

Global Greenchem Innovation & Network Program



CIRCULAR ECONOMY APPROACHES IN GREEN COSMETICS: VALORIZATION OF WASTE ETHANOL AND AGRO - BY - PRODUCTS

COMPANY: AMELLES, SERBIA

KEY CONCEPTS

- Circular economy
- Green technologies for the synthesis of mineral UV filters and bacterial biocellulose
- Reuse of waste ethanol, fruit and vegetable by-products.

SUMMARY

Amelles is a natural cosmetics brand offering handcrafted skincare, body care, and hair care for the whole family, including products suitable for sensitive skin and children. All formulations are free from silicones, mineral oils, parabens, synthetic colors, and synthetic fragrances.

In collaboration with the Vinča Institute of Nuclear Sciences, the University of Belgrade – Faculty of Agriculture, and the Institute for Chemistry, Technology and Metallurgy, and within a UNDP-supported project, Amelles developed two key innovations: a mineral-based sunscreen and bacterial cellulose facial masks produced from waste-derived resources using green and circular economy technologies.

The company is committed to sustainability through upcycling agro-food waste, using eco-friendly packaging (glass and paper), and developing a zero-waste product line, including solid soaps, shampoos, and balms.

BACKGROUND

Amelles is a Serbian natural cosmetics brand that combines tradition, authenticity, and laboratory-based innovation to develop gentle, family-oriented skincare, body, and hair products. The company applies circular economy principles by repurposing production-related waste streams and optimizing resource use within its manufacturing processes, thereby reducing environmental impact and supporting a more sustainable production model.

STAKEHOLDERS

- Amelles (lead company)
- Vinča Institute of Nuclear Sciences, University of Belgrade - Faculty of Agriculture.
- Institute for Chemistry, Technology and Metallurgy.
- European Union, UNDP.
- Ministry of Environmental Protection, Swedish Embassy, European Investment Bank.
- Consumers and agro-food by-product suppliers.

CENTRAL PROBLEM

Unsustainable linear economic models place increasing pressure on finite natural resources and are major drivers of waste generation and environmental pollution. In the cosmetics industry, this is particularly evident through the continued reliance on non-renewable, often petroleum- and wood-derived raw materials, while potentially valuable industrial by-products are still largely underutilized. This not only accelerates resource depletion and environmental degradation but also highlights the urgent need to redesign production systems toward more efficient and sustainable use of available resources.

SOLUTIONS

Amelles developed innovative hydroxyapatite (HaP) - based mineral UV filters for sunscreen formulations, incorporating recycled ethanol from cosmetic packaging sterilization into the synthesis process. HaP provides excellent biocompatibility, antimicrobial activity, and effective UVA/UVB protection. As a natural component of human bones and teeth, it is inherently biocompatible and, unlike titanium dioxide (TiO₂), does not act as a photocatalyst or generate harmful free radicals under UV exposure. Its antimicrobial properties enabled a reduction of commercial preservatives





by up to 40%, as demonstrated by challenge testing performed at the Faculty of Agriculture and an independent accredited laboratory. This functionality has been successfully applied in both sunscreen lotions and biocellulose masks. To our knowledge, the use of HaP as a multifunctional UV filter in sunscreen products is unique within the cosmetics sector. Sunscreen formulations additionally contain cold-pressed raspberry and blackberry oils obtained as by-products of food production. The remaining press cake is subsequently upcycled into soap manufacturing, further supporting the circular economy approach. For biocellulose masks, recycled ethanol is also utilized, while green-synthesized HaP is incorporated into the biocellulose matrix, further enhancing product performance. The approach reduced production costs by up to 30% through the replacement of imported materials with circular in-house resources. Sustainability is further supported through eco-packaging, zero-waste product concepts, and digital consumer education.

LESSON LEARNED

R&D enables transformation of waste into high-value green cosmetic ingredients through circular biotechnology.

- Developing alternative raw materials replaces conventional inputs, reducing environmental impact and production costs in green production.
- Circular innovation integrates green sustainability and efficiency, improving both ecological and economic performance.

References

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