CapTop
supercap@thetop

Spin-off of the University of Naples *Federico II*

Towards industrialization of a new supercap generation

(scientific research)

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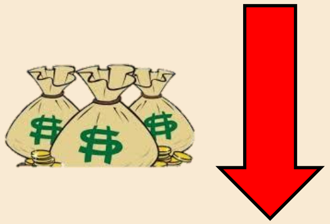
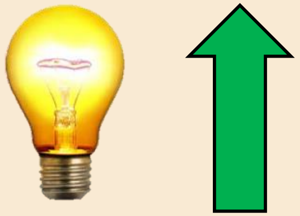
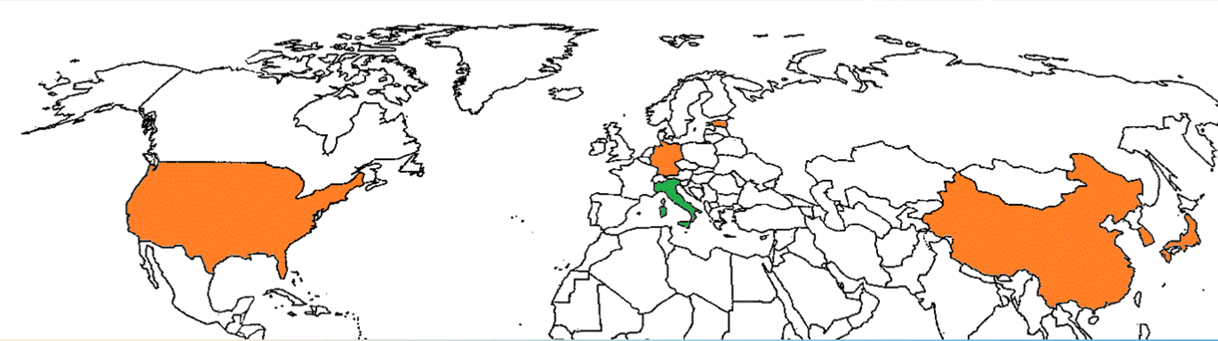
Our proposal: to enter and to enlarge present SC market

CapTop aim is to enter in the SC field/market following three parallel paths with the final goal of facilitating and/or accelerating the explosion of SCs in the electrical storage market.
These paths are:



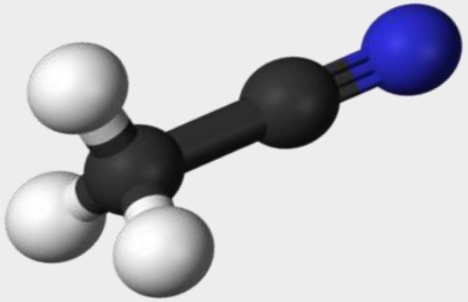


1. Increasing the specific energy by exploiting the scientific research results and technological developments.
2. Reducing the cost by full automation and optimization of the production process
3. Enlarging SC market in Italy and in Europe

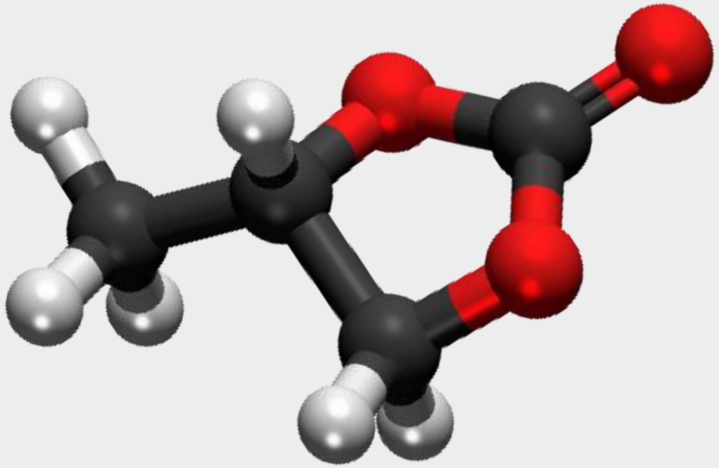


ELECTROLYTE RESEARCH LINE

Most used solvents



Acetonitrile



Propylene carbonate

GHS hazard statements:

