

Da scarto agri-food a prezioso ingrediente in nutraceutica e cosmesi : un caso studio tutto italiano

*E. Ghedini, F. Menegazzo, M.
Signoretto*

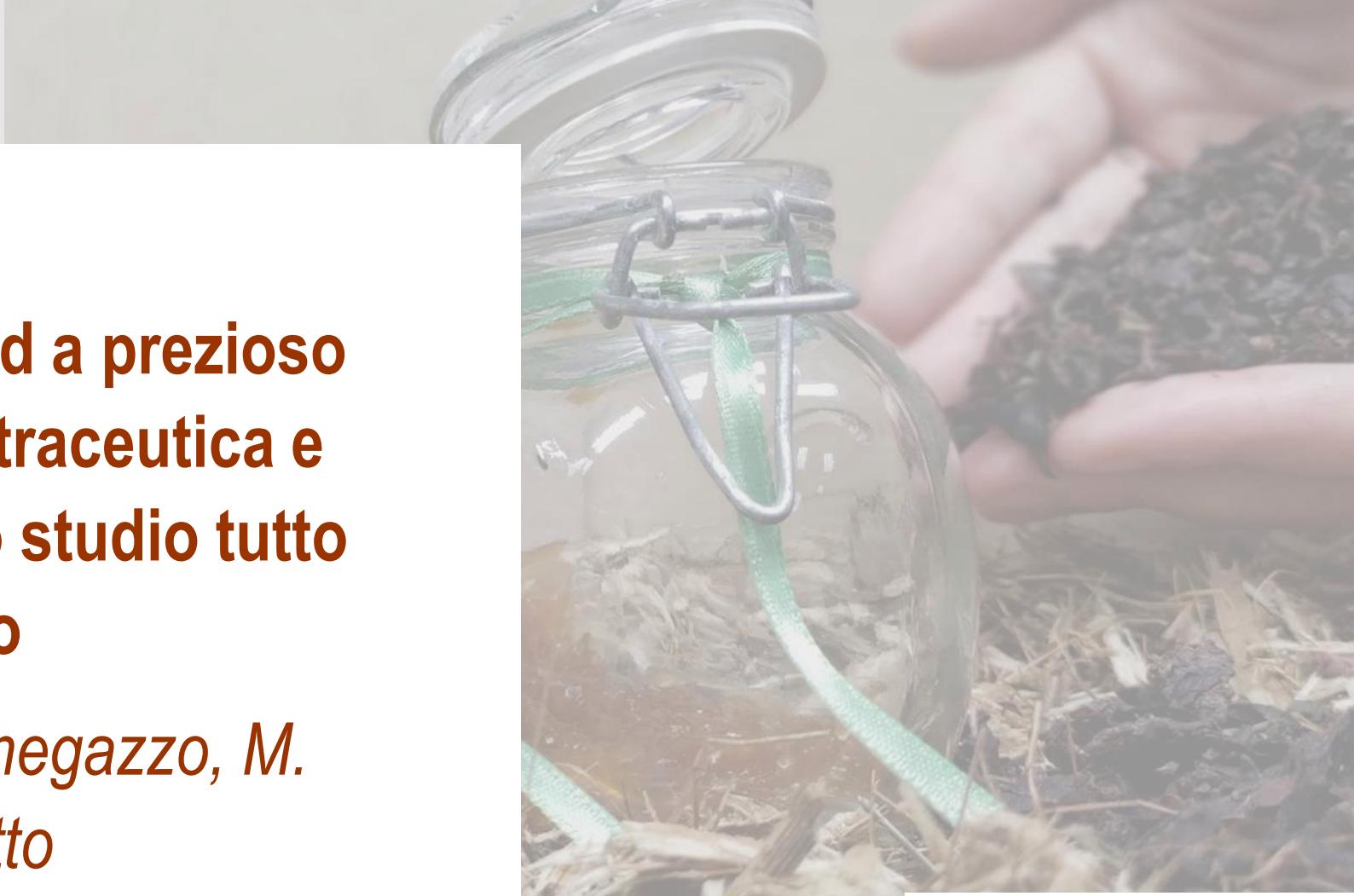


25-26 November
2021 Milan
Let's meet again

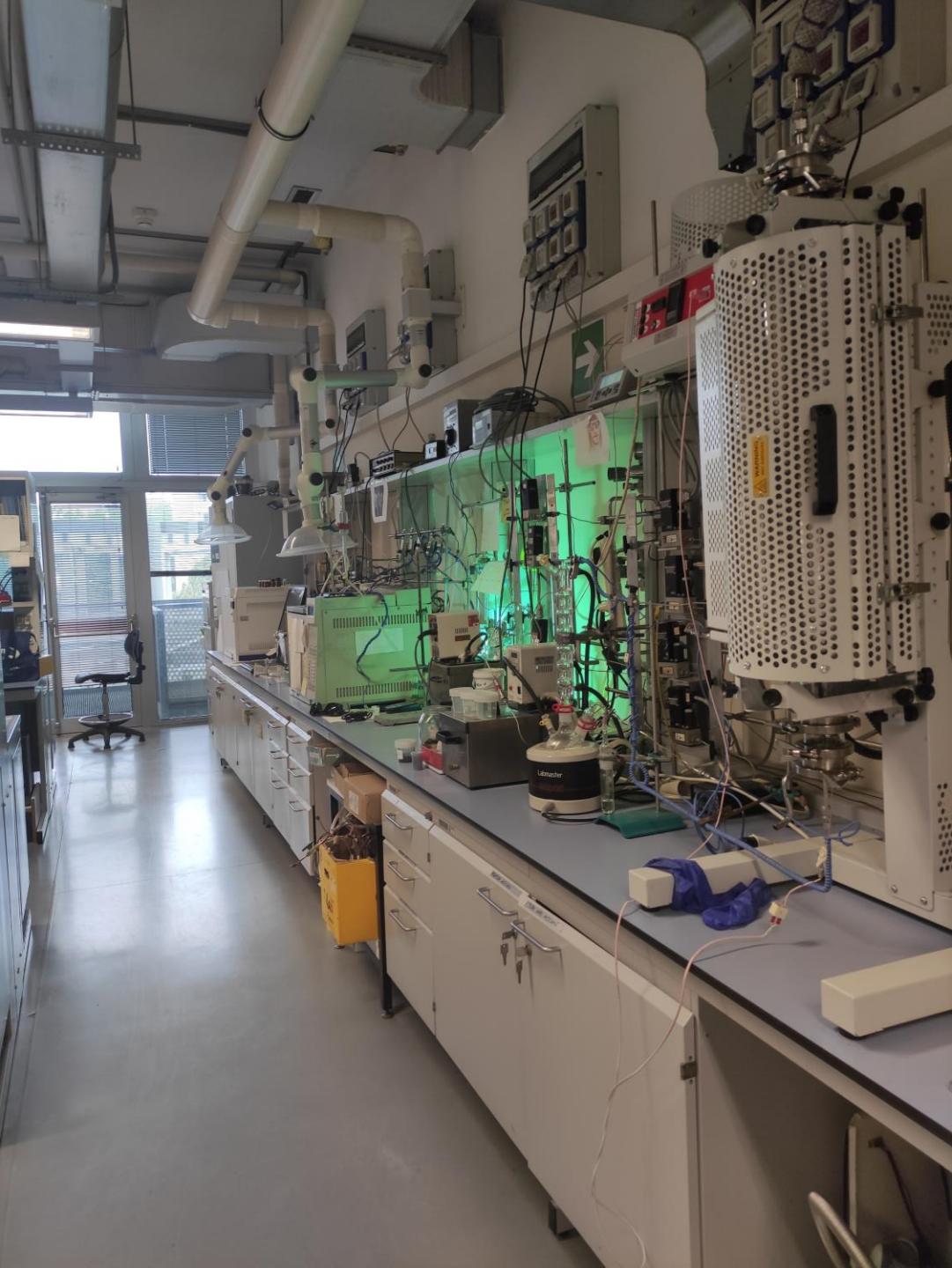
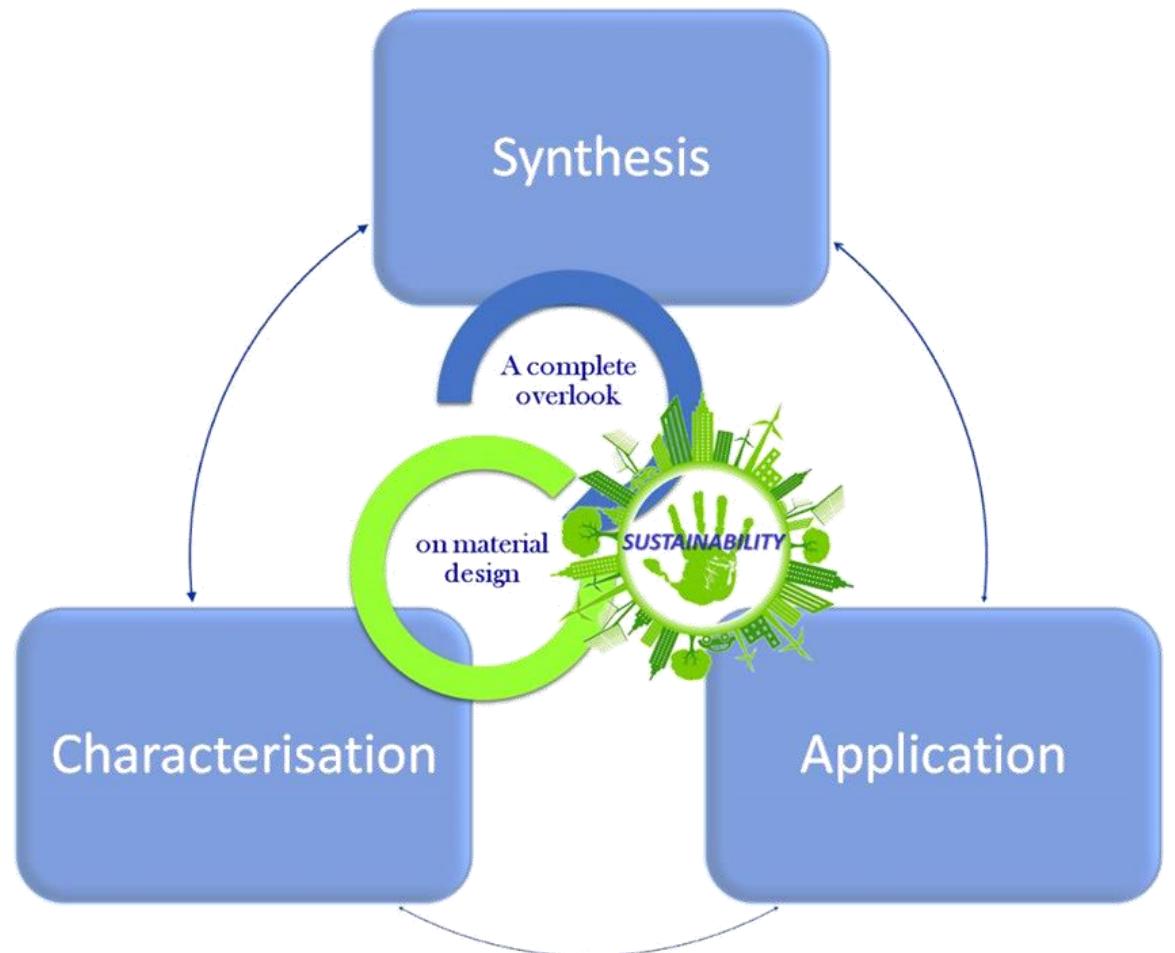


