Centro Tecnológico Nacional de la Conserva y Alimentación

SMART DIASPORA 2023

GOBIERNO DE ESPAÑA
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA
AGENDA 2030

Región de Murcia

Economía Circular Región de Murcia

CTNC experience in green techniques for the implementation of a Circular Economy in the agri-food sector of the Region of Murcia, Spain

Timisoara, April 2023

Centro Tecnológico Nacional de la Conserva y Alimentación

SMART DIASPORA 2023

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Strong sector

Knowledge

Región de Murcia

Public Administrations as catalysts

Economical support

Implementation of CE Strategies

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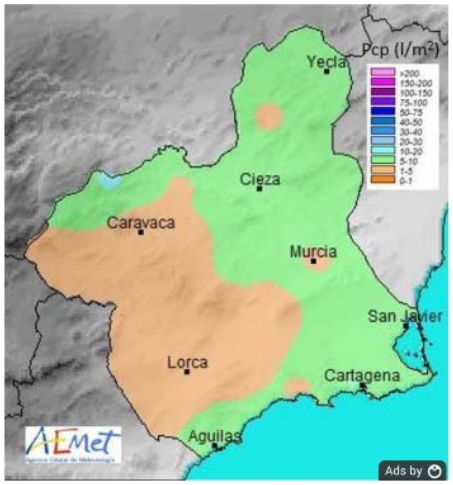
1. Strong sector



WHILE MURCIA REPRESENTS 2.2% OF SPAIN'S TERRITORY, WE ACCOUNT FOR 20% OF THE COUNTRY'S FRUIT AND VEGETABLE EXPORT REVENUE!

Region of Murcia's Share in National Exports

Product	
Lettuce	65.74
Cabbage	69.56
Pepper	13.4
Tomato	8.99
Celery	61.53
Other vegetables	9.25
Total vegetables	23%

Product	Percentage %
Lemon	55.76
Dessert Grapes	67.09
Melon	54.78
Peach	24.21
Watermelon	17.04
Other fruits	5.27
Total Fruits	17%

Total fruits and vegetables 20%

Source: Customs Records

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1. Strong sector

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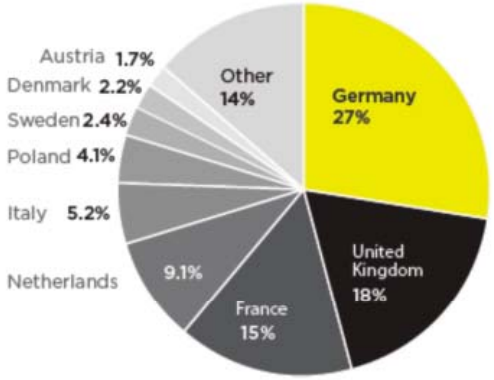
AGROFOOD SECTOR

The agrofood sector is the main exporter to Europe, representing 32.5% of employment and 28.3% of production in the region. Murcia is the Spanish region with the highest percentage of land devoted to organic farming and leads the production of 4th- and 5th-range food products.

Distribution of Export within EU Countries



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1. Strong sector

REGION OF MURCIA AGRO FOOD NETWORK

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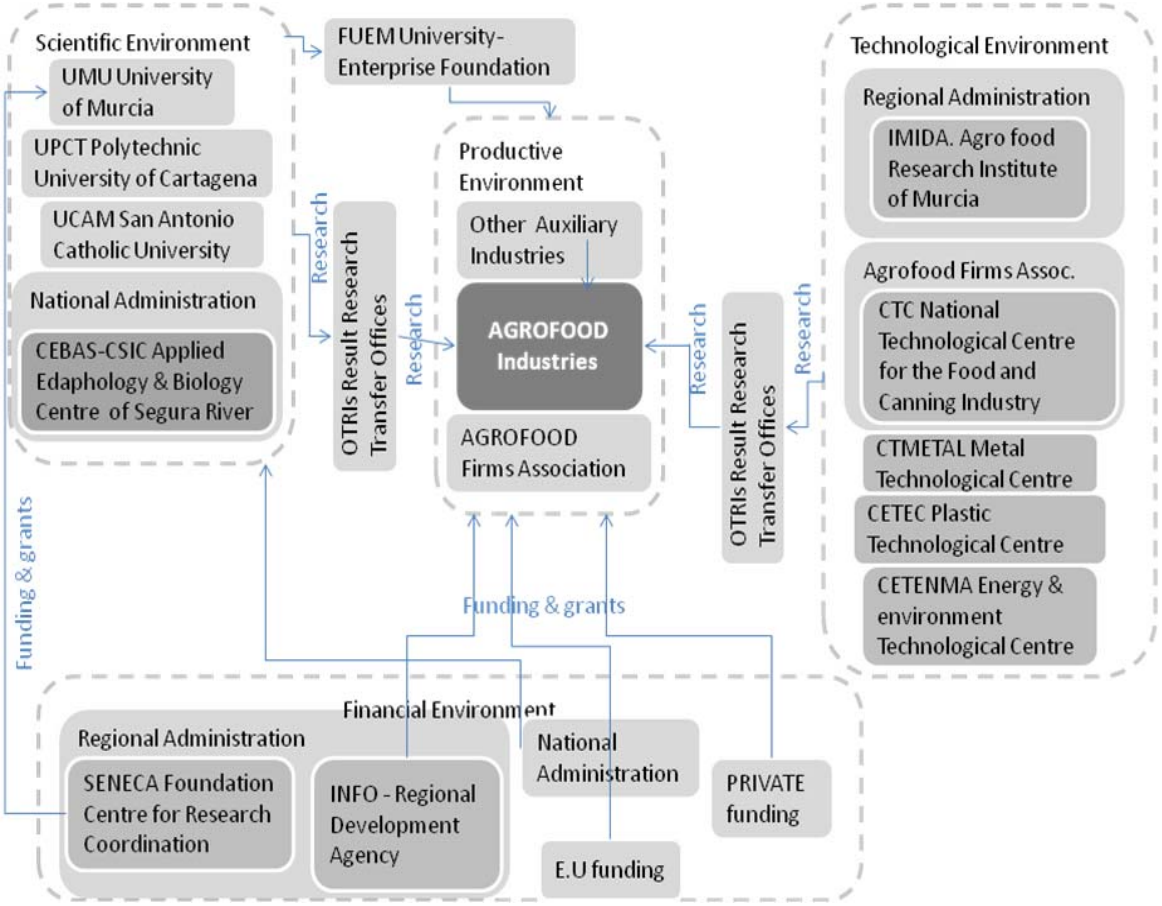
Professional Training Schools

