

RECOVERY OF BIOACTIVE MOLECULES FROM PLANT OR WASTE BIOMASS THROUGH SUSTAINABLE EXTRACTION METHODOLOGIES

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“NUTRIZIONE, ALIMENTAZIONE & INVECCHIAMENTO ATTIVO”
NUTRAGE

ATTIVITA' IPCB

WP2

TECNOLOGIE GREEN E SOSTENIBILI PER LO SVILUPPO DI FILIERE AGRO-ALIMENTARI AD ALTO VALORE SALUTISTICO

Subtask 2.2.2.

Sviluppo di tecnologie di stabilizzazione e di sistemi per la gestione integrata di sottoprodotti/scarti delle lavorazioni agro-industriali

Subtask 2.2.3.

Sviluppo e ottimizzazione di tecnologie di estrazione e purificazione per il recupero e valorizzazione di molecole bioattive (metaboliti secondari, carboidrati, proteine) da sotto-prodotti delle filiere agro-alimentari

Subtask 2.2.5.

Sviluppo e valutazione di tecnologie innovative per l'incapsulamento, la stabilizzazione e la modulazione del rilascio di biocomposti.

Subtask 2.2.6.

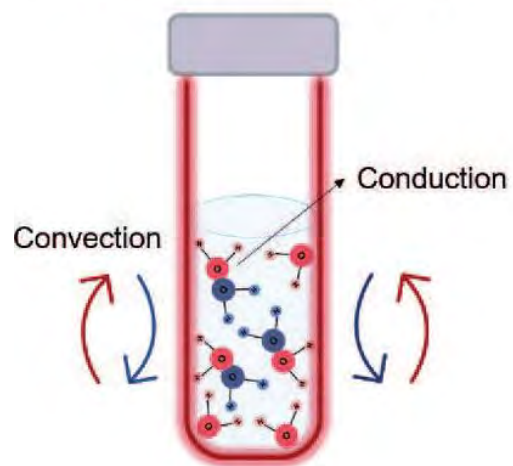
Studio della stabilità, dell'attività biologica e della cinetica di rilascio di biocomposti incapsulati e di formulazioni innovative

MICROWAVE ASSISTED EXTRACTION (MAE)

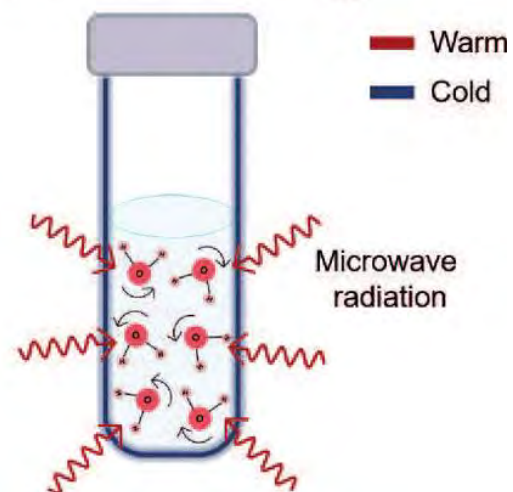


- Extraction of organic pollutants from different matrices
- Isolation of natural bioactive molecules

Conventional Heating



Microwave Heating



ADVANTAGES COMPARED TO TRADITIONAL SOXHLET EXTRACTION

- ✓ Direct heating
- ✓ Reduction of process time
- ✓ Reduction of employed solvent volumes

Subtask Sviluppo di tecnologie di estrazione e purificazione per il recupero di molecole bioattive da sotto-prodotti delle filiere agro-alimentari

