

Le projet européen Biotecmar



Coordination : **F. GUERARD** & **C. FLOCH-LAIZET**, UBO LEMAR UMR6539
2009-2011; 2,3M€ (dont 1,5M€ FEDER)

12 Partenaires : 4 pays (Irlande, France, Espagne, Portugal)



8 centres de Recherche

- UEB®- Université de Bretagne Occidentale (FR)
- Museum National Histoire Naturelle (FR)
- Irish Seaweed Centre (IE)
- CSIC (ES)
- IPIMAR (PT)
- Université de La Rochelle (FR)
- Université de Nantes (FR)
- IFREMER (FR)

**Producteurs
(amont)**



**Transformateurs
(aval)**

4 centres de transfert

- INDIGO Rock (IE)
- CETMAR (ES)
- Technopole Quimper-Cornouaille (FR)
- N.E.T. Novas Empresas Tecnologias (PT)

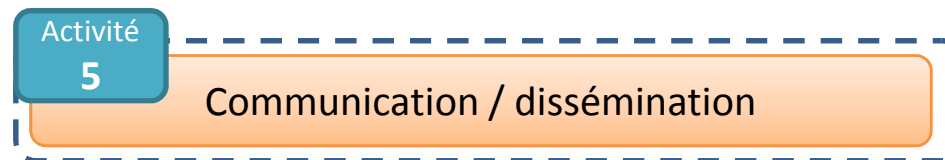
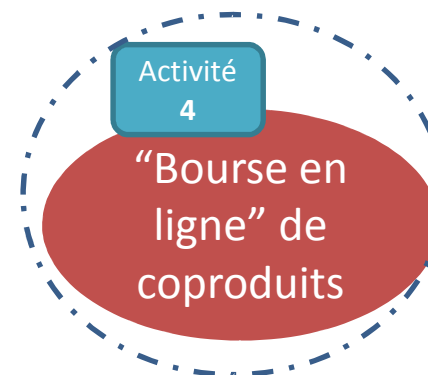
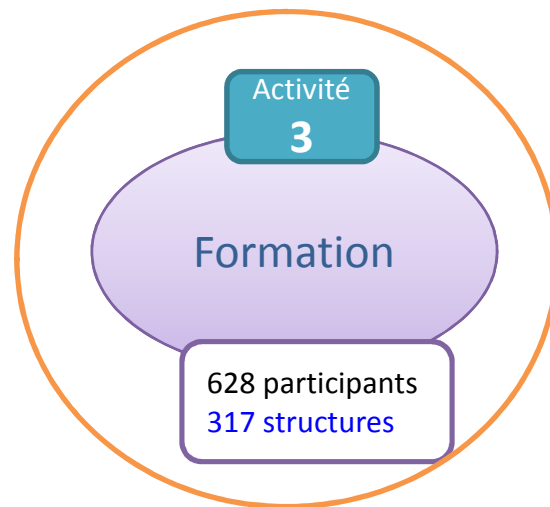
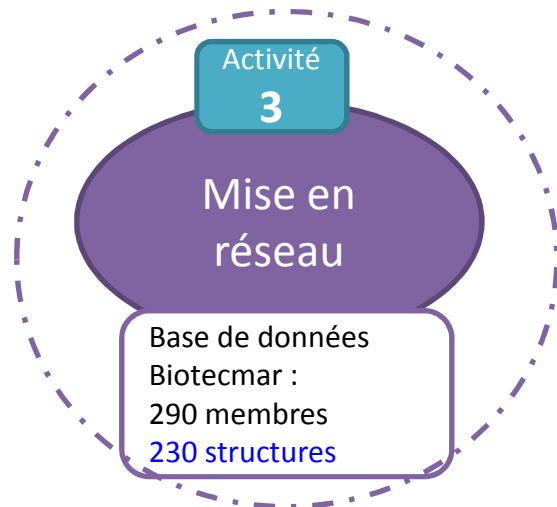
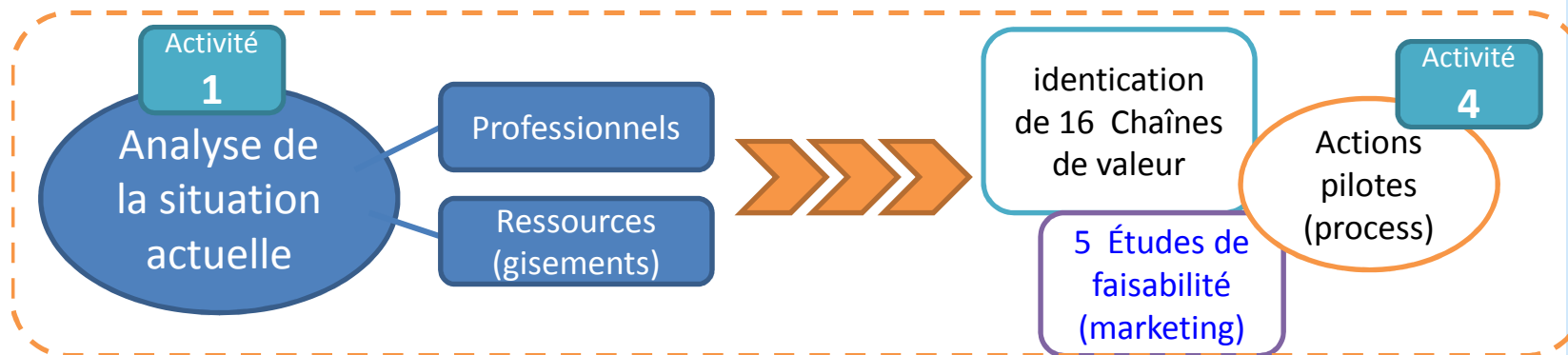