Centre for Integrated Agricultural Training and Experience (CIFEA)- Agriculture and Water



<u>Technological Centres</u>

Private non profit companies research associations.

Budget:

- Regional Administration for general interest research
- European and national projects
- Private projects and other activities

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1. Strong sector

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National Technological Centre for Food and Canning Industry CTNC

Murcia, Spain

www.ctnc.es

CTNC is a private non profit research organization with more than 120 associated companies and working for more than 500 companies every year.

CTNC is recognized by the Spanish Government as Innovation and Technological Centre, Office of Transfer of Research Results and it is declared of Public Use.

Key figures

Turnover: 1.9 M€
Employees: 29
Market: PRIVATE NON PROFIT RESEARCH ASSOCIATION OF COMPANIES
Products: INNOVATION, APPLIED RESEARCH, DISSEMINATION, ETC.

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1. Strong sector

CTC's aim is to promote research, innovation and competitiveness in the agrofood sector.

- **Internationalization of the Agrofood sector: International projects and activities.**
- **SME consultancy activities.**
- **Analytical and technological services.**
- **Training at all levels.**
- **To make our industry more competitive.**
- **To solve environmental problems, introduction of new products and technologies, valorisation of by products, water reuse, etc.**
- **Technology transfer and dissemination activities**

2. Knowledge

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2007/2009

One aim of S.T.E.P. is to help companies in the food processing industry to integrate sustainable processing technologies in giving them tools to help in their decision to change. These tools have to be adapted to little and medium sized companies, because they have less resources than big companies and have almost to face the same environmental focus. They have to ensure that the company knows the impact of a future investment in terms of

- technological criteria
- economic criteria
- environmental criteria
- social criteria

The investment in sustainable processing technologies has to be seen as a factor of increasing the company's competitiveness.

STEP Sustainable Technology for Economic Procesing

- CCID - Chambre de Commerce et d'Industrie de la Drôme (Rhône-Alpes, Francia)
- CCIMP - Chambre de Commerce et d'Industrie Marseille Provence (Provenza-Alpes-Cote d'Azur, Francia)
- Euro Info Centre IT 351 - Azienda Speciale della Camera di Commercio di Milano (Lombardia, Italia)
- Euro Info Centre IT 361 Promofirenze - Azienda Speciale della Camera di Commercio Industria Artigianato di Firenze (Toscana, Italia)
- Chamber of Drama (Drama, Grecia)
- Chambre de Commerce et d'Industrie et de Services de Casablanca (Casablanca, Marruecos)
- CTC - Centro Tecnológico Nacional de la Conserva y Alimentación (Región de Murcia, España)

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2009/2011

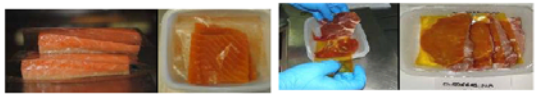
DEVELOPMENT OF NEW ACTIVE CONTAINERS WITH NATURAL ADDITIVES FROM AGROFOOD WASTES (NATAL)
Spanish Ministry of Science

Natural additives from agroindustrial wastes that have been studied

Additives (active principle)	Action
Onion extracts (quercitina and other flavonoides)	Antioxidant and antimicrobial
Pepper extractcs	
Grape extracts (poliphenols)	
Alperujo extracts (poliphenols)	
Tomato skin extracts (lycopene)	Antioxidant
Alga extracts (ascorbic acid and tocoferol)	
Papaya extracts(papaina)	
Garlic extracts (organosulfurados)	Antimicrobial

Food and technology	Active container	Protection
Slices of cooked ham (soft pasteurisation)	Barrier and flexible packaging and separator film	Antimicrobial
Smoked salmon (refrigeration)		
Swordfish (sterilization)	Barrier and flexible packaging	
Slices of aged cheeses (refrigeration)		Antioxidant
Sliced cured Iberian pork meat (refrigeration and modified atmosphere)	Barrier and flexible packaging and separator film	
Fresh meat of Iberian pork (refrigeration and modified atmosphere)		Antioxidant and antimicrobial
Sliced cheeses (refrigeration)		
Fresh salmon (refrigeration)		
Sliced fruits and vegetables (refrigeration)	Barrier and flexible packaging	

Studied foods and containers

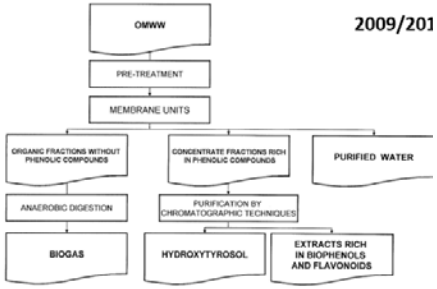


Re-waste

Recovery · Recycling · Resource

Valorization of olive mill effluents by recovering high added value bio-products

2009/201



LIFE + Environment Policy and Governance

Industria Olearia Biagio Mataluni srl

EuroImpresa consulenza & formazione

CTC Centro Tecnológico Nacional de la Conserva

Biomasse et Emploi en milieu rural, BIOMEMPLOI, Leonardo

BiomEmploi

2011/2013

OBJECTIVES

- To identify challenges in terms of employment in the rural sector related with biomass in agriculture and forestry
- To define the skills / qualifications required for new jobs in biomass valorization.
- To set up a guide of skills for careers in the biomass sector
- To identify the role that communities can play to promote development of the sustainable resources management .
-To determine the restraints and success elements in the development of the sector.