Ca' Foscari
University
of Venice

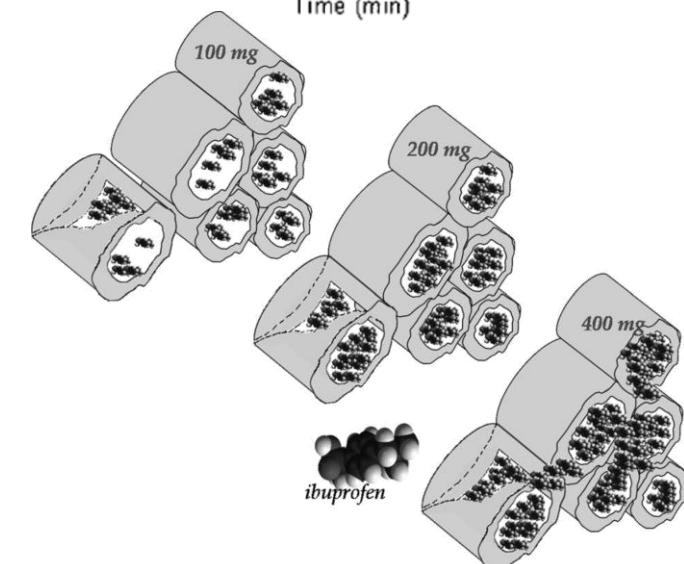
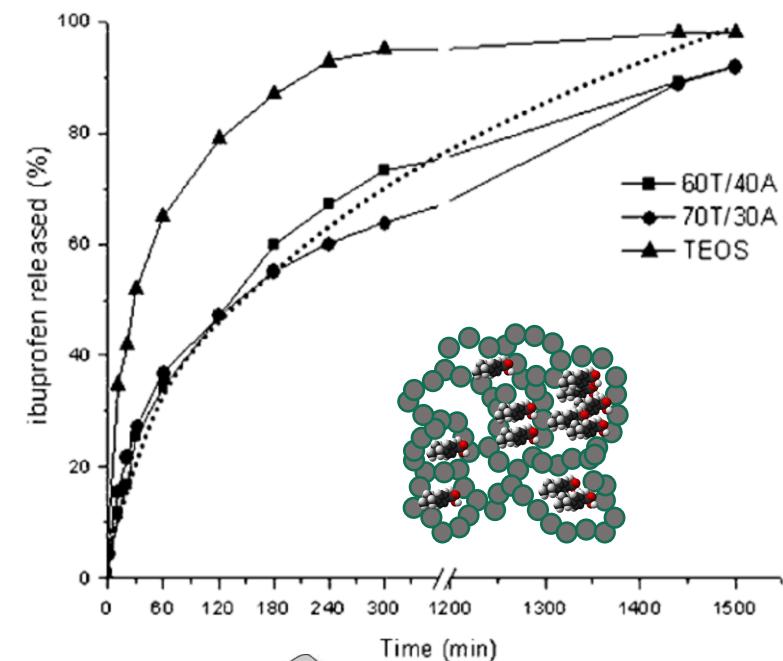
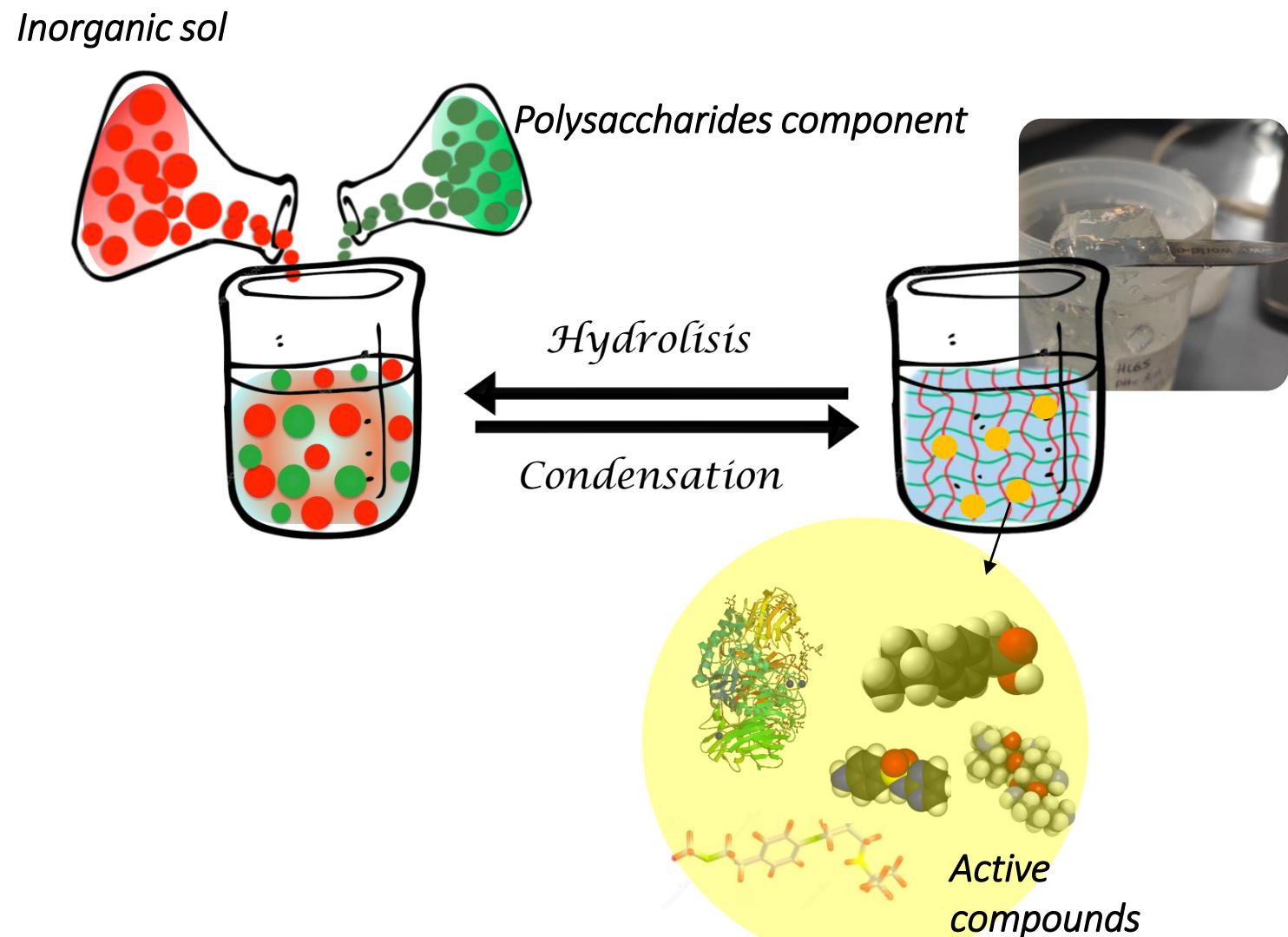
VeNice
www.ve-nice.org



CatMat



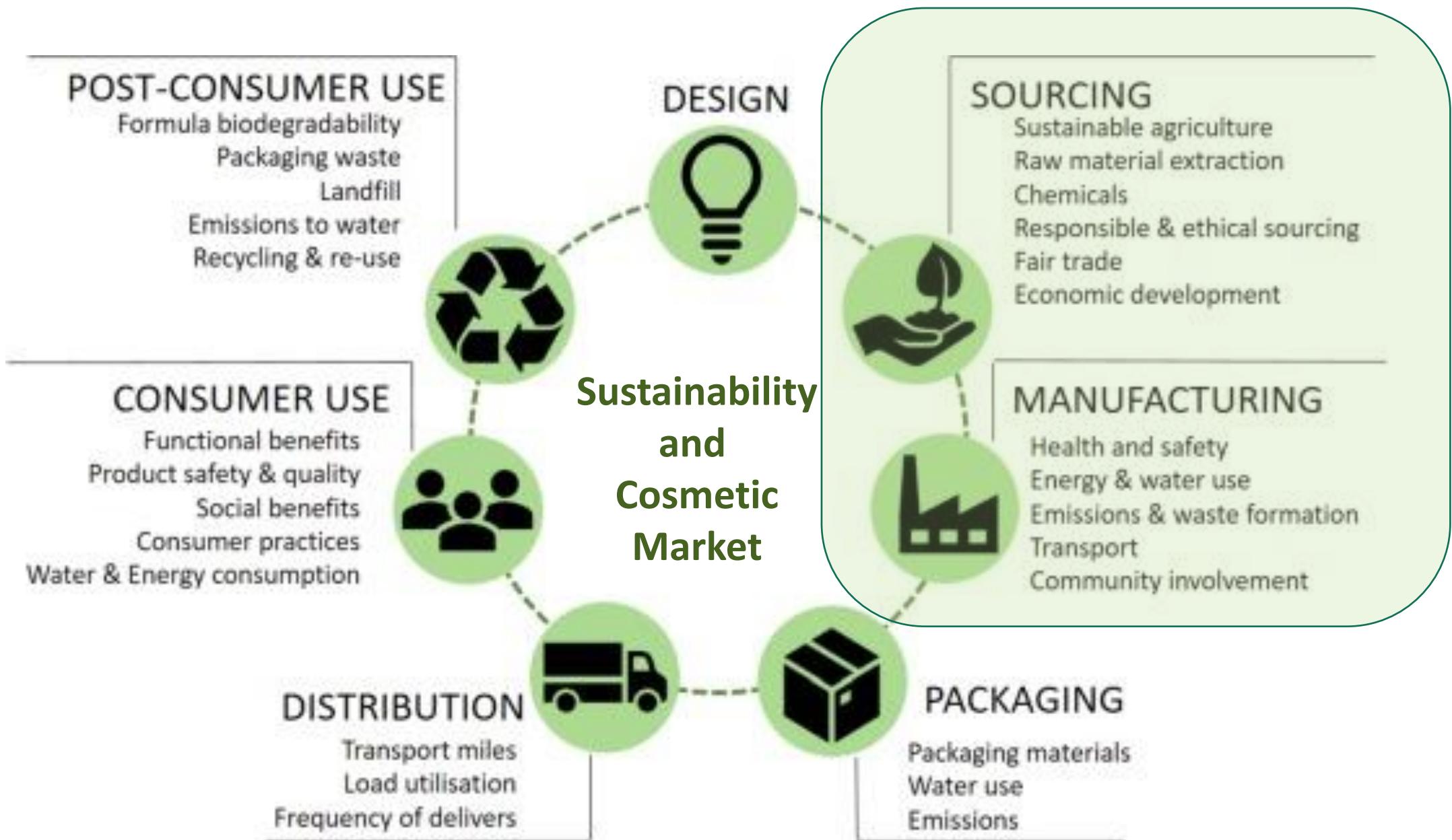
From CatMat and Drug Delivery..