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Stratégie & actions Biotecmar :

une approche *modèle* et *intégrative* de la valorisation des coproduits



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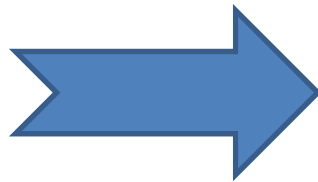


● **Activité N° 1 : “Analysis of the current situation”**

Quels sont les gisements pour la filière de valorisation des coproduits marins?

Cartographie des ressources disponibles

Cartographie des professionnels



Identification de 16 chaînes de valeur :
collagène de poisson, jus de moule, pigments d'algue rouge, etc.

Quelle est la faisabilité technique et économique d'une chaîne de valeur de coproduits marins:

5 Études de faisabilité (marketing)

Actions pilotes (process)



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• Activité N° 4 : Pilot actions



Résultats des actions pilotes => sous forme de posters



PILOT ACTION 2, demonstration 2: Phenolic compounds in *Sargassum muticum*: conditioning and extraction methods

Asunción Tardaguila, Carolina Jimenez-Ladron, Laurent Vigneron, Luc Maréchal, Valérie Stiger-Pierrat

Introduction
Phenolic compounds, or polyphenols, are metabolites found at high levels in Brown algae. The purpose of this study were then (1) to improve the pre-extraction phase and (2) to propose innovative extraction processes, in order to obtain a better selectivity in the extraction of phenolic compounds from the brown macroalgae *Sargassum muticum* (Fensholt, Phaeophyceae).

Conservation method
The effects of different conditioning were tested.

Solid/liquid extraction
The effects of the use of various solvents were investigated and compared.

Centrifugal Partition Chromatography (CPC)
CPC – liquid-liquid extraction method based on the liquid-liquid partitioning of compounds.

S/L extraction vs CPC

Conclusion
This work constitutes a progress in the recovery of bioactive phenolics in crude extracts and represents a requirement for new inquiries in their further structural identification. It will allow a better understanding of the brown seaweeds phytochemistry and should open tracks for the valorisation of those phenolic biomolecules in brown algae.

Optimisation of hydrolysis conditions of the edible red seaweed *Palmaria palmata* to enhance R-PE extraction using experimental design

Rachelle Chénier, Isabelle Elmer, Myrielle Monroque, and Florence MMS EA 2262 Université de Nantes | jolanta.chenier@univ-nantes.fr | +33(0)2 51 12 51 93

Introduction
Palmaria palmata is one of the 4 edible red seaweeds in France. As other brownish, redheads to redheads seaweeds, P. palmata polyphenols are rich in carotenoids and polyphenols. The aim of this work was to improve the extraction of polyphenols from P. palmata using experimental design. The aim of this work was to improve the extraction of polyphenols from P. palmata using experimental design. The aim of this work was to improve the extraction of polyphenols from P. palmata using experimental design.

Materials and Methods
Hydrolysis: Cutted Palmaria palmata (10g), Acetic acid (pH 5), 50 mM Palmaric (CC), 2,2,2,2-T. Experimental design: Central Composite Design (2² Surface response methodology 23 experiments). Responses investigated: R-PE Purify Index (PI), R-PE Yield (mg/g dried algae), Polyphenol content (mg/g dried algae), Reducing sugar (mg/g dried algae).