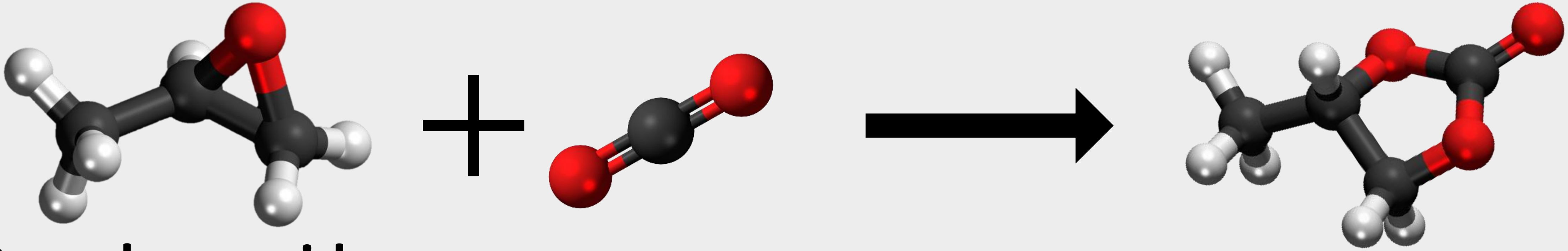
- **H225**: Highly flammable liquid vapour;
- **H230**: Harmful if swallowed;
- **H312**: Harmful in contact with skin;
- **H319**: Causes serious eye irritation;
- **H332**: Harmful if inhaled.

GHS hazard statements:

- **H319**: Causes serious eye irritation.

Surely among them, it is the **safest** choice.
But is its synthesis so "**safe**"?