AGRICULTEUR ➡ ENERGICULTEUR

CTC Centro Tecnológico Nacional de la Conserva y Alimentación

Programme d'éducation et de formation tout au long de la vie

DUE MONDI

AGRICULTURES & TERRITOIRES

ASSELDOR

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2. Knowledge

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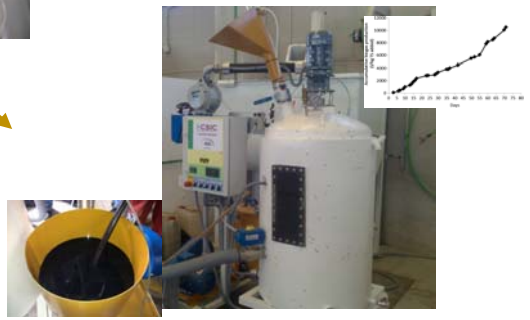
Sustainable solutions in the agrofood sector

2010/2014

Sustainable strategies for integrated management of agroindustrial fruit and vegetable wastes (AGROWASTE) LIFE Programme of European Union

Reference: LIFE10 ENV/ES/000469. Coordinator: CEBAS-CSIC; Partners: CTC and AGRUPAL

Artichoke, onion, garlic, tomato, lemon, orange, carrots, broccoli, peach, apricot, etc.



OBJECTIVE

The main objective of this project is to design an integrated management system for fruit and vegetable wastes (FVW) at the Region of Murcia (Spain), by using environmentally friendly technologies that will convert "residues" on "resource". The proposed technologies will be adapted to the specific type of residues and it will be integral managed, depending on the intrinsic FVW characteristics.

Main ways of Valorisation :

1. **Agriculture and Environment (composting)**
2. **Food (enriched extracts)**
3. **Energy (biomethanization)**

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2. Knowledge

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Sustainable solutions in the agrofood sector

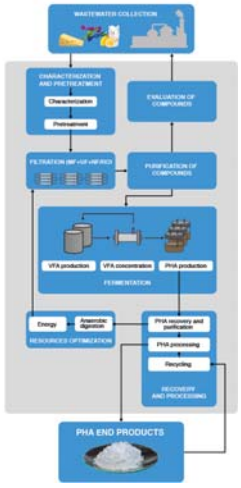
Life Clean Up

VALIDATION OF ADSORBENT MATERIALS AND ADVANCED OXIDATION TECHNIQUES TO REMOVE EMERGING POLLUTANTS IN TREATED WASTEWATER (LIFE CLEANUP) LIFE Programme of European Union
Reference: LIFE 16 ENV/ES/000169. 2017/2020
Coordinator: UCAM; Partners: Hidrogea, Regenera Levante, Hidrotec, CTC (Spain), CNR-IPCF and Universidad de Bari (Italia).

iWATERMAP Interreg Europe

WATER TECHNOLOGY INNOVATION ROADMAPS. Interreg Europe**.** 2018/2023
Index Number: PGI05062
Coordinator: Wetsus (NL); Partners: CREA Hydro&Energy, z.s. (CZ); Region of Crete (EL); Food and Agriculture Cluster Foundation of the Murcia Region (ES); Riga Technical University (RTU) (LV); Ministry of Education and Science of Republic of Latvia (MoES) (LV); Province of Fryslân (NL); University of Minho (Uminho) (PT); North-East Regional Development Agency (RO).

THE PROCESS



AN INTEGRATED SOLUTION FOR THE RECOVERY AND CONVERSION OF RELEVANT FRACTIONS FROM WASTEWATER (AFTERLIFE). Bio Based Industries (BBI-H2020). 2017/2021
Grant agreement No 745737
Coordinator: EggPlant; Partners: 14 partners from 7 European countries (Belgium, Germany, Finland, Croatia, Italy, Spain *(CTC)* and Portugal).

afterlife

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Circular Economy. Strategy 2030

ESPAÑA CIRCULAR 2030

Circular Economy Spanish Strategy

AXES OF ACTION

1. **Production and design**
2. **Consumption**
3. **Waste management**
4. **Secondary raw materials market**
5. **Water reuse**
6. **Research, innovation and competitiveness**
7. **Participation and awareness**
8. **Employment and training**

3. Public Administrations

17 MEASURES out of 70 close to the agri-food sector

2. Industry 4.0 as an effective way to promote the circular economy.
3. Development of European standards on ecodesign and circular economy.
7. Promotion of the eco-label.
9. Promotion of the integral sustainability of the agri-food industry.
10. Support for organic food production.
15. Implementation of the Strategy "More food, less waste“ 2017-2020.
31. Declaration and promotion of by-products.
35. Revision of the regulations on plastic materials and objects recycling intended to come into contact with food.
37. Revision of the Royal Decree of Fertilizer Products.
38. Regulatory adjustment for the promotion of water reuse regenerated residuals.
40. Support to irrigation projects that have as resources the reuse of wastewater.
42. Promotion of research work to establish the criteria minimum quality requirements for water reused from the sanitary and environmental point of view.
44. R&D+i project oriented to the Challenges of Society in public-private collaboration ("Research Challenges").
45. R&D+i projects oriented to the Challenges of Society in public-private collaboration ("Challenges Collaboration").
52. Knowledge transfer and exchange of good practices.
59. National Reference Centers with directed training plans to the professional profiles needed to move towards circular economy model.
60. Training programs for young researchers (Innovation-alternative raw materials / energies renewable).

