

NOVISHPAK

NOVEL BIODEGRADABLE, ANTIMICROBIAL AND SMART PACKAGING AND COATINGS FOR INCREASED SHELF-LIFE OF MEDITERRANEAN FISH FILETS

Terms of reference for a service provider in support for the project implementation

1. Context

NOVISHPAK (Novel biodegradable, antimicrobial and smart packaging and coatings for increased shelf-life of Mediterranean fish filets) is an awarded project under the PRIMA Programme "Partnership for Research and Innovation in the Mediterranean Area", Section 2 (Projects funded by Participant States), -- Multi-topic 2023 - Topic 2.3.1-2023 (RIA) Assessing novel antimicrobial food packaging and coating materials to reduce food waste to improve safety in the Mediterranean food supply chain.

The main objective of NOVISHPAK is to develop innovative biodegradable, antimicrobial and smart packaging films and edible coatings based on kelp seaweed polysaccharides used for the extension of shelf-life of Mediterranean fish fillets. The project aims to effectively contribute to food sustainability and healthy products development along with food waste reduction. Within this project, 9 partners and two companies as subcontractors will join forces to develop, produce, test in small scales, and validate in larger scales innovative packaging and coatings. They will also evaluate them in terms of consumers perspective and design business models for the packaging solutions proposed.

More specifically, NOVISHPAK will design and produce biodegradable films and edible coatings using algae and fish waste extracts. Simultaneously, antimicrobial agents such as appropriate lactic acid bacteria and their compounds (e.g., bacterial lysate, bacteriocin) will be incorporated in the films and coatings. Novel technologies such as Cold Atmospheric Plasma will be used for the alteration of the properties of the films (mainly targeting to hydrophobicity increase for the new films).

The packaging solutions will be first developed at lab scale at the Institute of Technology of Agricultural Products ELGO-DEMETER by the research teams of Dr. Markou and Dr. Katsaros.

The protocol for developing the final proposed solutions will then be transferred to higher scale and films and coatings will be produced in a semi-industrial environment. This higher scale production will allow evaluating the economic feasibility of the novel packaging solutions and designing the corresponding business models.

Those tasks are included in NOVISHPAK project Work Package (WP) 4 “Assessment of the developed packaging film and coatings on fish filets preservation” and WP5 “Socio-economic impacts of innovative techniques and Business models”. CIHEAM-IAMM is responsible for leading WP5 and contributing to work packages WP4 and WP6. To implement the work-packages and tasks under its responsibility, CIHEAM-IAMM will need technical and economic results from higher scale production of the novel packaging solutions developed in-lab.

The service provision advertised will thus consist in three complementary activities (a) providing know how on the application of novel process technologies; (b) applying at higher scale the in-lab developed protocol of new packaging solutions; (c) providing technical and economic data necessary for the detailed cost-benefit analysis of the novel technologies and the co-design of profitable and sustainable business models.

Those activities are all closely interlinked and necessary for the successful completion of the tasks under CIHEAM-IAMM responsibility in NOVISHPAK.

2. Description of the main activities

The role of the service provider will be:

1. Activity 1: Providing know-how on the application of novel process technologies such as cold atmospheric plasma treatment.

The service provider will offer advanced know-how on the application of atmospheric cold plasma technology, a transformative process that significantly enhances the performance and sustainability of biodegradable, antimicrobial packaging films derived from microalgal components. This cutting-edge technology utilizes ionized gas under atmospheric pressure to precisely modify the film's surface properties, creating enhanced adhesion, wettability, and antimicrobial activity—all without the need for harsh chemicals or elevated temperatures. By refining the microstructure at a molecular level, the cold plasma treatment not only improves mechanical strength and thermal stability but also enhances barrier properties, ensuring greater protection against moisture and microbial contamination. The service provider's expertise will be critical in optimizing these parameters, tailoring the technology to meet specific industry requirements while supporting environmental sustainability. Additionally, this innovative approach will contribute to reducing food waste by extending the shelf life of packaged products, offering a pioneering solution that aligns with emerging demands for eco-conscious packaging in the food industry.

The services will be provided to support the execution of **Work Package 2**, entitled “Packaging Films and Edible Coatings Production and Characterization”. This work package comprises several essential tasks designed to advance the development of innovative, sustainable packaging solutions, a necessary step for their final evaluation..

Specifically, the service provider will:

- Provide know-how on the application of cold plasma technology for the microstructure modification of the new packaging material, allowing for the adhesion of antimicrobial compounds. The process parameters will be selected based on the cold plasma setup and the effect on the packaging material. All activities will be aligned with the project's milestones, ensuring the timely delivery of innovative solutions. This activity will have to be completed within 6 months from the signing of the service provision contract.

2. **Activity 2: Applying at higher scale the in-lab developed protocol of new packaging solutions** (production of plastic and flexible packaging material in semi-industrial environment).

