SIGUR

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Volume 1

Advanced Ecological Solutions for Safer Fruits and Vegetables

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SIGUR - the project

Project name: *Advanced Ecological Solutions for Increasing the Food Safety of Fruits and Vegetables, from Producer to Consumer*

Acronym: SIGUR

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The vegetables - an important part of our daily diet

Implementation period: June 2025 – May 2027

A consortium dedicated to the consumers' safety

HOFIGAL
Natura nu minte niciodată

ICECHIM

USAMV
BUCUREȘTI
EX·TERRA·AVRVM

Project Overview

SIGUR – *Advanced Ecological Solutions for Increasing the Food Safety of Fruits and Vegetables, from Producer to Consumer* – develops and transfers an innovative, eco-friendly technology for obtaining **natural surfactants and plant-derived antimicrobial compounds**, enabling a safe, efficient washing solution for fresh produce. The project builds on a validated laboratory technology (TRL4), aiming to bring it to **TRL6** through industrial optimization, validation, and pilot demonstration

Why This Matters?

Caption describing picture or graphic.

Food safety is becoming a critical global concern as fresh fruits and vegetables increasingly carry **microbial contamination**, **pesticide residues**, and **environmental pollutants**. Recent international reports highlight outbreaks of *Listeria monocytogenes*, *Salmonella*, and *E. coli* associated with contaminated produce, emphasizing the urgent need for safer solutions. Traditional industrial washing methods, including chlorine-based treatments, have limited efficiency and generate hazardous by-products such as trihalomethanes and haloacetic acids. At the same time, consumer expectations are shifting towards natural, non-toxic and environmentally responsible products.

SIGUR responds to this challenge by developing **the first fully ecological Romanian washing solution** - based on natural surfactants, bioactive plant compounds, and biobased acetic extract—designed to remove microbial load, pesticide residues, waxes and dirt without altering taste, aroma or texture.

By uniting scientific innovation with circular, plant-based resources, SIGUR offers a timely and credible alternative to conventional washing systems. The project not only supports public health and consumer confidence, but also aligns with European sustainability goals—laying the groundwork for cleaner supply chains, reduced chemical use, and a safer future for fresh products.

Why now?

"Safe food now for a healthy tomorrow"

Theme for World Food Safety Day

The need for safer, greener solutions in the fresh-produce sector has never been more urgent.

Rising contamination events, climate-driven pathogen proliferation, and the widespread detection of pesticide residues place increasing pressure on both producers and consumers. Traditional chlorine-based washing methods are losing credibility due to low efficiency and harmful by-products, while EU and global trends demand natural, non-toxic alternatives.

At the same time, recent breakthroughs in natural surfactants, green extraction and biobased antimicrobials make large-scale ecological formulations finally feasible.

This rare overlap of public-health urgency, consumer demand, and technological maturity makes SIGUR *exactly the right project at exactly the right moment.*

From Laboratory to Market

Aubergines deserve purity. SIGUR brings it naturally.

At the core of the SIGUR project is the technology transfer of a proven laboratory process to industrial scale. The technology includes:

- synthesis/obtaining of natural surfactants from vegetal sources, carbohydrates, amino acids or collagen hydrolysates, with high biodegradability and antimicrobial activity;
- production of an acetic solution obtained by fermenting plant waste streams rich in polysaccharides—an approach that valorizes agricultural residues from HOFIGAL's existing production lines Extraction of polyphenolic antimicrobial compounds from vegetal by-products using microwave-assisted extraction;
- integration of all components into a safe, optimized produce-wash formulation.

The project brings together HOFIGAL (Coordinator), ICECHIM (P1), and USAMV (P2), ensuring complementary expertise in biotechnology, chemistry, green extraction, food safety, and industrial process design.

Project Highlights (So Far)

Stakeholder Engagement

The consortium has initiated consultations with producers, distributors, and food-safety experts to align the final product with industry needs. Pre-research discussions revealed a clear demand for natural, non-corrosive, residue-free washing agents suitable for both household and industrial use.