*...To Ve Nice,
innovative Start Up
and Ca' Foscari Spin Off*

*The company's mission is to innovate the
cosmetic sector
by offering **high-performance products**
in the name of **sustainability***





Raw material: from Natural to Petrol... and back to Bio

Primitive people	Skin painting: Ornamental and religious purposes
Egypt	Eyes: Ash and dyes Skin: Animal and vegetable fats, beeswax, honey, milk, and aromatic oils
Ancient Greece	Visage: Blackberries and seaweed Lipstick: Cinnabar (mercury sulfide—pigment)
China	Nails: Pigmented polish
Rome	Skin: Donkey milk; powder to lighten skin Cilia and eyebrows: Coal
Middle ages	Lipstick: Saffron Cilia: Black soot Teeth: Sage (bleaching) Skin: Egg and Vinegar Prohibition of the cult of hygiene and exaltation of beauty—the disappearance of the use of cosmetics in Europe
Crusades	Resurgence of cosmetics. Growth of perfumes development
Late eighteenth century	Witchcraft in England
Twentieth century	Home production and emergence of the first cosmetic industries
1970s	Popularization of makeups
1980s	Formulas evolved for cosmetics pigmented
1990 until nowadays	New technologies and process, refined products, concerns about security, concerns about animal safety, concerns about environmental quality and preservation





Local Biomasses:
valuable raw material to produce smart sustainable
cosmetic and nutraceutical products made in Italy

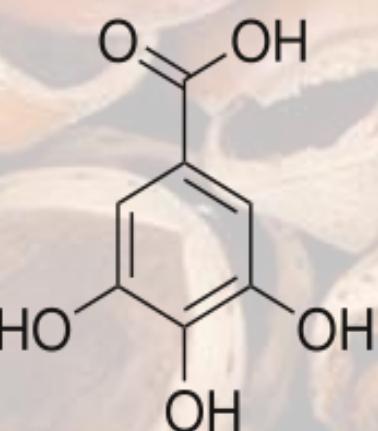
HAZELNUTS SHELLS

The hazelnut shell represents more than 50% of the total weight

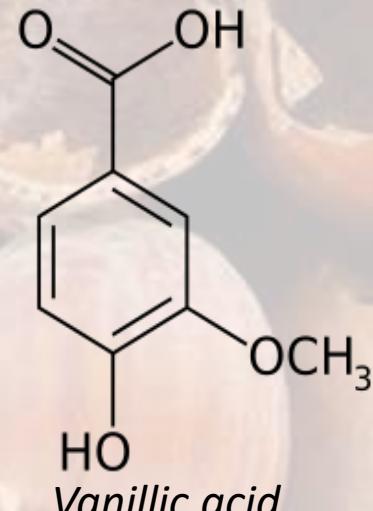
Italy is the second largest producer of hazelnuts in the world

Hazelnut shells are rich in phytometabolites

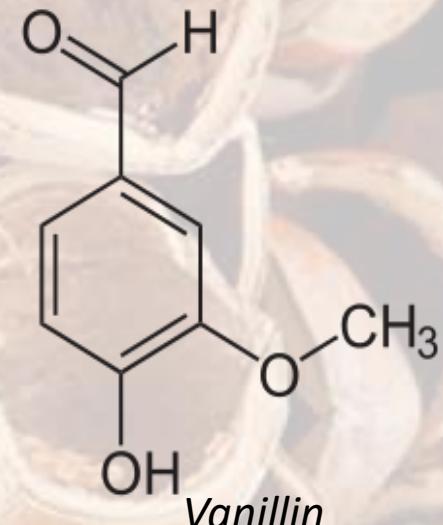
Vitamin E, with α -tocopherol predominant form



Gallic acid



Vanillic acid



Vanillin



Quercitin



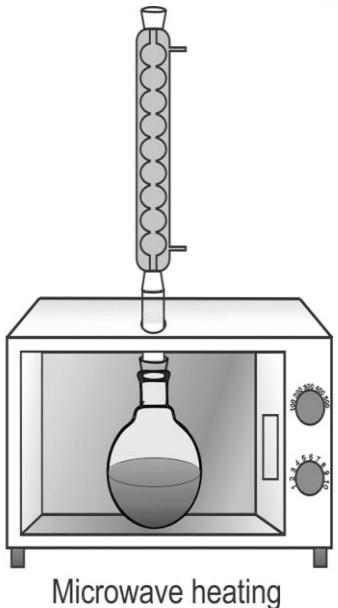
Catechin

From HAZELNUTS SHELLS to PHYTOMETABOLITES



Hydrothermal maceration: water, 45 °C, 5h, 1000rpm

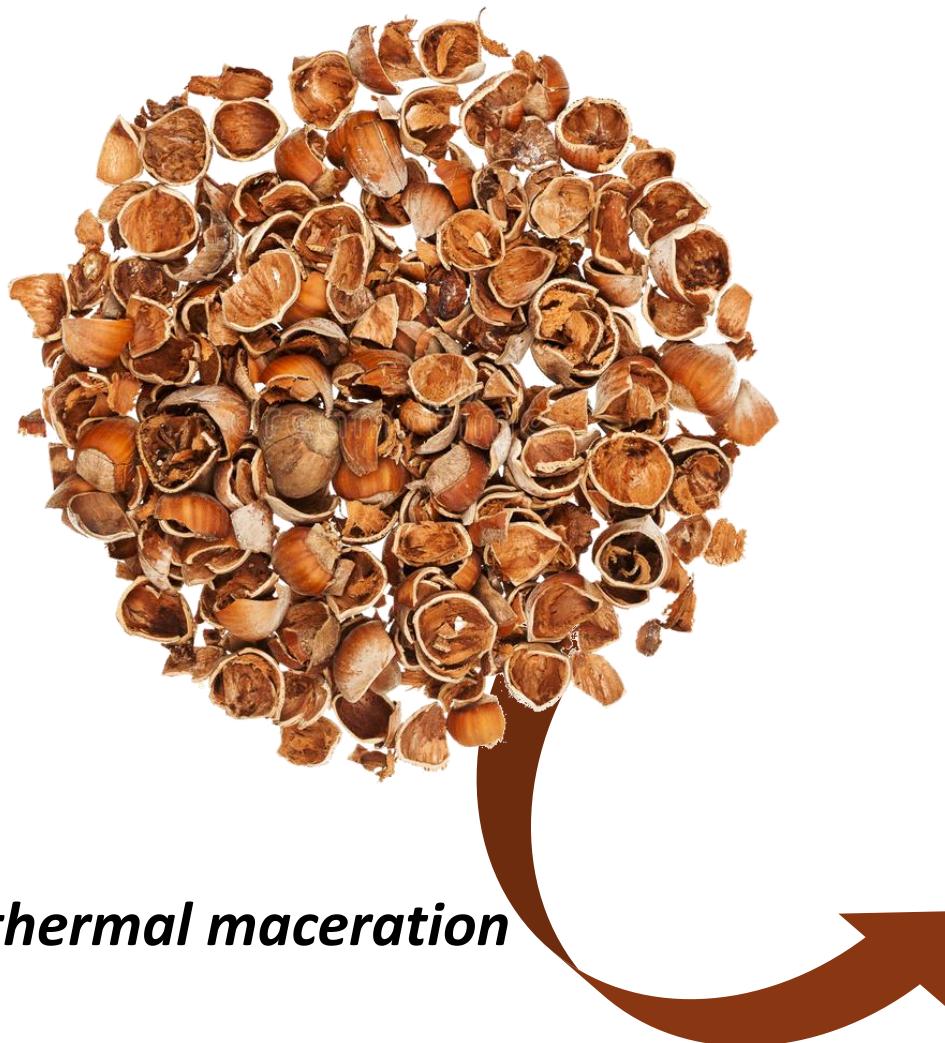
Yield 1,1%



Microwave assisted extraction:
water:ethanol (30:70 v/v), 60 °C, 25 min, 1000rpm

Yield 0,42 %

From HAZELNUTS SHELLS to PHYTOMETABOLITES



Phytometabolite	%
Isoquercitin	12
Chlorogenic acid	6
Catechin	5
Tyrosol	4
Isoxanthumol	4
Ferulic acid	2
Caffeic Acid	1