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3. Public Administrations

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Circular Economy. Strategy 2030

Region of Murcia Circular Economy Strategy

In review

In **December 2018** the Region of Murcia launched its Circular Economy **2017-2030** strategy, which considers the circular economy as an opportunity for the sustainable growth of employment and common wealth and which is structured around **eight basic axes**:

Economía Circular Región de Murcia

1. **Energy efficiency** improvements in companies to boost sustainable production
2. **Sustainable consumption**
3. A **program against food waste** will be launched,
4. A plan for the **use of secondary raw materials** will be drawn up
5. **Efficient use of water**
6. Promotion of research and development in the field of circular economy for R & D & I programs in the field of systemic eco-innovation
7. Promotion of knowledge, awareness and participation
8. Promotion of employment and training

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3. Public Administrations

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Circular Economy. Strategy 2030

Region of Murcia Circular Economy Strategy

In review

participación ciudadana REGIÓN DE MURCIA

The Circular Economy Strategy began to be implemented on January 1st 2019.

- Its design has involved **six regional ministries and up to 60 organizations** in the Region during 2018.
- **51 measures** divided into eight axes of action,
- **Creation of about 2,000 'green' jobs**. These jobs will be created mainly through entrepreneurship, but also "in companies that develop specialized areas in circular economy"
- **510.4 M€ to develop 51 measures** in favor of responsible consumption, sustainable production and waste management.

Analysis of Weaknesses, Threats, Strengths and Opportunities, SWOT is established as a Tool for the Diagnosis of the Situation in the Region of Murcia, which leads to the determination of strategic priorities.

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3. Public Administrations

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Circular Economy. Strategy 2030

Region of Murcia Circular Economy Strategy

In review

510,4 M€

RM CIRCULAR ECONOMY STRATEGY 2030

SUSTAINABLE DEVELOPMENT

- **205 M€** will be allocated to the **efficient use of water** in the Region, to improve irrigation and sanitation systems and wastewater treatment.
- 172.7 M€ to the boost of the '**bioeconomy**' and the improvement of energy efficiency.
- 16,2 M€ As for measures of the area of **sustainable consumption**: awareness campaigns, companies to create dosed products based on the current family model, etc.
- 29.7M€ measures for **waste management**
- 19 M€ actions for the development of **secondary raw materials**
- 46.6 promotion of **R & D**
- 2.1 M€ campaigns for **knowledge, awareness and participation of the population** in the circular economy
- 15.4 M€ development of **employment and training** for companies.

PROJECTS – NEW IDEAS

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3. Public Administrations

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CTC: main stakeholder in CE in the Regional agrofood sector

In 2018, within the Program of Aids of the **Regional Development Agency INFO** directed to Technological Centers of the Region of Murcia, co-financed by the European Regional Development Fund, the project of "Technological Surveillance to Support the R & D of the Agri-Food Sector" was carried out.

Many surveys were carried out to detect the R & D needs of the sector and to guide the CTC in its new research lines. Among the detected needs are:

- Research in the valorization of by-products or food waste: obtaining dehydrated extracts, antioxidants and natural antimicrobials.
- Water management and recovery of wastewater through new bioprocesses: bioplastics, microalgae, etc.

info Región de Murcia

Una manera de hacer Europa
Fondo Europeo de Desarrollo Regional

Región de Murcia Unión Europea

RESOLUCIÓN GENERAL DE CONCESIÓN DE SOLICITUDES DE AYUDAS INTEGRADAS EN EL PROGRAMA DE AYUDAS DIRIGIDAS A CENTROS TECNOLÓGICOS DE LA REGIÓN DE MURCIA DESTINADAS A LA REALIZACIÓN DE ACTIVIDADES I+D DE CARÁCTER NO ECONÓMICO. MODALIDAD 2: "PROGRAMA DE ACTUACIONES NO ECONÓMICAS DE APOYO A LA I+D"

In 2019, in this approved INFO (VT- ECOCIMUR) project a SWOT Analysis will be carried out by CTC on the state of the Circular Economy in the agri-food sector and in related organizations, following a University of Ghent methodology, in order to define the strategic priorities of the sector. This methodology has already been used by the CTC in the AGFORISE FP7 Project.

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3. Public Administrations

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Methodology

UNIVERSITEIT GENT

SWOT ANALYSIS

2019

1. Food Industry

2. Support and related organisms

Working group
(researchs, technicians, policy makers, stakeholders, etc.)

Interviews to industry

Final SWOT

Definition of priority strategies in Circular Economy in the food sector of the Region of Murcia

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4. Economical support

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1. **OBTAINING COMPOUNDS OF INTEREST. THE CTNC HAS EQUIPMENT TO DEVELOP EXTRACTION TECHNIQUES CONSIDERED AS GREEN TECHNIQUES**
   - ❑ Enzymatic extraction
   - ❑ Subcritical water extraction
   - ❑ Microwave assisted extraction

Enzymatic extraction

Microwave assisted extraction

Subcritical water extraction

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4. Economical support

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- Ultrasound assisted extraction
- Extraction by adsorption-desorption methods
- Supercritical CO2 extraction

Supercritical CO2 plant

adsorption-desorption columns

Ultrasound pilot plant

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4. Economical support

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- Mechanical extraction: use of micronizers, physical separators such as decanter and centrifuge

Washer machine

decanter

Cutter

Micronizer

Centrifuge machine

Crusher

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4. Economical support

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- Separation concentration through Membranes
  - Spiral MF-UF-NF 0,2 micras-300 Dalton
  - Ceramic
  - Cross filtration 600-50 nm
  - Inverse Osmosis

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4. Economical support

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2. **BIOTECHNOLOGY. BIOLOGICAL PROCESSES SUCH AS FERMENTATION AND HARNESSES BIOCATALYSTS**
   - ❑ BIOREACTOR 5 L
   - ❑ BIOREACTOR 75 L

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4. Economical support

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3. DRYING TECHNOLOGIES:

- ❑ Spray dryer
- ❑ Lyophilizer
- ❑ Hot Air oven

Spray dryer.