2.2.3. bioattive da sotto-prodotti delle filiere agro-alimentari

HEMP SEEDS

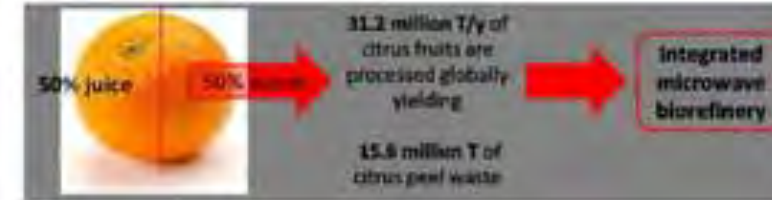
Exceptional food and source of oils



- ✓ The composition of omega-6 (γ -Linolenic) and omega-3 (α -Linolenic) fatty acids is beneficial for health
- ✓ Hemp proteins contain all amino acids, including the 9 essential amino acids

CITRUS WASTE

Nutritional rich source of vitamins and antioxidants



- ✓ Citrus peels typically contains a 30% of pectin. Which occurs as a white to light brown powder or granular and odourless
- ✓ Mainly used as gelling agent, thickening agent and stabilizer

HEMP SEEDS



MAE

t: 2.5'-5'-15'-30'-1h

T: 50°C

Power: 300 W

Solvent: Hexane

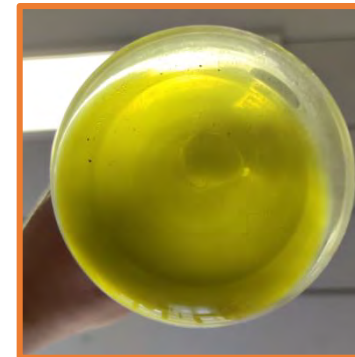
Solvent/Biomass: 10:1



HEMP SEEDS

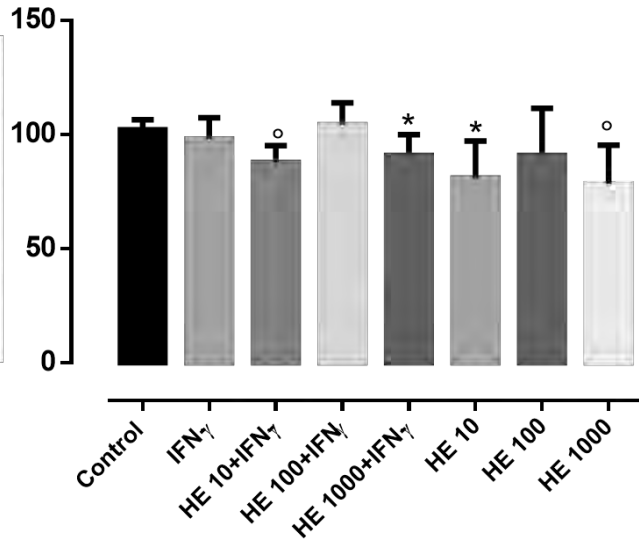


HEXAN EXTRACT

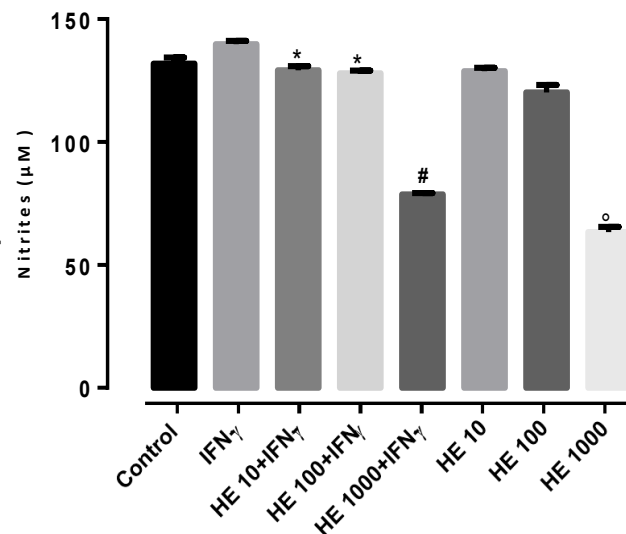


HEMP SEED OILS

SAMPLES	YIELD (%)	DPPH (%)
MAE 2.5'	27	67
MAE 5'	26	68
MAE 15'	26	71
MAE 30'	30	68
MAE 1h	28	68
Soxhlet 6h	30	68