TPC (mg GAE/g)	DPPH (mg TE/g)
4,66	4,37

From EXTRACTION RESIDUES to BIO-CHAR by PYROLYSIS

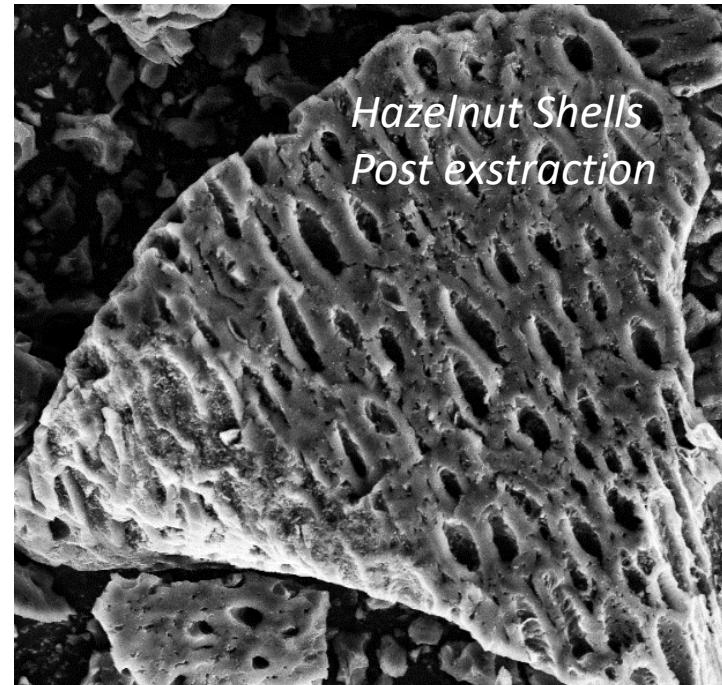


$600\text{ }^{\circ}\text{C}$
 30 min
 100 mL/min, N_2



BIO-CHAR CHARACTERIZATION

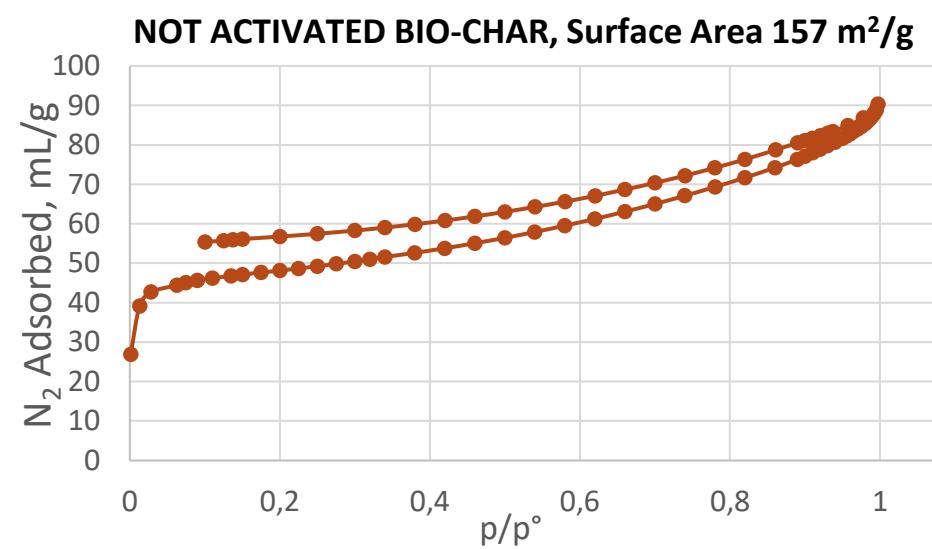
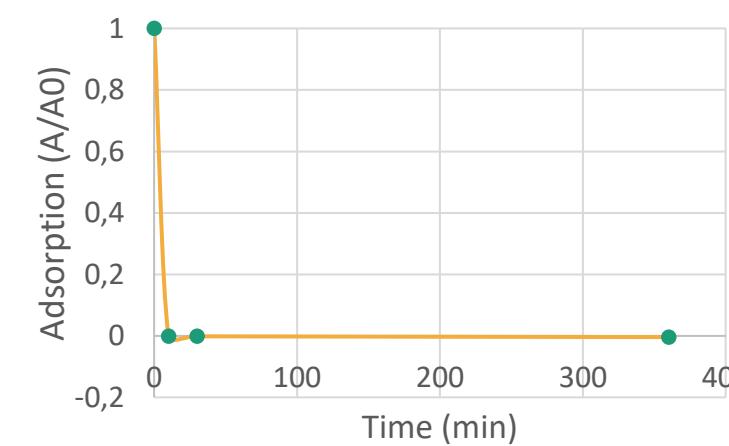
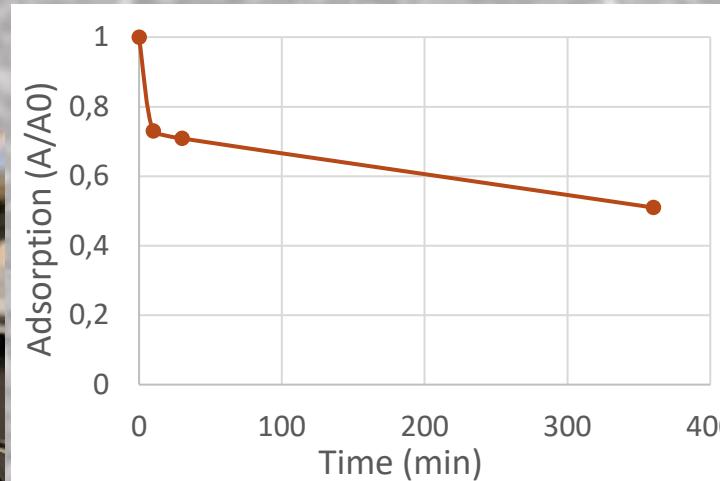
	C %	O %	H %	N %	S %	Ashes %
Hazelnut Shells	49,13	42,21	5,74	0,80	0,34	1,78
Not activated Bio-char	83,72	8,24	2,41	0,67	0,85	4,11
Activated bio-char	82,26	7,94	2,23	0,67	0,22	6,68