The service provider will play a pivotal role in Activity 2, focusing on scaling up the in-lab developed protocols to produce innovative packaging solutions. This activity involves transitioning from laboratory-scale processes to the semi-industrial production of plastic and flexible packaging materials. The services will include the production of biodegradable films and coatings, ensuring that the materials meet the high standards established during the research phase.

The provider will:

- Leverage its expertise to optimize key production parameters, such as material formulation, processing conditions, and cold plasma treatment. The goal is to ensure that the packaging films retain their essential properties, including mechanical strength, flexibility, antimicrobial efficacy, and biodegradability, even at a larger production scale.
- Address challenges related to semi-industrial production, such as achieving consistent film quality, maximizing throughput, and minimizing production waste. By refining these processes, the provider will demonstrate the feasibility of producing sustainable packaging at a scale suitable for industrial application.
- At least 1000 samples respecting the two above criteria should be delivered by the end of this activity.

These activities will contribute significantly to the project's objectives by providing practical data for commercial application, ensuring the packaging's functionality and sustainability. Activity 2 will also contribute to the successful execution of Work Package 2, entitled: "Packaging Films and Edible Coatings Production and Characterization", and thus be conducted in close interaction with both CIHEAM-IAMM and ELGO-DEMETER. This activity will have to be completed within 12 months from the signing of this contract.

3. **Activity 3: Providing data for the detailed cost-benefit analysis** of the novel technologies and the co-design of profitable and sustainable business models.

Building on the results of Activities 1 and 2, the service provider will contribute critical data and insights for assessing the economic feasibility of the novel packaging technologies and supporting the design of sustainable and profitable business models. This activity will provide CIHEAM-IAMM with the necessary qualitative and quantitative information to ensure the project's long-term viability and alignment with market and environmental goals. The service provider will:

- **Data Collection and Analysis:** Collect and analyze key metrics related to production costs (e.g., materials, energy consumption, labor), operational efficiencies, and product performance at semi-industrial scales. This includes:
 - Quantitative data on the cost of raw materials, processing steps, energy usage, and waste management.
 - Performance data on the packaging films' durability, biodegradability, and antimicrobial effectiveness.
 - **Feedback for Optimization:** Provide qualitative insights on areas for improvement, including suggestions for optimizing processing parameters, reducing production waste, and improving energy efficiency.

This activity will directly support the project's overarching goal of ensuring the economic and environmental sustainability of the innovative packaging solutions. By delivering critical cost-benefit insights, the service provider will play a pivotal role in the successful market adoption of these novel technologies. This activity will have to be completed within 18 months from the signing of the contract.

3. Duration and Location

Duration: The overall execution period of these tasks is for 18 months.

The commencement date of the contract is set for 01 March, 2025 or at the earliest possible point.

Location: Home country of the service provider.

4. Deliverables

a. Activity 1 Deliverables

- **Technical Guidelines Report:**
 - Comprehensive guidelines on the application of cold atmospheric plasma technology for biodegradable packaging material.
 - **Deadline:** Within 6 months from the signing of the contract.
 - **Format:** PDF document.
- **Experimental Data Set:**
 - Data on process parameters (e.g., gas composition, treatment time, power settings) and their effects on the material's properties.
 - **Deadline:** Within 6 months from the signing of the contract.
 - **Format:** Excel spreadsheet and accompanying technical report in PDF.
- **Optimization Report:**
 - Recommendations for the optimal application of plasma treatment tailored to the project requirements.
 - **Deadline:** Within 6 months from the signing of the contract.
 - **Format:** PDF document.

b. Activity 2 Deliverables

- **Semi-Industrial Production Report:**

- Detailed documentation of scaling-up processes, including challenges, optimizations, and final methodologies.
- **Deadline:** Within 12 months from the signing of the contract.
- **Format:** PDF document.
- **Product Sample Batch:**
 - Delivery of at least 1,000 biodegradable and antimicrobial packaging film samples meeting the specified criteria.
 - **Deadline:** Within 12 months from the signing of the contract.
 - **Format:** Physical samples accompanied by a short description in PDF.

c. Activity 3 Deliverables

- **Cost-Benefit Analysis Report:**
 - Detailed quantitative and qualitative cost-benefit analysis of the developed packaging solutions, including cold plasma treatment.
 - Critical sensitivity analysis for major variables.
 - **Deadline:** Within 18 months from the signing of the contract.
 - **Format:** PDF document and Excel data sheet.
- **Optimization Recommendations:**
 - A document providing actionable feedback on improving the cost-efficiency and quality of the production process.
 - **Deadline:** Within 18 months from the signing of the contract.
 - **Format:** PDF document.

All PDF documents will also be provided as drafts and final versions in Word, for review by the Steering Committee.

5. Steering Committee

A steering committee will be set-up among project partners to follow the service provision, under the leadership of CIHEAM-IAMM. Regular interactions with the Steering committee should be included in the methodological proposal.