Propylene carbonate industrial synthesis



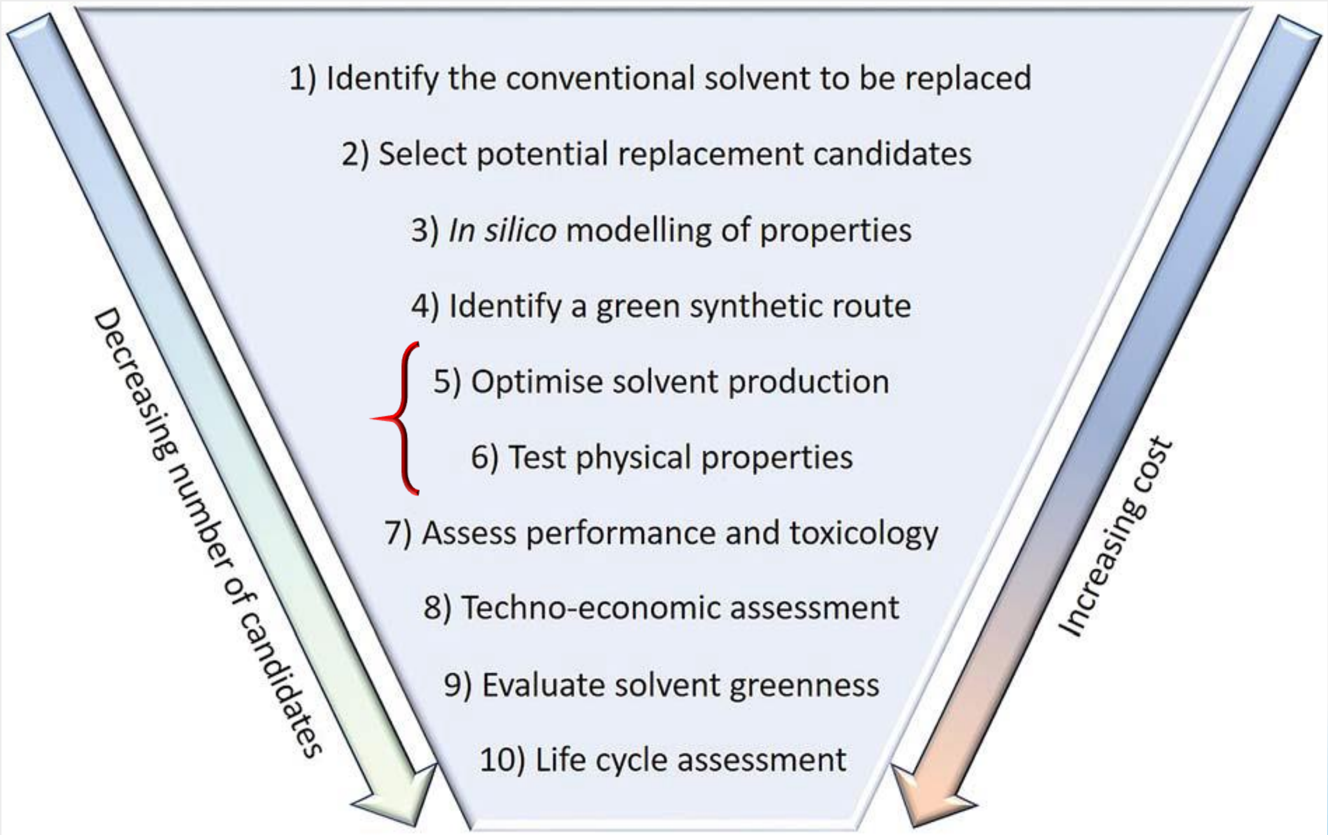
Propylene oxide

Not so “**safe**”its **synthesis** and its **starting materials**!

Propylene oxide GHS hazard statements:

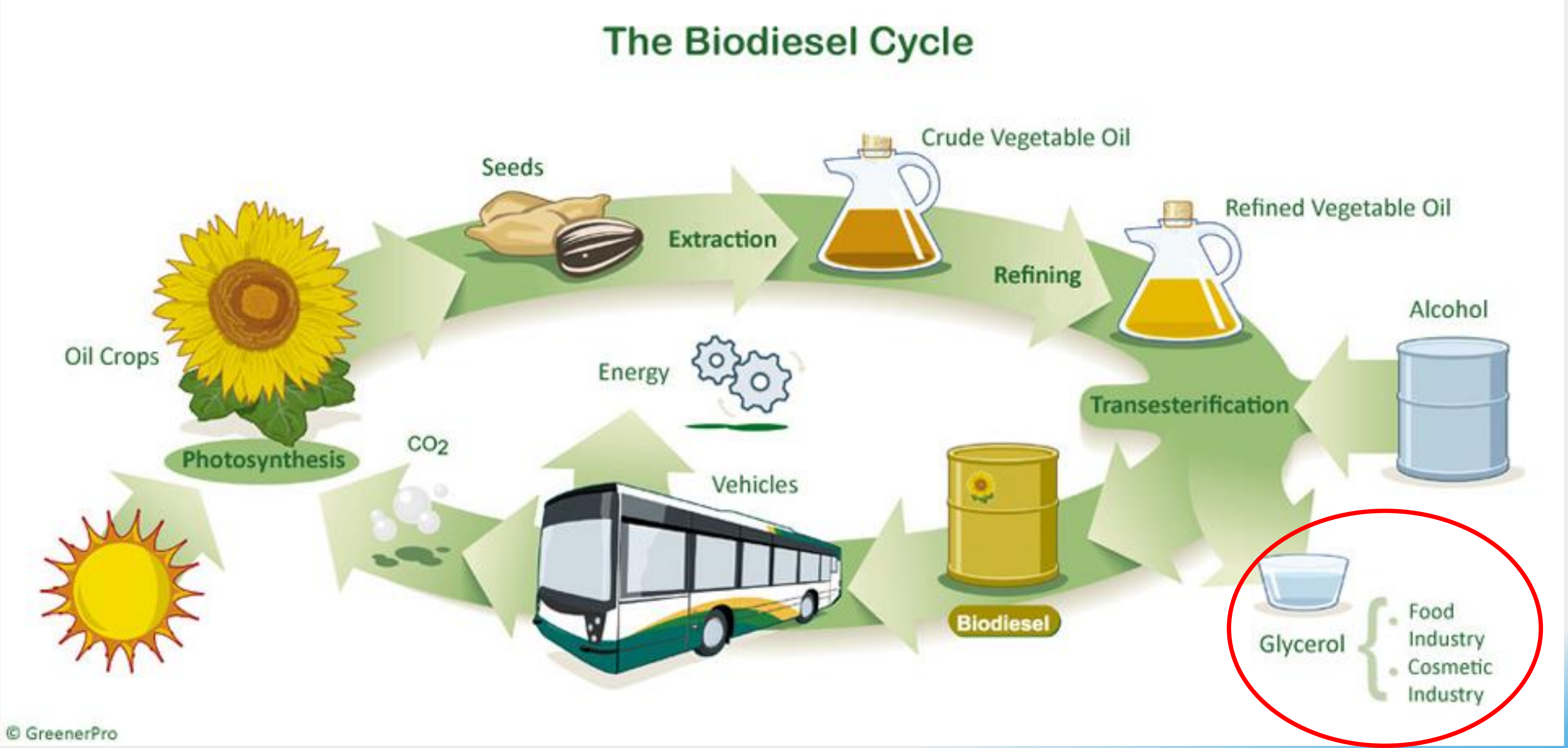
- **H224:** Extremely flammable liquid and vapour
- **H302+H312:** Harmful if swallowed/contact with skin
- **H315:** Causes skin irritation
- **H319:** Causes serious eye irritation
- **H331:**Toxic if inhaled
- **H335:** May cause respiratory irritation
- **H340**: May cause genetic defects
- **H350**: May cause cancer