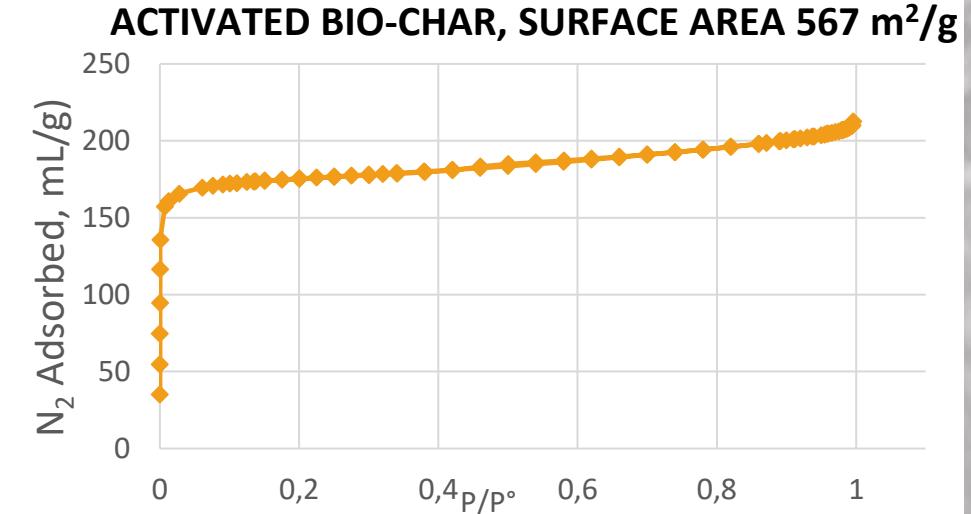
BIO-CHAR CHARACTERIZATION:

Adsorption properties

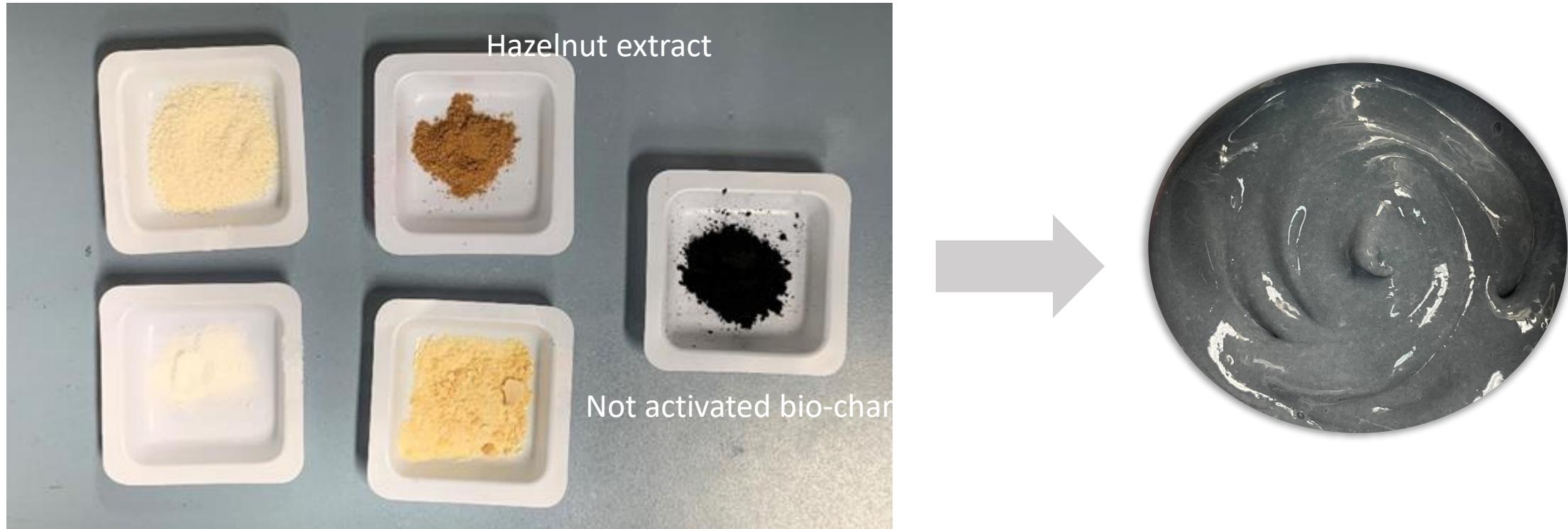
Methylene blue test



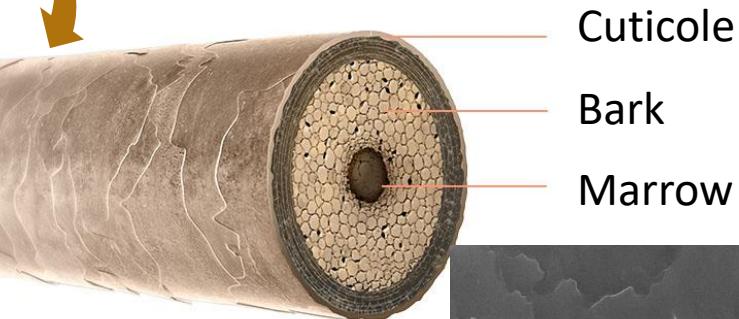
Surface area of commercial vegetable carbon:
 $257 \text{ m}^2/\text{g}$