Freeze dryer

Hot Air oven

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4. Economical support

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ENCAPSULATION AND MICROENCAPSULATION:

- Dry encapsulation
- Wet encapsulation

Mini spray dryer

Encapsulator

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5. Implementation

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Financiado por la Unión Europea NextGenerationEU

Plan de Recuperación, Transformación y Resiliencia

The CERVERA AGROMATTER Group comprises five complementary Technology Centres in the fields of agriculture, biotechnology and materials science. Its aims are to establish a network of Technology Centres of scientific and technical excellence in the field of the Circular Economy applied to the development of bio-based materials for technical applications, to gain recognition as R&D centres of reference both nationally and internationally, to bring about growth in R&D projects and technology transfer to the business sector.

agromatter

SIDE STREAMS AND WASTES

Olive industry
Citrus industry
Grape and wine industry
Cereals industry
Cruciferous industry

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5. Implementation

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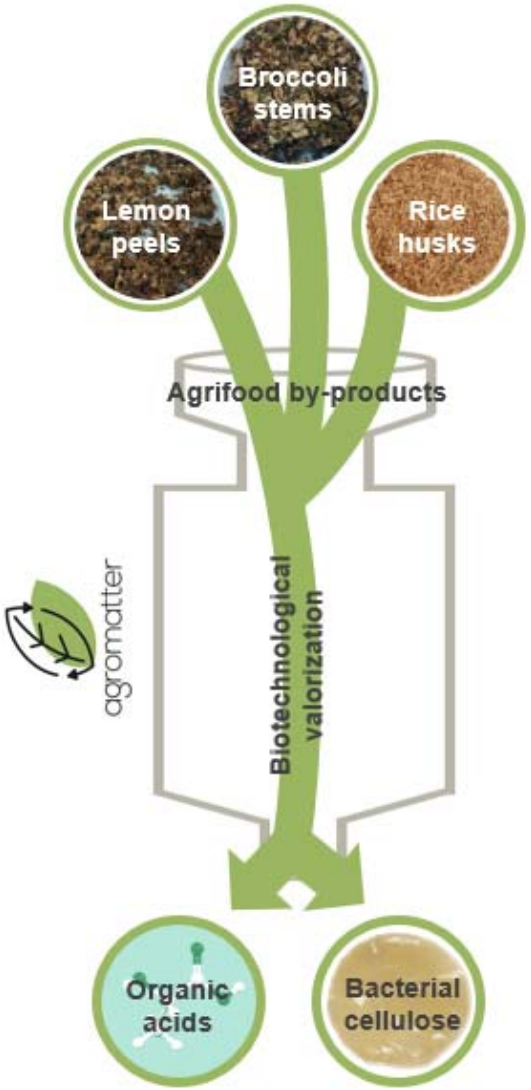
Different studies have been carried out in AGROMATTER project for the valorisation of a wide range of by-products, such as **lemon peels, broccoli stems and rice husks**, into compounds with high-added value and for multiple applications for the **packaging, textile and cosmetic sectors**.



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5. Implementation

OBTAINING ENRICHED BROCCOLI EXTRACTS

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BY-PRODUCT

WASHING BY-PRODUCT

SHREDDING

EXTRACTION

SEPARATION

SOLID PHASE

AQUEOUS PHASE

DEHYDRATION

AQUEOUS PHASE

CONCENTRATION

LYOPHILIZATION

	BROCCOLI BY-PRODUCT	AQUEOUS EXTRACTION	ENZYMATIC EXTRACTION	ULTRASONIC EXTRACTION
				
Determination of Compounds Interest (mg/kg)				
CHLOROGENIC ACID	13	<10	<10	<10
CAFFEIC ACID	18	<10	<10	<10
VITAMIN C	99	<55	< 55	<55
Determination of nutritional analysis (g/100g)				
EDIBLE FIBER	4,0	67,5	68,8	50,0
PROTEIN	2,8	16,2	13,7	11,1
TOTAL SUGARS	1,1	1,8	< 0,01	<0,1
Yield (% by weight of initial raw material)				
YIELD	-	5,4	4,43	3,0

	BROCCOLI BY-PRODUCT	AQUEOUS EXTRACTION	ENZYMATIC EXTRACTION	ULTRASONIC EXTRACTION
				
Determination of Compounds Interest (mg/kg)				
CHLOROGENIC ACID	13	<10	<10	<10
CAFFEIC ACID	18	109	75	49
VITAMIN C	99	<55	<55	185
TOTAL POLYPHENOLS	-	5237,9 (0,52%)	4643,2 (0,46%)	4821,6 (0,48%)
Determination of nutritional analysis (g/100g)				
EDIBLE FIBER	4,0	2,0	6,8	19,3
PROTEIN	2,8	17,6	16,2	33,3
TOTAL SUGARS	1,1	42,9	38,1	1,4
Yield (% by weight of initial raw material)				
YIELD	-	0,7	0,49	1,72