Future trends – replacement and restriction of hazardous chemicals and synthesis

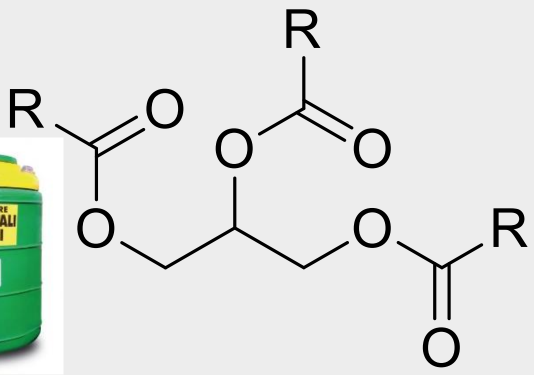


Saimeng Jin - Faraday Discuss., 2017, 202, 157–173

Starting from renewable feedstock- oily biomass



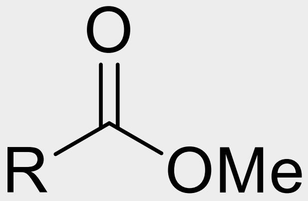
Starting from renewable feedstock- oily biomass



Waste vegetable oil

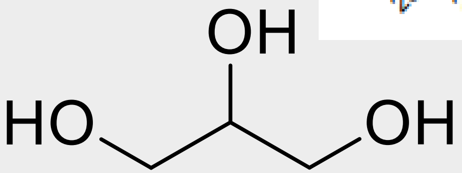
Triglycerides R:C12–C20

MeOH

3 

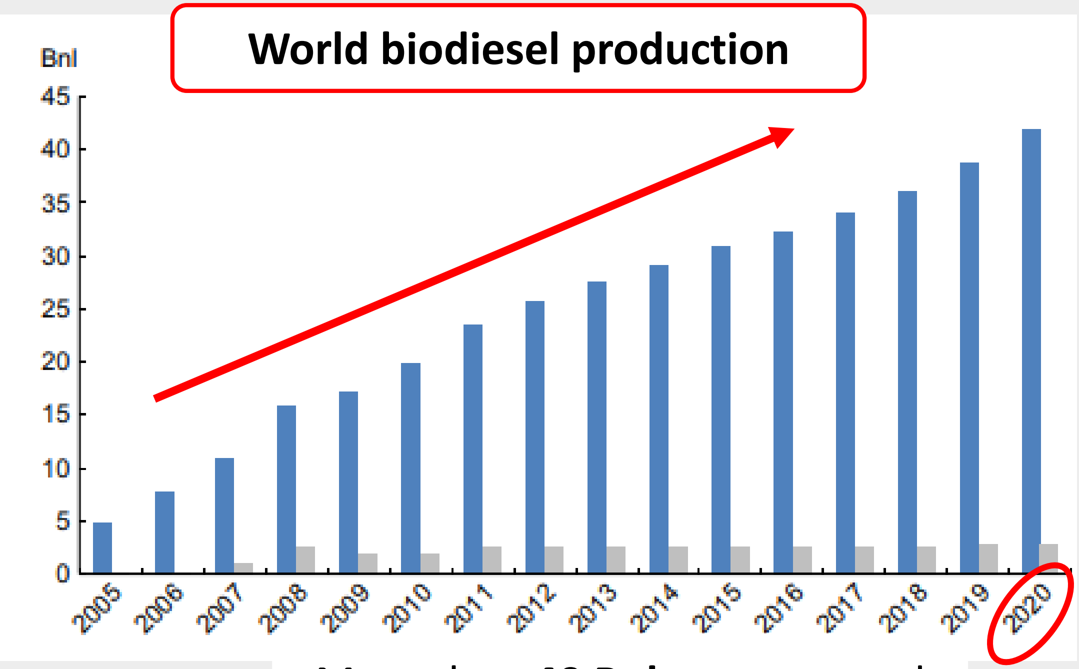
FAMEs

(biodiesel)