Decrease of nitrite production with HE concentration



	C16:0	C18:3	C18:2	C18:1	C18:0	C20:0	C16:1	C20:1
MAE 5	8,77	1,50	54,63	31,05	3,04	0,98	tracce	tracce
MAE 15	8,84	1,48	54,60	31,10	3,01	0,94	tracce	tracce
MAE 30	9,02	1,57	53,74	31,44	3,16	1,04	tracce	tracce
Soxhlet	8,70	1,51	54,18	31,55	3,03	1,01	tracce	tracce

There are no cytotoxic effects at different concentrations of HE

Palermo, 16th May 2024

CITRUS WASTE



MAE

t: 180 s

T: 90°C

Power 750-1000 W
Solvent: water/citric acid (CA)

Solvent/Biomass: 20:1

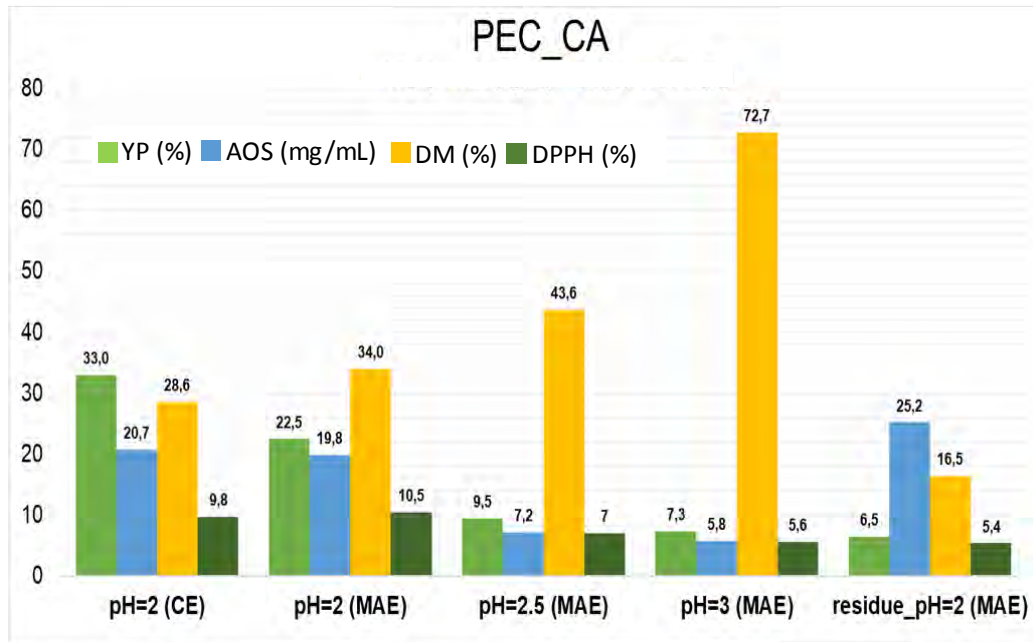


Liquid phase



Solid phase

SAMPLES	pH	Mn (Kda)	Mw (Kda)
PEC-com	-	85	128.8
PEC-CE6h	2	35.3	93.3
MAE-2	2	134.3	218.9
MAE-2.5	2.5	134.7	226.2
MAE-3	3	186.2	377.9
Residue MAE-2	2	270.9	517.9

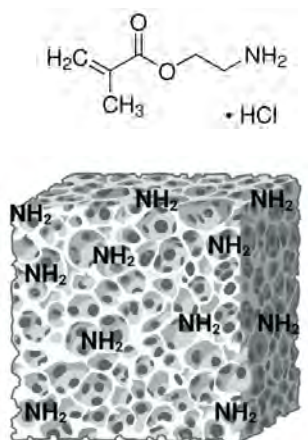


- ✓ MAE PEC show higher Mw and lower degree of methoxylation (DM) respect to conventionally extracted PEC
- ✓ DM is an index of PEC gelling properties
- ✓ Microwave radiation loose cell wall matrix, leading to enhanced interactions between plant material and extracting solvent