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Financiado por la Unión Europea NextGenerationEU

Plan de Recuperación, Transformación y Resiliencia

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5. Implementation

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BROCCOLI BY-PRODUCT

AQUEOUS EXTRACTION

SOLID PHASE

CUTTER

H_2O_2 TREATMENT

WATER WASHING

DEHYDRATION

EXTRACTION

DEHYDRATION

PURIFICATION OF ENRICHED BROCCOLI EXTRACTS

	BROCCOLI BY-PRODUCT	AQUEOUS EXTRACTION	PURIFIED FIBER
			
	Determination of nutritional analysis (g/100g)		
EDIBLE FIBER	4,0	67,5	70,8

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Plan de Recuperación, Transformación y Resiliencia

Centro Tecnológico Nacional de la Conserva y Alimentación

5. Implementation

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aitex

Financiado por la Unión Europea NextGenerationEU

Plan de Recuperación, Transformación y Resiliencia

1. ÁREA TEXTIL

Fabricación de no tejidos por wet-laid a partir de subproductos Agromatter

Nuevas pruebas realizadas

Nº	Prototipos	Material	Gramaje (g/m2)
19	WL19-HACE-50	50% Hueso de Aceitunas triturado 25% Lyocell 25% PLA	200
20	WL20-HACE-60	60% Hueso de Aceitunas triturado 20% Lyocell 20% PLA	200
21	WL21-HACE-70	70% Hueso de Aceitunas triturado 15% Lyocell 15% PLA	200
22	WL22-CASC-50	50% Cascarilla de Arroz 25% Lyocell 25% PLA	200
23	WL23-CASC-60	60% Cascarilla de Arroz 20% Lyocell 20% PLA	200
24	WL24-CASC-70	70% Cascarilla de Arroz 15% Lyocell 15% PLA	200
25	WL25-PAJ-50	50% Paja de Arroz triturada 25% Lyocell 25% PLA	200
26	WL26-PAJ-60	60% Paja de Arroz triturada 20% Lyocell 20% PLA	200
27	WL27-PAJ-70	70% Paja de Arroz triturada 15% Lyocell 15% PLA	200
28	WL28-PJTR-50	50% Paja de Trigo triturada 25% Lyocell 25% PLA	200
29	WL29-PJTR-60	60% Paja de Trigo triturada 20% Lyocell 20% PLA	200
30	WL30-PJTR-70	70% Paja de Trigo triturada 15% Lyocell 15% PLA	200
31	WL31-CÑR-50	50% Caña de Rio triturada 25% Lyocell 25% PLA	200
32	WL32-CÑR-60	60% Caña de Rio triturada 20% Lyocell 20% PLA	200
33	WL33-CÑR-70	70% Caña de Rio triturada 15% Lyocell 15% PLA	200
34	WL34-PAJ-600	70% Paja de Arroz triturada 15% Lyocell 15% PLA	600
35	WL35-PJTR-600	70% Paja de Trigo triturada 15% Lyocell 15% PLA	600

Varios gramajes

Prueba 22 (50% casc.)

Prueba 24 (70% casc.)

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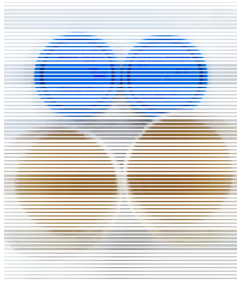
✓ Antimicrobial capacity

APPLICATION OF FORTIFIED LEMON EXTRACTS IN THE COSMETICS INDUSTRY

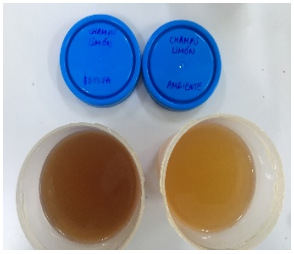
aitex research & innovation center

LEMON SERUM
Stable (2 months)
*Darkening of extract
Pending Challenge test and microbiological control



LEMON EXTRACT DRY SHAMPOO
Stable
Microbiological control: OK

LEMON SHAMPOO
Stable (2 months)
*Extract darkening
Challenge test: OK
Microbiological control: OK



LEMON EXTRACT BASE CREAM
Stable (3 months)
Challenge test: OK
Microbiological control: OK

✓ Stable extracts in creams

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5. Implementation

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A2C solution: Territorial circular systemic solution for the upcycling of residues from the Agro-food Sector

Programme

H2020-EU.3.5 Societal Challenges- Climate action, Environment, Resource Efficiency and Raw materials

Agro2Circular

Topic

LC-GD-3-2-2020-Demonstration of systemic solutions for territorial deployment of circular economy

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036838.

Project Information

Agro2Circular
Grant agreement ID: 101036838

DOI
10.3030/101036838

Start date 1 October 2021
End date 30 September 2024

Funded under
SOCIETAL CHALLENGES - Climate action, Environment, Resource Efficiency and Raw Materials

Total cost
€ 16 846 032,50

EU contribution
€ 14 074 828,28

Coordinated by
ASOCIACION EMPRESARIAL DE INVESTIGACION CENTRO TECNOLOGICO DEL CALZADOY DEL PLASTICO DE LA REGION DE MURCIA
Spain

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A2C Consortium: 41 partners from 11 European countries

Germany, Spain, Austria, United Kingdon, Italy, The Netherland, Finland, Belgium, Switzerland, Greece and Lithuania

- 6 RTOs
- 13 SMEs
- 6 Large Companies
- 5 NPOs
- 4 NGOs
- 5 UNIs
- 2 Public administrations

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In Europe fruits & vegetales (F&V) are the higher contributors to food waste (>40%)

They are an excellent source on natural bioactive compounds as alternative to synthetic additives for food, nutraceuticals and cosmetics

F&V wastes are not exploited!