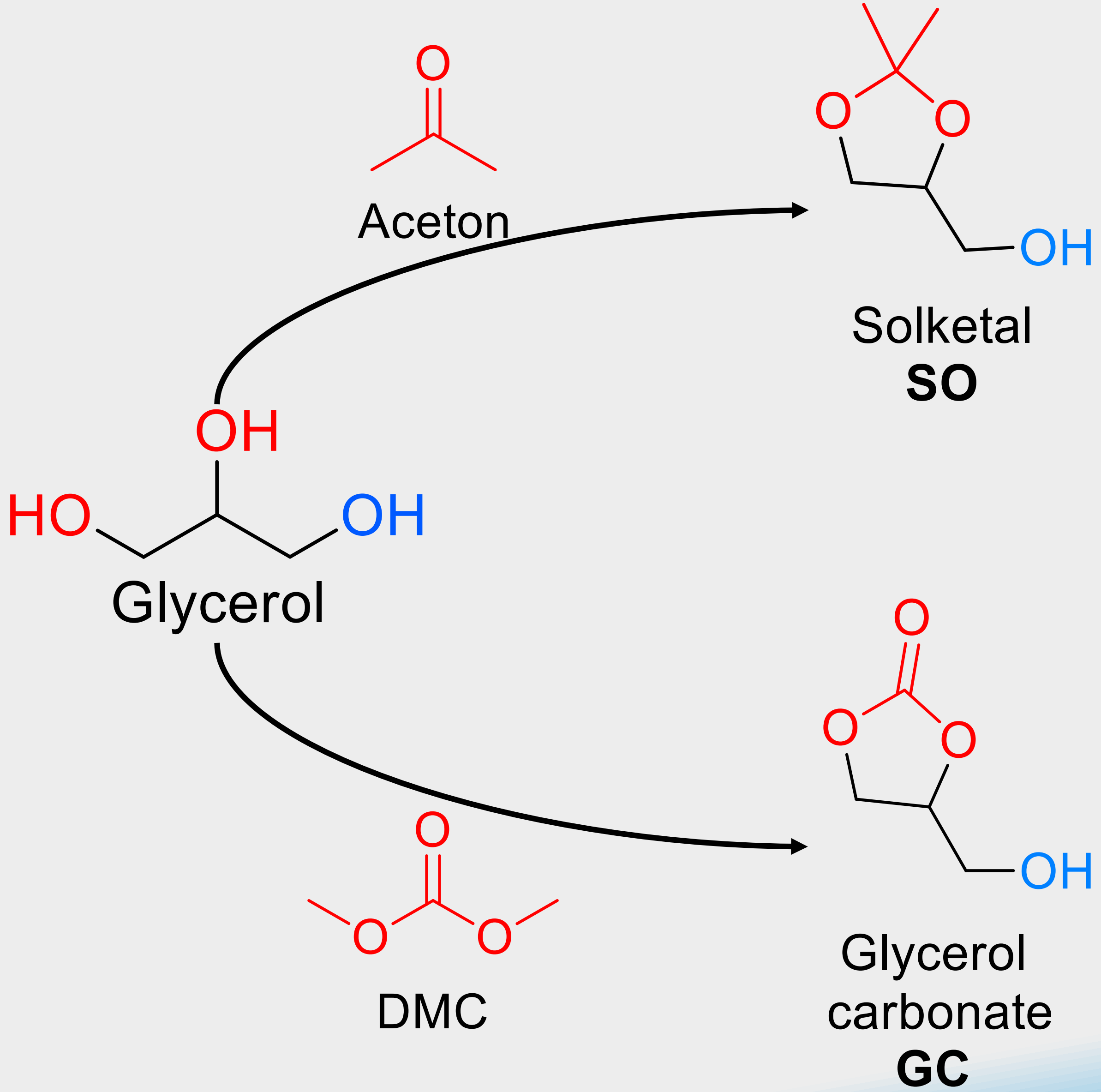
Glycerol (10% wt)

Often treated as by-product



More then **40 Bnl ton** expected for next year

Solvents synthesis – Glycerol modification, 1st Step



Glycerol advantage:

- Highly available *bio*-based feed-stock;
- Low production cost;
- Very versatile building-block;
- Very low eco-toxicological profile.