OIL INDUSTRY WASTEWATER



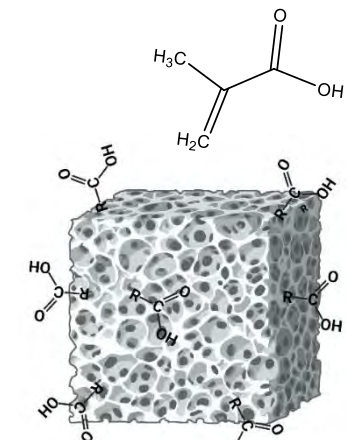
Macroporous Cryogel as promising material for Oleuropein Capturing



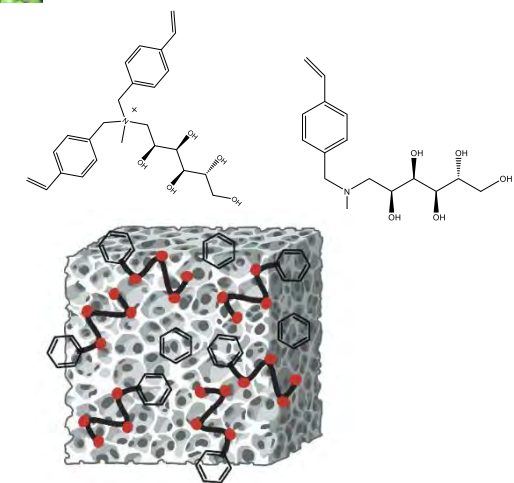
a) Cryo_AEMA



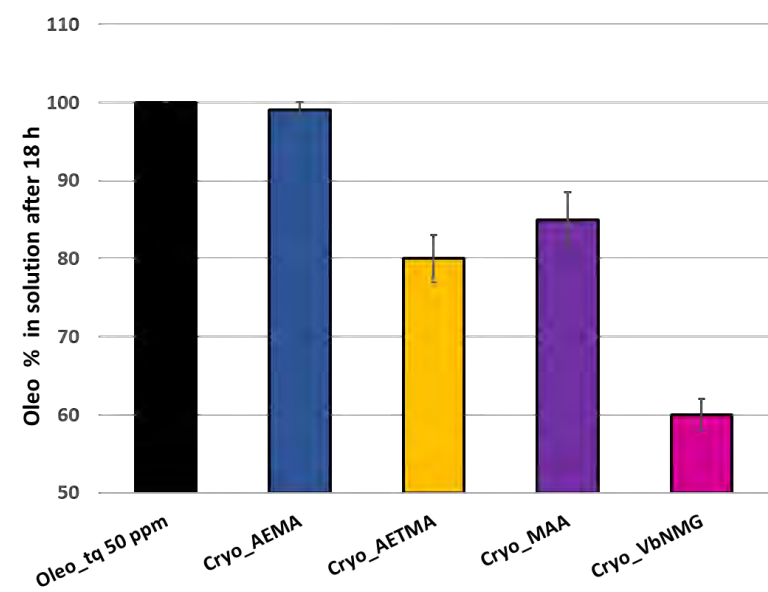
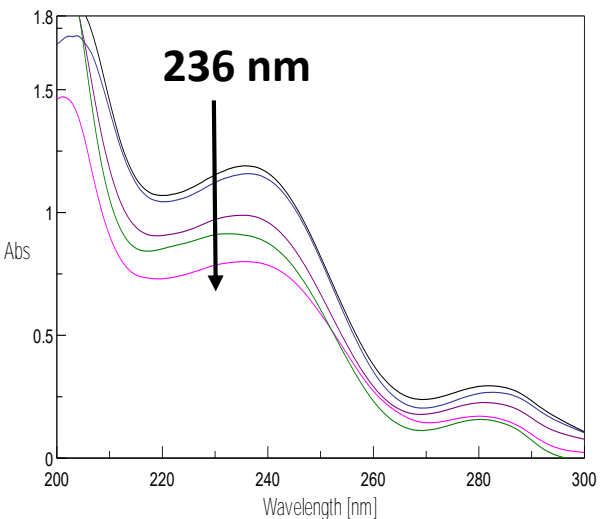
b) Cryo_AETMA