Results
Results obtained after the experimental design procedure led to obtain an optimisation of hydrolysis conditions in order to increase the R-PE. The extraction of this method was 22.5% to 31%, which indicates good reliability. In accordance with other studies, the use of this method led to an increase in the R-PE yield and the R-PE yield.

Recovery of Protein Hydrolysates, Pigments and Chitin/Chitosan from Discarded Crustaceans

Ricardo I. Pérez Martín, Carmen G. Soledad, Mónica García, Raquel G. Morillo, Patricia Ariza & Jose M. Valero

Introduction
Fisheries discards are a matter of concern due to their economic and environmental impact. Thus, the use and valorization of both discarded species and the byproducts of target captured species is an active area of research. The valorization of crustaceans could be a source of protein hydrolysates, pigments and chitin/chitosan. In the framework of BIOTECMAR project, four sources of discarded crustacean byproducts (crustaceans) caught on the Galician-Northern Portugal coast and/or the Grand Sole fishery were considered for potential valorisation (Figure 1). Some data about the abundance of these discarded crustaceans can be seen in Figure 2. For all these species, more than 20 000 Tm per year could be easily yielded.

Technical Procedure
The proposed process involves an enzymatic hydrolysis step involving a protein hydrolytic risk in allergens, an acid treatment step to remove the mineral salts (mainly CaCO₃) and a washing step to eliminate the residual colour and drying step to obtain the dry solids (Figure 3). Different enzymes and acid concentrations (Temperature, pH, time, etc) are being studied for the optimization of the overall production before the implementation of pilot plant.

Characterization of products and potential uses
The topics related to the use of hydrolyzed protein obtained in the first stage is an on-going work for aquaculture due to its composition in proteins and a potential use of pigments. In terms of pigments, the hydrolyzed protein obtained in different conditions are being analyzed by HPLC and the treatment are being tested for various bioactive compounds and antioxidant capacity. The effect on the mineral salts, and so on, in the case of your results, when purified fractions could be used in food supplement or as nutraceutical feed ingredients for specific cultured fish or molluscs, at initial growing stage.

Conclusion
In relation to chitin/chitosan, their characteristics in terms of molecular weight, structure, purity and other properties are being analyzed using different analytical techniques such as IR, NMR, electron microscopy, viscosity. The amount obtained is about 10% of a total dry weight.

Feasibility Study of the Recovery of Marine Aromas in Mussel Cooking Juice in Ireland

Sara Maguire, Niamh O'Connell, Lorraine O'Connell, & Patrick O'Connell

Raw material supply
The mussel industry in Ireland is the largest aquaculture sector in terms of tonnage (17-200T in 2008) and second to salmon in terms of value (€22,036,000 in 2008). 90% of mussels produced are processed therefore, all mussel cooking juices could come from these processing plants.

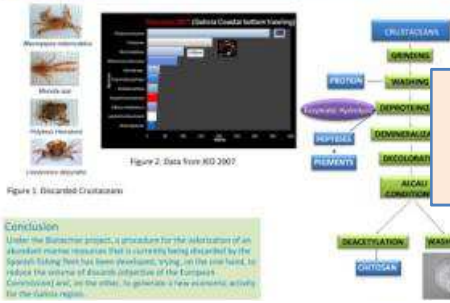
Extraction and transformation process
An analysis in Ireland (and most leading mussel producing areas) is relatively likely to be completed, the simplest way to recover them is distillation via steam extraction. Marine aromas can also be recovered by conventional processes aimed at wine processing.

Analysis of the situation
Most of the current liquid mussel aromas is coming from the New Zealand green-lipped mussel (*Perna canaliculus*). However this is considered to be a functional food product. Green-lipped mussel total market potential accounted for €24.2M in 2008 (€10,000 tonnes) in 2008, the projected market for 2012 is €40.2M (€15,000 tonnes) in 2012.