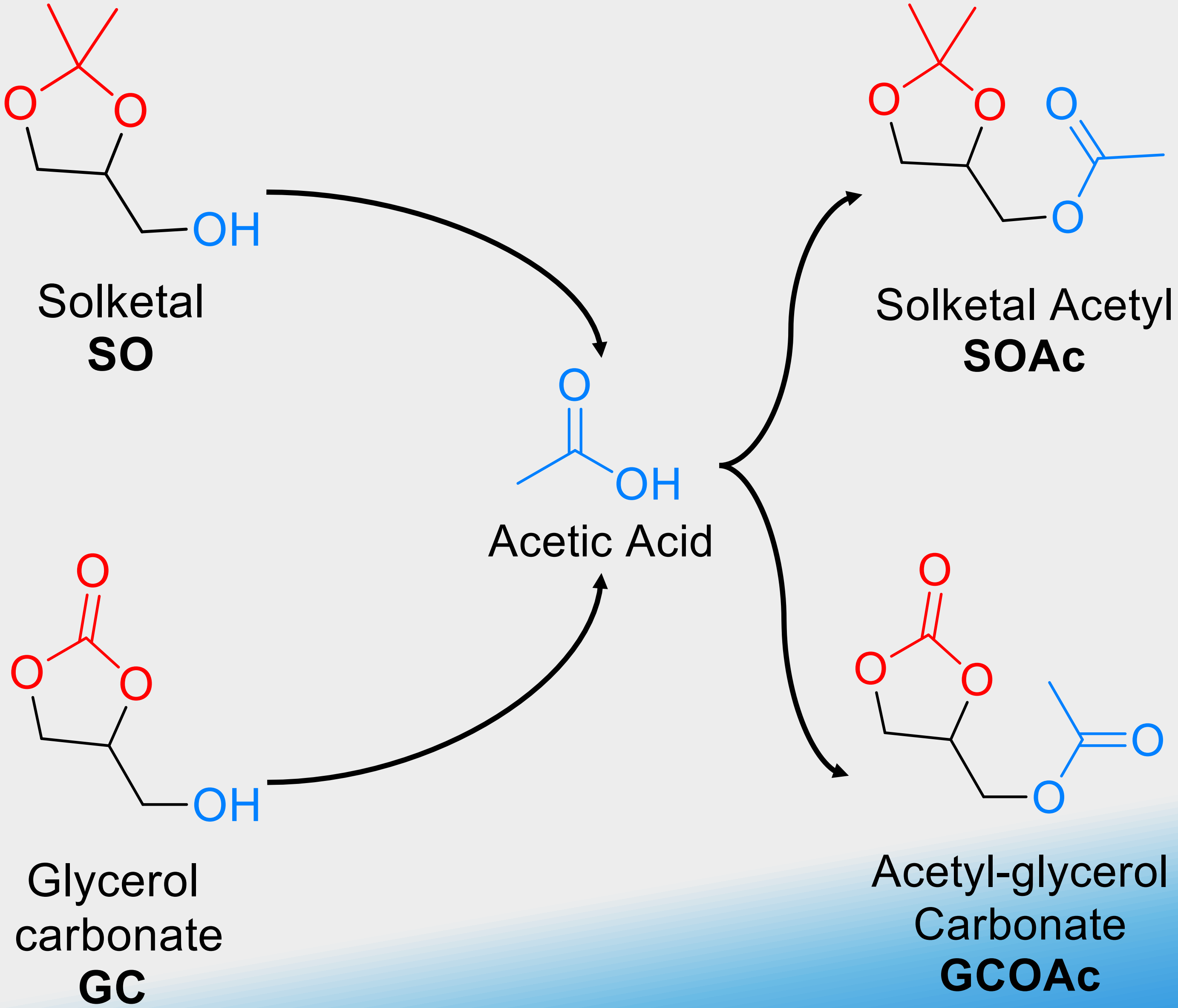
1st steps reagents

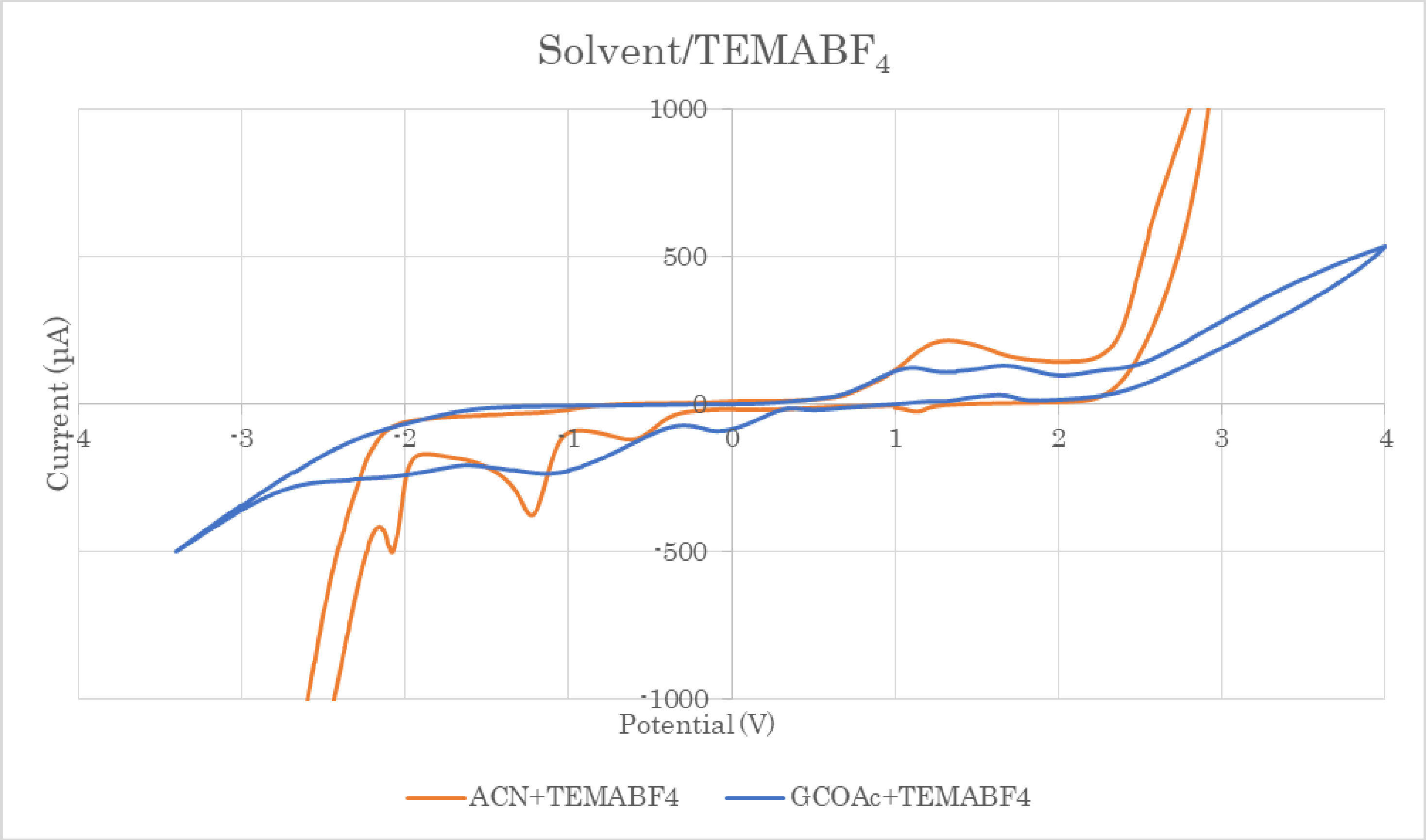
- Use of solvent-reagent molecules;
- DMC and Aceton: H225, highly flammable liquid and vapour;
- Aceton: H319 Causes serious eyes irritation; H336 may cause drowsiness and dizziness

Solvents synthesis – Glycerol modification, 2nd Step

2nd step

- Use of catalyst to achieve high product yield;
- High Atom economy;
- No auxiliaries utilized;
- Distillable products;
- Water as unique by-product;
- Very versatile bulding-block;
- Acetic Acid: H226 Flammable liquid and vapour;
  H314 Causes severe skin burns and eye damage Skin.





Electrolytic solution characterization - CV

SOAc did not provide good solvent-power. **GCOAc** has provided **wider ESW** respect to ACN with ammonium and salts.

A good starting to develope alternative solvents!