c) Cryo_MAA



d) Cryo_VbNMG



The most favorable outcomes were achieved using Cryo_VbNMG, reaching a capture rate of 40% of the initial oleuropein concentration. This result is likely due to the synergistic combination of hydrogen bonding interactions and π - π stacking with the sugar and vinyl moieties of the cryopolymers, respectively.

FUTURE PERSPECTIVE

HEMP SEEDS

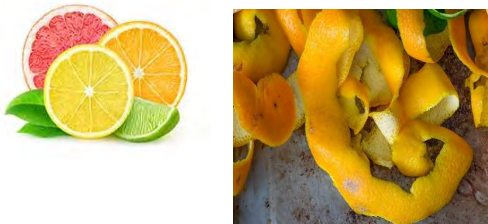


MAE



HEMP SEED OILS

CITRUS WASTE

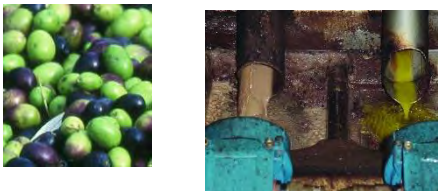


MAE

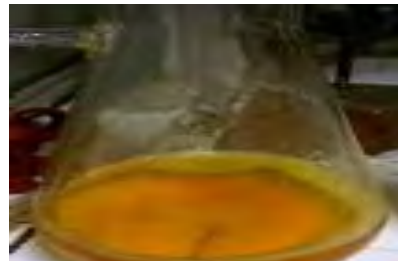


TUNABLE PECTIN

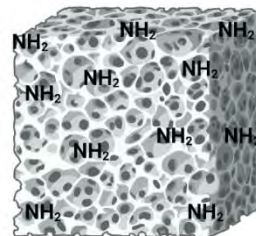
OIL INDUSTRY WASTEWATER



CRYOGEL



BIOACTIVE COMPOUNDS



OLEUROPEINA

Task 2.2.5.

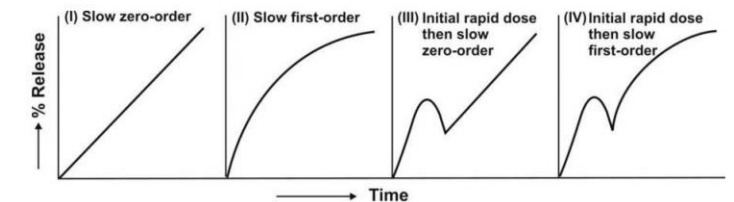
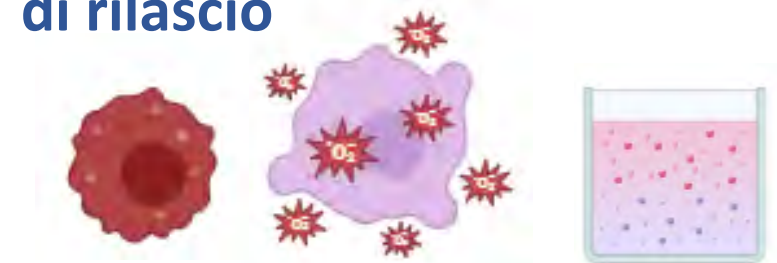
Sistemi di incapsulamento



- ✓ coacervation
- ✓ nanoemulsion
- ✓ spray-dry

Task 2.2.6.

Attività biologica e cinetica di rilascio



IPCB
NUTRAGE
TEAM



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THANK YOU FOR YOUR ATTENTION!

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