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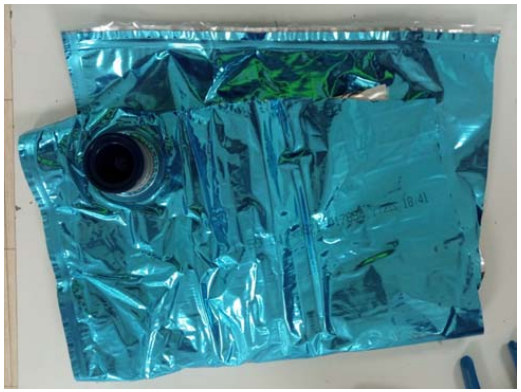

Aseptic bag-in-box

Multilayer with gas barrier properties.

Alumium foil/coating

No recycling solution available!

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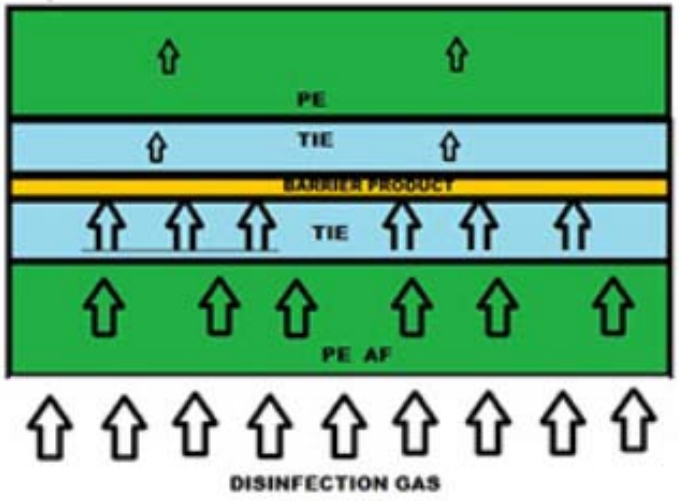

Multilayer gas barrier film for soil disinfection

No recycling solution available!

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Circular solution

Objective 1: Demonstrating the first value chain for the upcycling of most representative agrifood sector wastes: Fruits&Vegetables and multilayer plastics

Objective 2: Providing to the A2C technological solution the circular systemic approach by building a multidimensional model enabling the solution territorial deployment and its replication and scalability.

Objective 3: Maximizing project impacts and facilitating A2C systemic solution replication& scalability

A2C will implement a demonstrator in the Region of Murcia that can be replicated in different regions of Europe for a territorial implementation of the circular economy.

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OBJECTIVES

- Valorisation of **agrifood wastes** (F&V) to obtain high **valuable bioactives** (dietary fibres, phenolic compounds for new foods, nutraceuticals and cosmetics).

- Upcycling the **multilayers** (aseptic bags and agricultural barrier films) to obtain a range of **high barrier recyclable compounds** as alternative to current multilayers in food packaging and agriculture.

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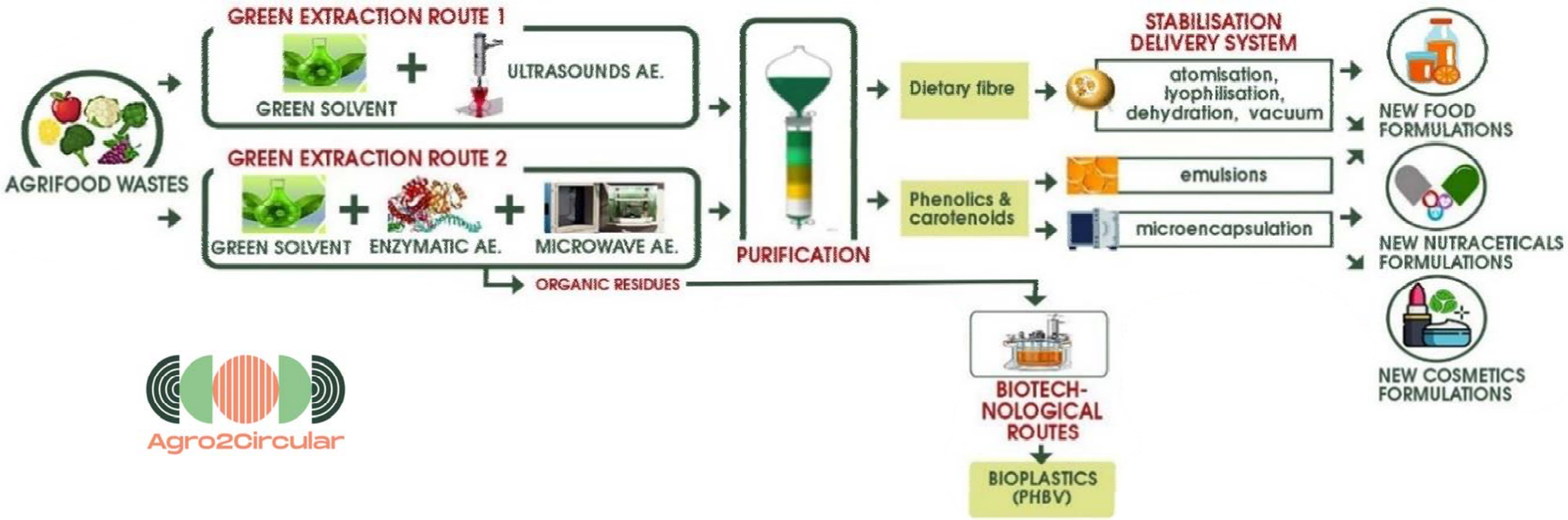
Agri-food waste upcycling