Scientific Achievements

Early analyses have mapped the principal contaminants on fruits and vegetables—including microbial species (*Salmonella, E. coli, Listeria, Campylobacter*) and pesticide residues commonly found on Romanian produce—setting the foundation for targeted formulation design

Technology Development

Research teams have progressed on:

- Obtaining natural surfactants and evaluating critical micelle concentration, foaming capacity, biodegradability, and antimicrobial effect

- Developing fermentation protocols for biobased acetic solutions

- Extracting and characterizing polyphenolic antimicrobials using HPLC, FTIR, UV-Vis and microbiological assays

- Early integration tests to assess stability, sensorial impact, and cleaning efficiency on real produce

Apricots at their best — naturally clean, naturally safe.

Innovation at the Core

SIGUR stands out for its integrated eco-friendly design:

- natural surfactants replacing synthetic detergents
- plant-derived antimicrobials with proven antiviral and antibacterial potential
- valorization of plant waste, ensuring circularity and reducing environmental impact
- absence of toxic residues, enabling application without rinsing risks
- compatibility with organoleptic properties, preserving taste, aroma and texture of fresh products.

This is not simply a washing solution—it is a rethinking of how food safety can be ensured using nature-derived chemistry aligned with green-chemistry principles.

Together, these elements position SIGUR as more than a technical advancement—they mark a shift toward a new generation of food-safety solutions rooted in green chemistry, circularity, and scientific rigor. The project demonstrates how natural ingredients, intelligently engineered, can deliver performance equal to or greater than conventional synthetic systems.

"Healthy citizens are the greatest asset any country can have."

Winston Churchill

Next Steps

Over the coming months, the consortium will focus on:

- optimizing synthesis and fermentation parameters through Design of Experiments and statistical modelling (DOE, ANOVA);

- defining industrial-scale requirements, including functional model development, prototype design and pilot-line testing;

- validating performance both in-house and through independent third-party laboratories;

- conducting Life Cycle Assessment (LCA) to quantify environmental benefits;

- preparing a patent application for the integrated ecological washing technology

- expanding dissemination, including scientific papers, conference contributions, and outreach to producers, NGOs and consumer groups.

From greenhouse to plate — cleaner, safer produce for everyone.

We're on the web!

https://hofigal.eu/

&

https://icechim.ro/project/siguren/

We welcome the interest of everyone committed to safer, cleaner, and more sustainable food—from producers and processors to retailers, laboratories, policymakers, and consumers who care about the quality of what reaches their tables. For media inquiries, scientific questions, collaboration opportunities, or any topic related to the SIGUR project, please contact us:

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Follow our institutional social media channels for ongoing updates, results, and news from the SIGUR consortium!

Please share this newsletter with your networks, colleagues and collaborators!

A Sustainable Future for Food Safety

Where purity begins: clean fruit starts long before the wash .

As SIGUR progresses, the project is positioned to leave a long-lasting imprint on the Romanian and European food-safety landscape. Beyond its technical objectives, the project's true value lies in establishing a **new standard of ecological safety**—a complete redefinition of how fruits and vegetables can be cleaned using natural, renewable and biodegradable ingredients. The knowledge generated within the consortium will remain available to producers, laboratories, and the wider scientific community, strengthening the transition toward safer, greener consumer products.

SIGUR also aspires to reshape the conversation between researchers, industry, regulators, and consumers. By developing a validated industrial model, supported by standardized testing, LCA analysis and independent certification, the project will create confidence in adopting natural washing technologies at scale. This bridges the gap between cutting-edge research and market-ready solutions, accelerating the uptake of green innovations in food processing, distribution and home use.

The consortium places high importance on **transparent communication**. Workshops, stakeholder meetings, and dialogues with NGOs will form the backbone of outreach activities, ensuring that concerns, expectations and practical needs from all sides are integrated into the final product design. This collaborative approach not only supports innovation but strengthens the wider ecosystem committed to food safety and environmental protection.

By uniting scientific excellence, industrial experience and a shared commitment to sustainability, SIGUR aims to deliver a technology capable of improving public health, reducing environmental impact, and empowering consumers to make safer, healthier choices.