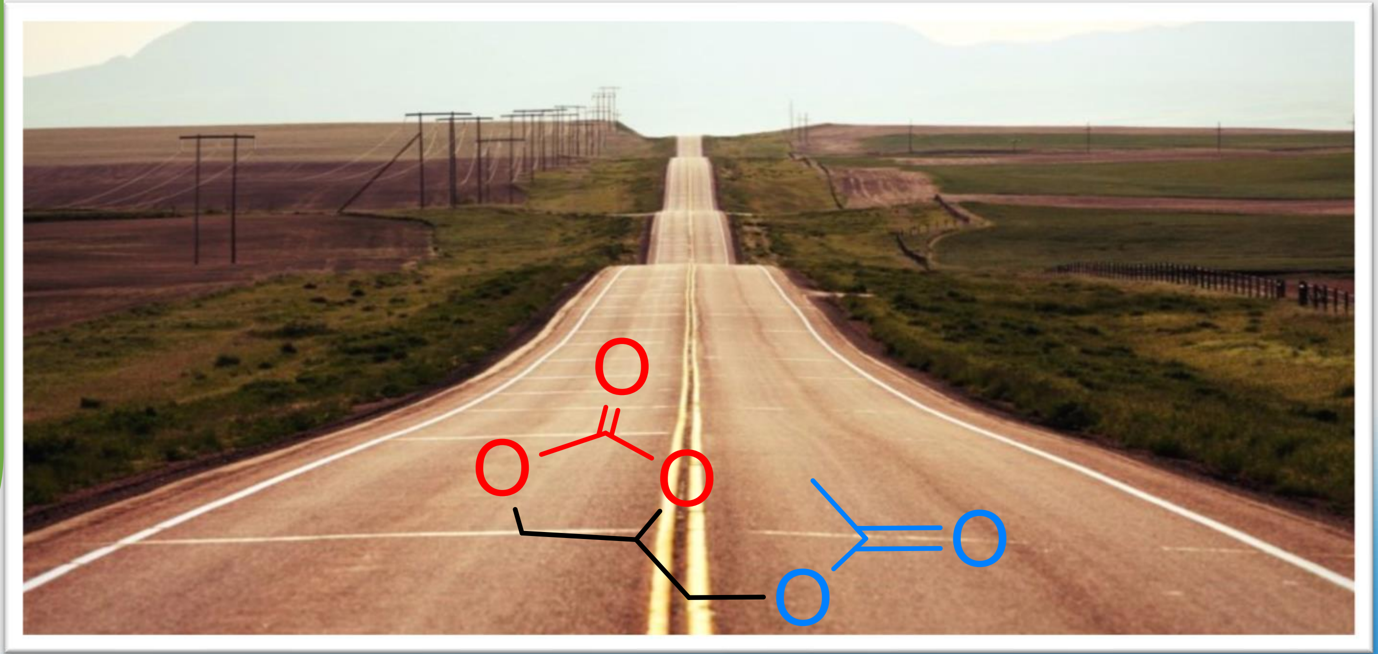
Cut-off current intensities	±0.100 mA		±0.500 mA		±1mA	
Potential	E_{Red}	E_{Ox}	E_{Red}	E_{Ox}	E_{Red}	E_{Ox}
ACN+TEMABF$_4$	-2.1	2.4	-2.4	2.7	-2.6	2.9
GOAc +TEMABF$_4$	-2.2	2.6	-3.4	3.9	-	-

Green principles to define a “green” synthetic route

Green Chemistry principles

1. Prevent waste;★
2. Atom economy;★
3. Less hazardous synthesis;★
4. Design benign chemicals;
5. Benign solvents & auxiliaries;★
6. Design for energy efficiency;
7. Use of renewable feedstocks;★
8. Reduce derivatives;
9. Catalysis (vs stoichiometric);★
10. Design for degradation;
11. Real-time analysis for pollution prevention;
12. Inherently benign chemistry for ★ accident prevention;

The road is still long but fair, all that remains is to follow it



ENTER THE SC MARKET … AND ENLARGE IT

Thanks to many collaborations with Universities, Research Organizations, Small & Medium Enterprises, and Large Companies, we have been able to acquire the SC production technology at the state-of-the-art. Thus,

We are ready to enter the market in few months.

We will focus on few products, but in the high range of performances. We see that the way imagined (or hoped) last year in Salerno is the right way.

We are confident in a brilliant future for the SC community, academic, industrial, commercial.

THANK YOU

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