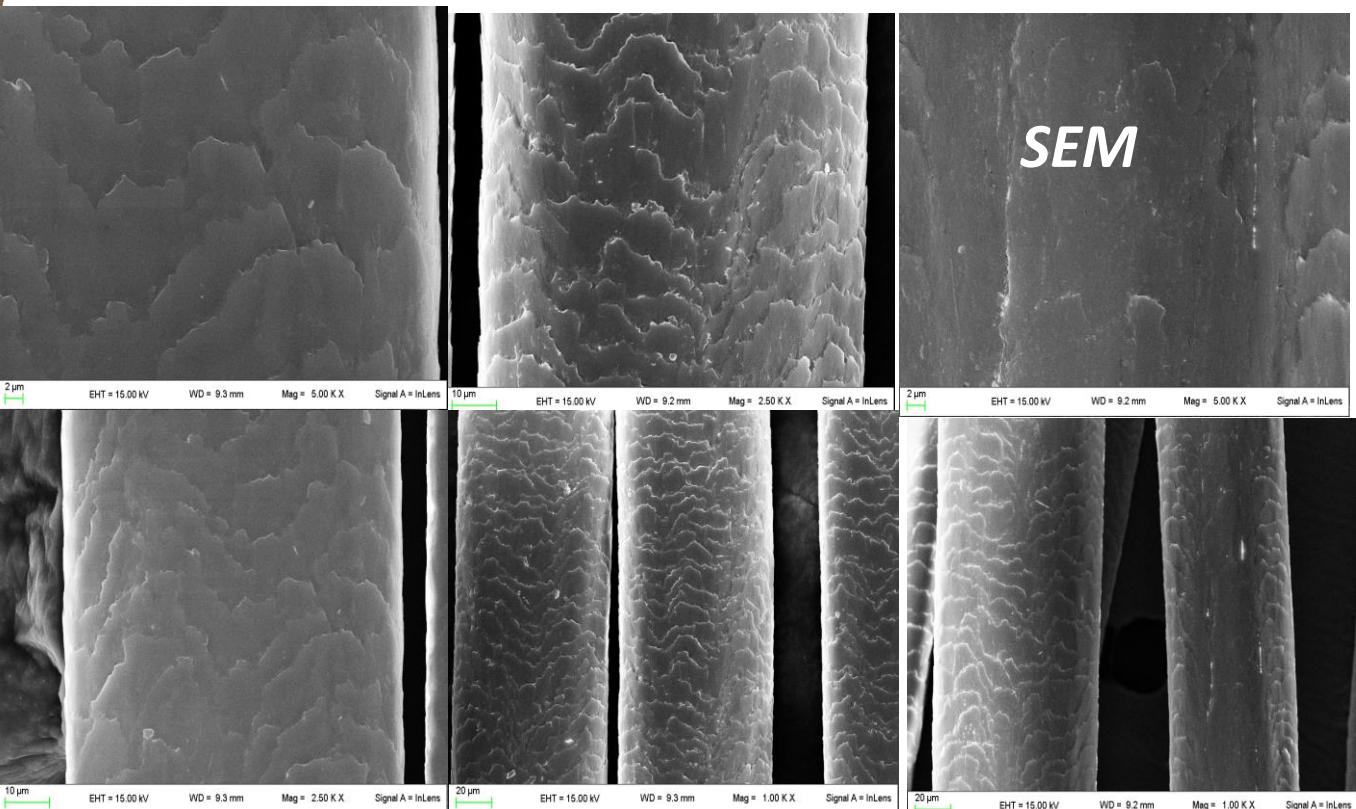
ANTI-POLLUTION HAIR CARE MASK FORMULATION

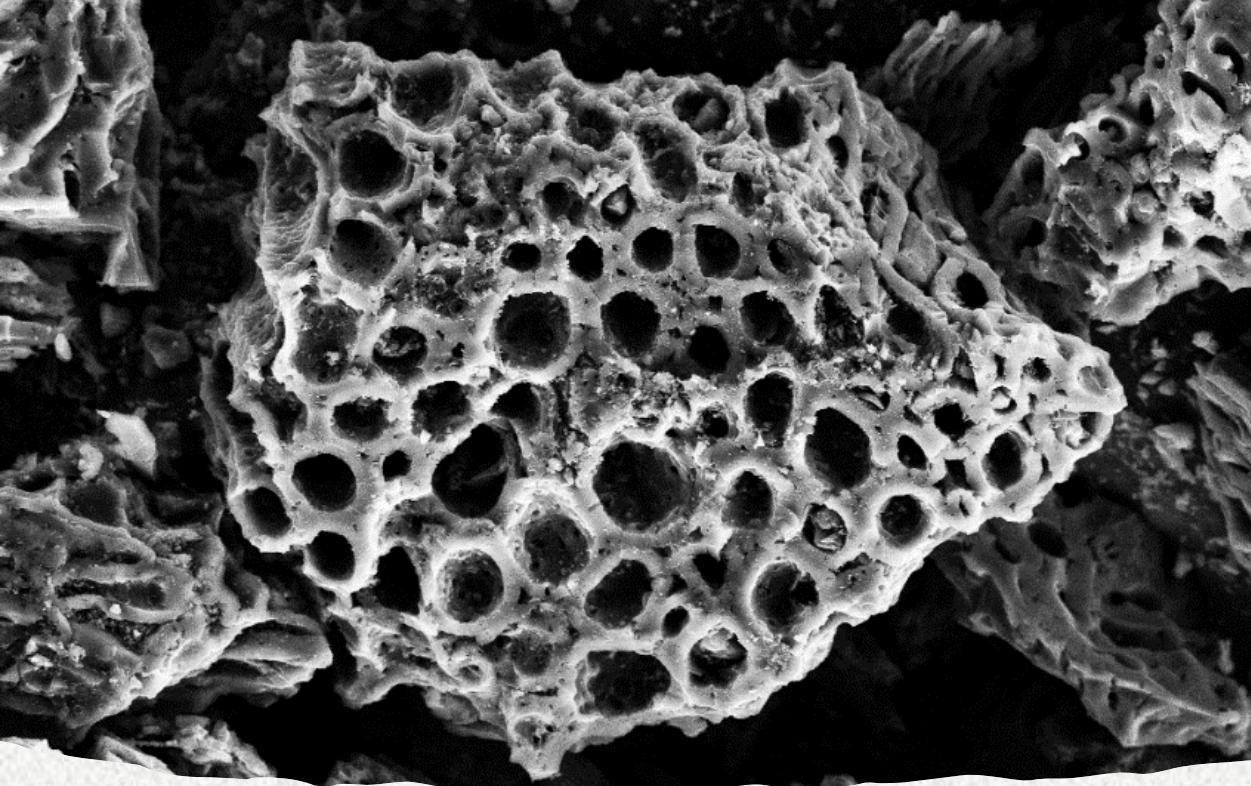


Effectiveness



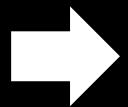
*Penetration evaluation,
Tape stripping*





NUTRACEUTICAL APPLICATIONS

The use of high porous materials in nutraceutical formulation can improve the pharmacokinetic of active ingredients and the effectiveness of the final products.

