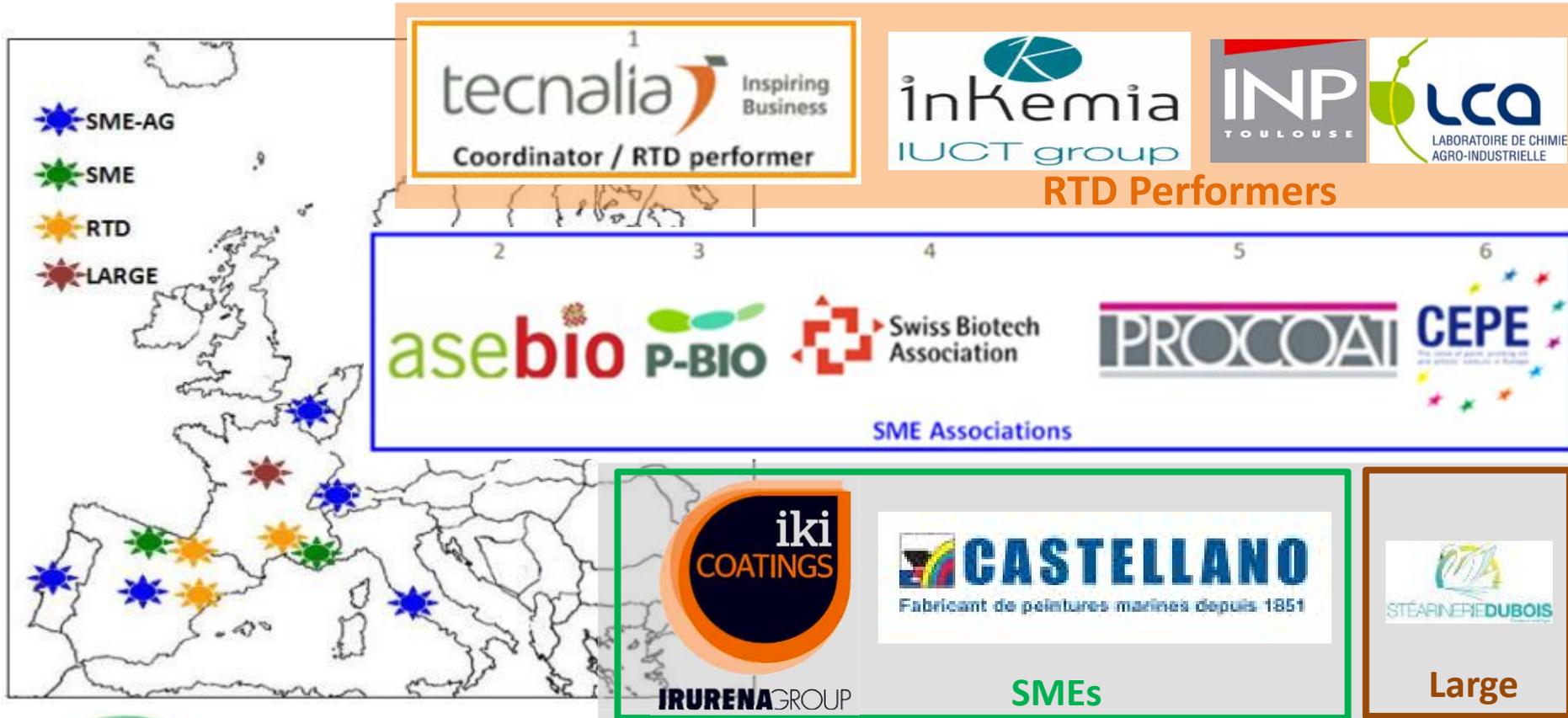
Ecobiofor alkyd paints including new **Allyl Reactive diluent** have been developed:

3.5% of petrochemical harmful solvent replaced by a non- VOC reactive solvent

High solid alkyd without needing an extra addition of VOC solvent to the formulation is achieved

Consortium members

- 11 European partners from 6 different European countries
- 5 SME-associations, 3 Companies (2 SMEs and 1 Large) & 3 RTD Performers



External Advisory Experts:

Dissemination activities

1.000 brochures delivered

5 presentations at relevant fairs and events

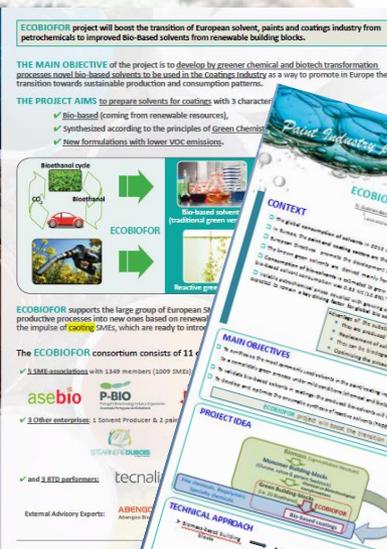
4 articles and 2 posters

15 fairs attended

- BioSpain 2014/2016
- CPHI
- CEPE annual conference
- Biotechnica 2015
- BioEurope 2015/2016
- BioEurope Spring 2016
- BioPharm 2014/2015
- EFIB
- Biotrinity 2015
- Nordic Life Science Days 2015
- Economiesuisse
- 11th International Conference on Renewable Resources and Biorefineries

Website: www.ecobiofor.eu

More than 50 private meetings





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