6. Confidentiality – Conflicts of Interest

The service provider contracted, along with its personnel involved in the project, will be required to sign a Non-Disclosure Agreement (NDA) and a Declaration of Absence of Conflict of Interest to ensure independence, ethical conduct, and the protection of project data.

Confidentiality

- The service provider agrees to maintain the strict confidentiality of all proprietary information, data, methodologies, and technologies shared by CIHEAM-IAMM and ELGO-DEMETER for the purpose of the project.
- The service provider will implement robust measures to safeguard any trade secrets, know-how, or confidential information disclosed during the execution of the contract.
- Under no circumstances shall the service provider disclose, use, or exploit any confidential information for purposes beyond the scope of the contracted activities.

Intellectual Property Rights

- Ownership of Intellectual Property: All intellectual property rights (IPR), including but not limited to methodologies, data, processes, and technologies developed or provided under the project, shall remain exclusively with CIHEAM-IAMM and ELGO-DEMETER.
- No Sharing of IPR: The service provider acknowledges that it will not gain or claim any intellectual property rights from its participation in the project or from any technologies or methodologies provided by CIHEAM-IAMM and ELGO-DEMETER.
- Grant of Limited Use License: The service provider will be granted a non-exclusive, non-transferable, and revocable license solely for the use of project-specific technologies and know-how for the execution of the contracted activities. This license will automatically terminate upon the completion of the contract.
- Prohibition of Independent Exploitation: The service provider is prohibited from using, commercializing, or sharing any outputs, technologies, or data arising from the project for any purpose outside the scope of the contract without prior written consent from CIHEAM-IAMM and ELGO-DEMETER.

Legal Enforcement

- Any breach of confidentiality or intellectual property rights provisions will result in immediate termination of the contract and may lead to legal action, including claims for damages and injunctive relief.

7. Required qualifications

The service provider must meet the following requirements:

a. Expertise

- Demonstrated experience in application of novel technologies mainly focusing on cold atmospheric plasma technology
- Familiarity with sustainable packaging innovations
- Strong internal monitoring system to track costs, waste, and assess industrial performances
- Experiences in report writing
- In-depth knowledge and understanding of European programs and projects, including their management practices and challenges, would be a plus

b. Equipment

- Appropriate machinery (cold atmospheric plasma device, extruders, high tech laminating and cutting machines etc.) for the application of Cold atmospheric plasma technology and the production in larger scale of the newly developed packaging films and coating materials that will be used for the field tests

8. Submission of proposal

Interested applicants are invited to submit the following:

Technical part:

- A technical and methodological proposal with details on the proposed approach, including expertise and equipment mobilized.
- The CVs of those involved and the sharing of responsibilities among them, with the corresponding estimated days of work per task.
- References on the service provider's equipment / machinery
- Financial references demonstrating the service provider's financial health (audited financial statements, budget reports, bank statements...)

Financial part:

- A quotation including a budget breakdown of the main planned tasks (see annex 2)
- The quotation must specify the cost (VAT-exclusive and VAT-inclusive) and include the company registration number or its local equivalent as proof of its legal existence; full bank details of the service provider: IBAN, SWIFT code, name and address of his/her bank
- Guarantees

The maximum budget for that contract is 50,000.00 euros VAT inclusive.

9. Submission deadline and selection procedure

The deadline for the quotation and proposal submission is **the 28th February 2025 at 12:00 (Paris time)**

Proposals should be submitted **in English** by email with the subject "**NOVISHPAK service provider proposal**" addressed to:

Georgios Kleftodimos : kleftodimos@iamm.fr

Amelie Bourceret: bourceret@iamm.fr

Main criteria for evaluating the proposals will be:

- The qualification of the candidate(s)
- Relevant experience
- Suitability of equipment / machinery
- Proposed methodology and price

The selection process may include interviews (through Zoom or phone), as well as a pre-selection phase followed by requests for complementary information / negotiation if required.

The selected candidate will be issued a contract with the CIHEAM-IAMM specifying the final delivery and completion schedule for the planned tasks, as well as the terms of payment.

ANNEX 1: Template for list of relevant experiences

It is asked to provide for each experience contacts which could provide feedback, or a certificate of satisfactory completion.

Experience	Description	Dates	Funding received by your organization (amount in €)	Reference contacts
1. <i>(For example: the name of the project for which the company, NGO/organisation is/was involved)</i>	<i>Please detail the role of your organization/company/NGO etc. activities for which it is or was involved, outputs produced and context (funded by what agency/organization?)</i>			
2.				

ANNEX 2: Example for quotation

N°	Description	Corresponding tasks / responsibilities	Unit cost (in euros)	Quantity (for example: persons/day; number of trips...)	Total cost in € excluding tax	Cost in €, including tax
Activity 1						
1	<i>(For example: Expert 1 name and qualification)</i>					
2...	<i>(e.g. Expert 2 name and qualification)</i>					
3...						
Activity 2						
1	<i>(e.g.: travel....)</i>					
2...						
	TOTAL COST					