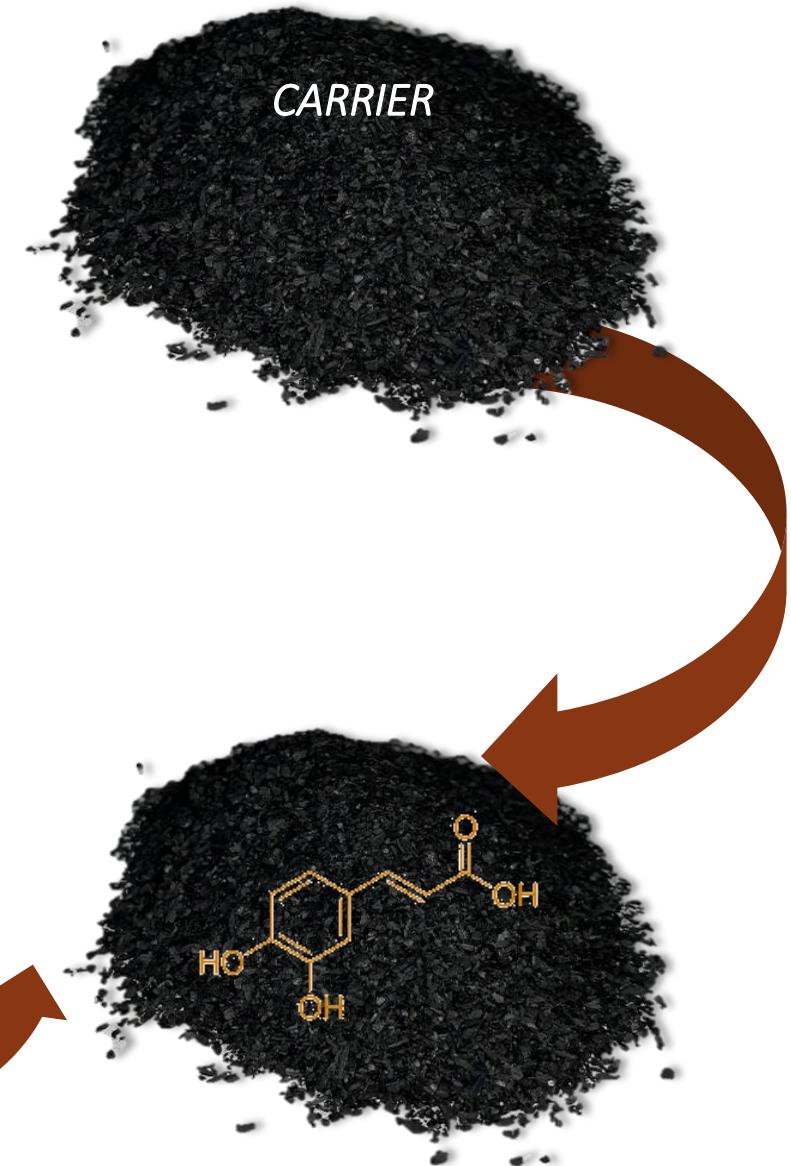


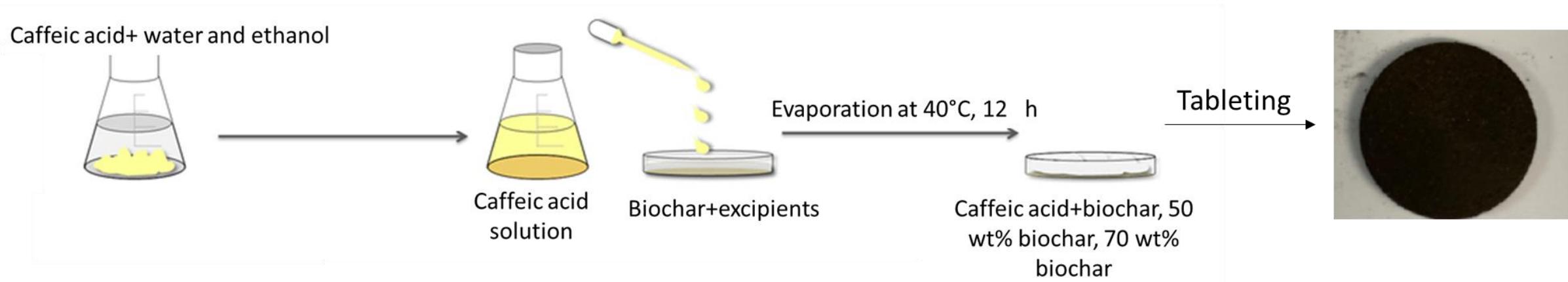
Porous **biochar** and **secondary metabolites** derived from local agri-food wastes can be excellents candidates to design sustainable and highly efficient food supplements



Phytometabolite	%
Isoquercitin	12
Chlorogenic acid	6
Catechin	5
Tyrosol	4
Isoxanthumol	4
Ferulic acid	2
Caffeic Acid	1

Model molecule



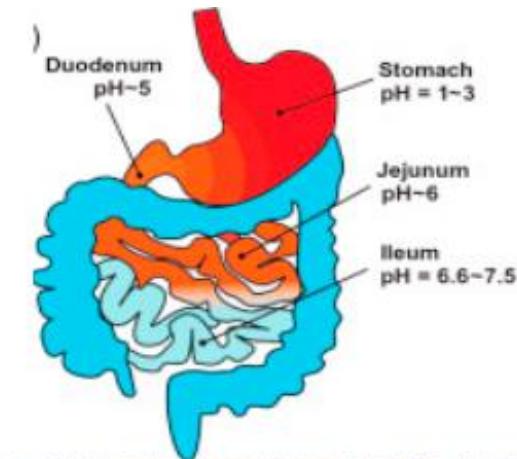
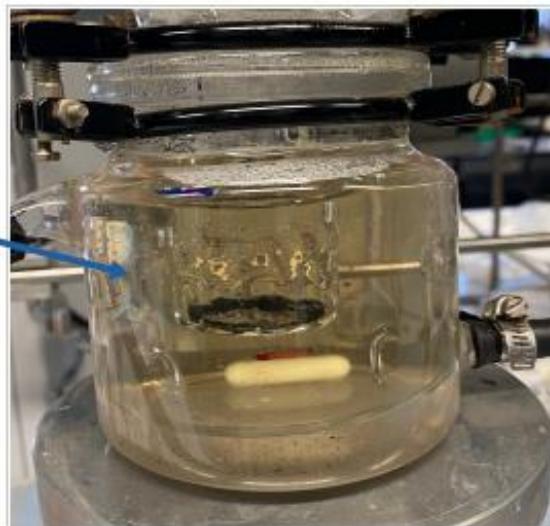


Formulation

DRUG DELIVERY TEST

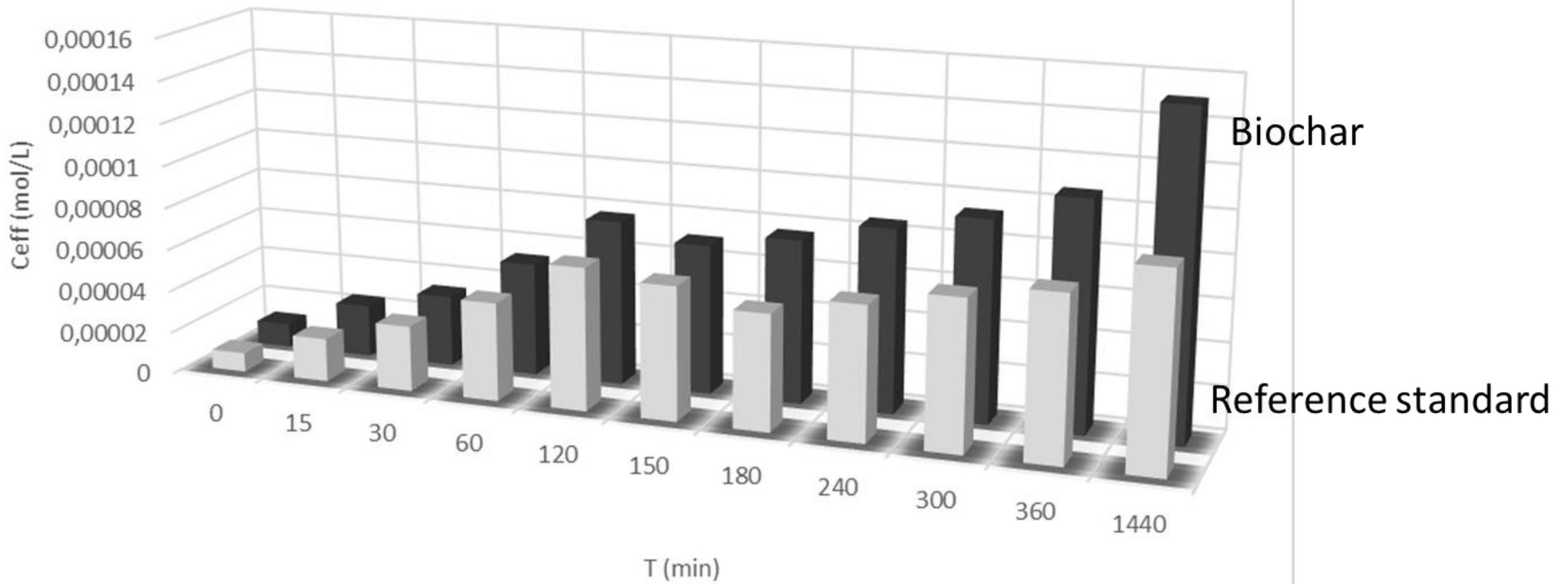
t=0 : 200mL of HCl (0,01M) pH= 2
t=2h : + 4mL of K₂HPO₄ (1,5M) pH = 7
at 37°C

take 1mL of solution after 0, 10, 20,
30, 40 min, 1h, 2h, 2.5h, 3h, 4h, (5h,
6h)



[6] Gil-Izquierdo, A.; Zafrilla, P.; Tomás-Barberán, F. A. An in Vitro Method to Simulate Phenolic Compound Release from the Food Matrix in the Gastrointestinal Tract. *Eur Food Res Technol* 2002, 214 (2), 155-159. <https://doi.org/10.1007/s00217-001-0428-3>.

[7] Ghaffar, A.; Yameen, B.; Latif, M.; Malik, M. I. PH-Sensitive Drug Delivery Systems. In *Metal Nanoparticles for Drug Delivery and Diagnostic Applications*; Elsevier, 2020; pp 259-278. <https://doi.org/10.1016/B978-0-12-816960-5.00014-8>.



DRUG DELIVERY, preliminary results

*Every end is a new
beginning*



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**M
C A T
T**



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The molecular designers of Cosmetics



Thank you !

V
in-vitality



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