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CITRUS
BY-PRODUCT

ARTICHOKE
BY-PRODUCT

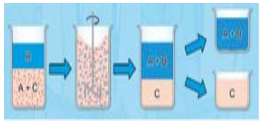
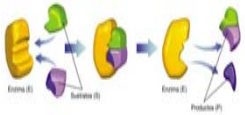
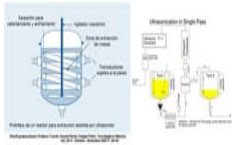
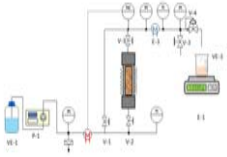
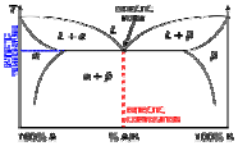
APPLE
BY-PRODUCT

CAULIFLOWER
BY-PRODUCT

GRAPES
BY-PRODUCT

Extraction of high value-added substances at laboratory scale

BY-PRODUCT

- AQUEOUS EXTRACTION
  - 
  - 1:3 w/v
    1 hour
    98 ºC
- ENZYMATIC EXTRACTION
  - 
  - 1:3 w/v
    VALIDASE® TRL (0.01% of matrix)
    1 hour
    25 ºC
- ULTRASOUND-ASSISTED EXTRACTION
  - 
  - 1:3 w/v
    90 % amplitude (164 W)
    1 hour
    98 ºC
- SUBCRITICAL WATER EXTRACTION
  - 
- EUTECTIC EXTRACTION (NADES)
  - 
- ENZYMATIC EXTRACTION
  - pH= 3 – 4; 50°C;3h;
    1:3 w/v

    ECOZYM 35
    ECOZYM PLUS
    ECOZYM PRESS HE
    POLIZIM COLOR
- MICROWAVE EXTRACTION
  - 
  - 70°C;5min; 1:10 w/v

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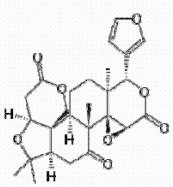
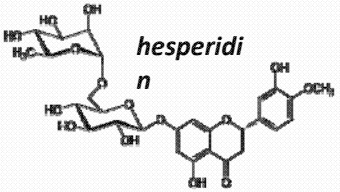
Extraction of high value-added substances at laboratory scale

Characterization of the A2C extract compounds

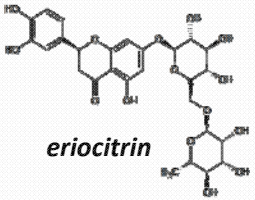
Citrus



limonin

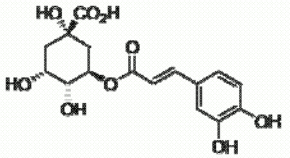


hesperidin



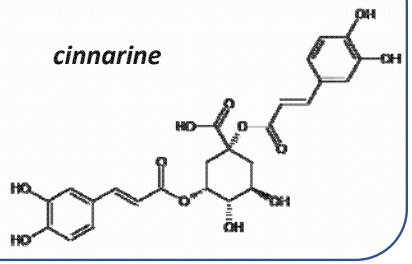
eriocitrin

Artichoke

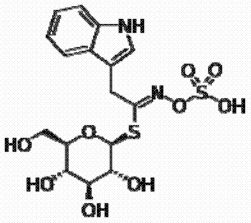


Chlorogenic acid

cinnarine

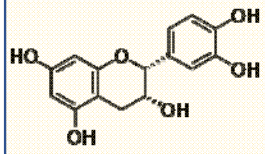


Cauliflower



glucobrassicin

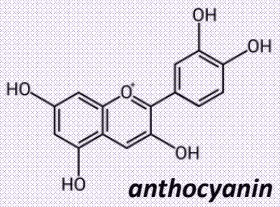
Apple



Chlorogenic acid

epicatechin

Grapes



anthocyanin

Catechin & epicatechin

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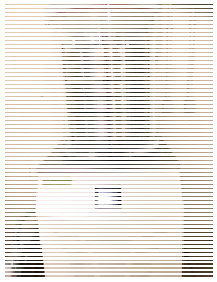
Purification and stabilisation of extracts

Bioactive extract	Target	Stabilisation technology
Fibre	Functional food ingredient	Conventional (atomisation, lyophilisation, dehydration, vacuum concentration)
Phenolic compounds & carotenoids	Functional food ingredient	Emulsions, multilayer emulsions, solid-lipid
	Cosmetics & nutraceuticals	Encapsulation

Agro2Circular

Spray dryer



Freeze dryer

Vacuum concentrator

Climatic chamber

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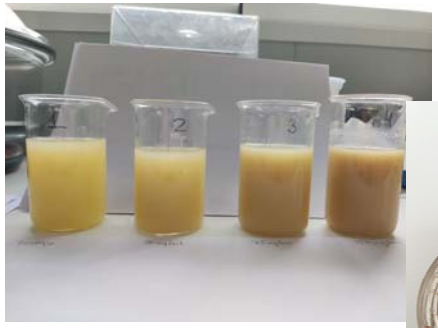
New formulations



Nutraceutics

Objective:
Nutraceuticals with antioxidant capacity

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Food

Objective:
Fibre-rich foods
Antioxidant rich foods

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6. Conclusions

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1. The transition to a circular economy is an obligation imposed by consumers and by society.

2. Region of Murcia is prepared to formulate public policies and collective action on the basis of the new global agenda for sustainable development.

3. **Support from public administrations is essential to implement a successful CE strategy (green equipments, specialized staff, etc.).**

4. CTNC works for improving the agrofood sector into a circular economy

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Mulțumesc foarte mult!!

Ángel Martinez Sanmartín

angel@ctnc.es