Diagnoses of the situation: SWOT analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> High quality raw material High quality product High quality product High quality product High quality product 	<ul style="list-style-type: none"> High quality product High quality product High quality product High quality product High quality product
Opportunities	Threats
<ul style="list-style-type: none"> High quality product High quality product High quality product High quality product High quality product 	<ul style="list-style-type: none"> High quality product High quality product High quality product High quality product High quality product

Conclusions
90% of all mussels produced are processed. Essentially all mussel processing plants produce a mussel cooking juice product. The availability of such an inexpensive raw material will attract attention. However, currently the market for such a product is limited. A new mussel juice product could be sold in conjunction with processing existing products. Potential buyers of the product include secondary manufacturers of ready meals such as chateaux, restaurants, pantries, Asian cuisine and the food service industry. The price will vary according to quality and concentration. Competition is likely coming from the large mussel producing nations particularly Chile.



Posters disponibles sur www.biotechmar.eu

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● **Actions N° 2 & 3 : Sessions Biotecmar :**

23 évènements de formation, transfert technologique,

France : 14 sessions

- 1 symposium international sur les biotechnologies marines
- 1 séminaire sur l'évaluation des gisements des coproduits marins
- **7 sessions techniques: transfert technologique** en direction des entreprises sur la valorisation des coproduits marins
 - 1 session technique sur les **aspects réglementaires**
 - **4 sessions transversales : créativité, analyse des risques en innovation, veille informationelle, propriété intellectuelle et brevets...**

Irlande : 2 sessions sur la valorisation des coproduits marins

Portugal : 3 sessions techniques : transfert technologique en direction des entreprises sur les coproduits marins

Espagne : 4 sessions : séminaires sur la valorisation des coproduits de pêche et des rejets et des algues (macro et micro)



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Programme Transnational



Projet BLUE HUMAN (2018-2020)

G. Le Blay, C. Hellio, V. Stiger, M. Buscaglia, M. Fauchon, & F. Guérard



Development of a New Biomaterial for Bone Tissue Engineering: Enzyme Cross Collagen from Salmon (*Salmo salar*)

M. Buscaglia¹, M. Fauchon¹, V. Stiger-Pouvreau¹, C. Hellio¹, G. Le Blay¹, F. Guérard¹

¹ Laboratoire des Sciences de l'Environnement Marin, UBO/CNRS/IRD/Ifremer - IUEM, Plouzané - France / Contact: manon.buscaglia@univ-brest.fr

CONTEXT

Bone is a tissue with various roles (support, protection, movement, mineral storage, blood cell synthesis...) and in constant remodeling helping:

→ > 2 million bone grafts are realized per year worldwide. Current implants are either inorganic (e.g. ceramics or titan) or organic (e.g. mammalian collagen matrix) [1,3,4]

Why collagen in bone tissue engineering?

- Biocompatible, biodegradable and low immunogenicity [4]
- Most abundant protein in connective tissues

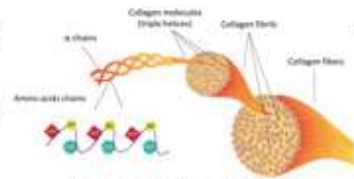


Fig. 1. Fibrous structure of collagen [4]

Why use marine collagens? [5,6]

- Compositions close to mammalian collagens
- Limit zoonosis
- Adding value to marine by-products
- No cultural or religious issues

Lower mechanical properties and stability than m...



Our role in the BlueHuman project

"BLUE biotechnology as a road for innovation on HUMAN's health aiming smart growth in Atlantic Area"



Marine collagen scaffold



BIOMATERIAL FOR BONE TISSUE ENGINEERING

Active polyphenol-enriched fractions



Marine plants



Search for bioactive extracts and fractions enriched in polyphenols

POLYPHENOLS extraction & purification optimisations

Crude extracts & enriched fractions

Multiple activities
Antioxidant, antibacterial & anti-biofilm

Tissue development aid
Osteogenic & pro-mineralogenic activities (Univ. of Faro)

Characterization
Quantification
Characterization

Projet Marmed (2011-2014)

V. Stiger, N. Poupart & F. Guérard



(Surget et al., 2015; Surget et al., 2017; Le Lann et al., 2016)

Conclusion - Perspectives



1 – Grande diversité de coproduits disponibles (**qualité & quantité**)
(protéines, peptides, huiles, omega 3, collagène, minéraux, mucopolysaccharides, etc.)

=> **Développements sur-mesure**

2 – Un potentiel de développement de composés nouveaux considérable
(nutrition humaine et animale, cosmétique, IAA, ...)

3 – Si les différentes voies de valorisation sont complémentaires

=> **Développement croissant d'applications de niche à très haute valeur ajoutée** (peptides actifs, biomatériaux)

vs production de masse (qui existera toujours)