

Cosmetic Performances Designed by Nature: Sustainable Emollients from Circular Economy

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abstract

The present paper aims at demonstrating the concrete efforts in pursuing circular economy models to develop cosmetic ingredients. Primary focus on the capacity in promoting sustainable methods of production through the efficient use of resources deriving from other supply chains (non-edible fractions from food chain). Two main categories have been investigated: sustainable esters and botanical extracts from Mediterranean basin.

Introduction

What is SUSTAINABILITY? In the past years, it has been defined as the method used by biological systems to improve their resistance and production. Nevertheless, the 21st-century definition goes far beyond these narrow parameters.

In fact, today Sustainability is a balancing act. It takes in consideration the present and the future: as indicated in the Report of the World Commission on Environment and Development, sustainability meets the needs of the present without compromising the well-being of future generations.

The topic of sustainability is evolving linked to the interdependence of global markets and growing customer's awareness. As it is known, companies and customers need metrics by which to make decision and several customers have posed the question about how to assess sustainability in raw materials, and their own impact on Environment. Economic growth must take into account the availability of resources offered by our planet and the rate at which they are renewed. Over-exploitation of stock today will fall on future generations. It is therefore indispensable to rethink our economic models to make them more compatible with the regeneration rhythms of the planet's resources.

Availability and secure access to natural resources of the planet represent the indispensable basis for human life and socio-economic well-being of our society. However, in a globalized world in which the estimated population growth is estimated to reach 9 billion people by 2050, the continued growth of demand and competition related to limited resources jeopardizes security of supply of the resources themselves. As result, an increased pressure and effects on the environment generating a crisis for the sustainability of existing production models and consumption (UN DESA, 2015).

Cosmetic market should take into account its performances to concur in a positive manner to achieve the challenging goals of sustainability. One example among all, the Sustainable Development Goals of the United

Nations 2030 Agenda (UN, 2015). Concerted efforts are called for building an inclusive, sustainable and resilient future for the people and the planet. To reach this goal, governments, businesses and civil society together with the United Nations have started to mobilize actions to achieve the Sustainable Development Agenda by 2030. Universal, inclusive and indivisible, the Agenda calls for action by all countries to improve the lives of people everywhere.

Sustainable approaches, innovation, local organic agriculture and maintenance of biological diversity in a sustainable supply chain and in the global economic context, were deeply taken into consideration within a project developed by ROELMI HPC, the inventor of "NIP® Program", strictly committed in designing, developing and producing active and functional ingredients for Health & Personal Care markets.

Following this program, two main categories have been investigated: sustainable emollients and a new vision of botanicals from Mediterranean basin.

Focus on a new Category of Emollient Agents

Esters are one of most largely employed ingredients in cosmetic formulations as per their remarkable emollient capacity. Nowadays, several categories of them are under investigation because of their food chain origin. Growing interest in different raw materials sources, through a controlled supply chain aiming at minimize the impact on Environment, is now challenging the market to find a reliable opportunity.

An industrial plant, completely converted to "green chemistry" allows the creation of high-purity Pelargonic acid (above 98%) from local crops, by local cultivar in marginal lands, as starting base for the development of high-quality esters.

Targeting the cosmetic market, EMotion® Esters are the sustainable choice for formulators. Eco-designed esters

with surprising capacities: outstanding properties in terms of solubilisation and dispersion of UV filters and pigments, strong ability in conferring color intensity, homogeneity tint, good texture, bright and glossy effect to the formulation.

EMotion® Silky (INCI: Neopentyl Glycol Dipelargonate): emollient ester with a dry, silky, smooth and evanescent touch, characterized by easy spreading qualities, good and quick absorption. It can be used instead of other dry and silky-touch esters, having the same final performances. Esters with similar characteristics available on the market are: Isodecyl Neopentanoate, Isononyl Isononanoate, C12-15 Alkyl Benzoate and Ethylhexyl Palmitate. It has as a benchmark in terms of performance the silicone Cyclopentasiloxane. Thanks to these features, EMotion® Silky is particularly suggested for skin care, sun care and hair care products.

EMotion® Light (INCI: Tripelargonin): emollient ester with a light and soft touch, characterized by high spreadability and good absorption rate. It can be used in formulation instead of other emollient esters without leaving any greasy sensation on the skin. Esters with similar characteristics available on the market are Caprylic/Capric Triglyceride (MCT) and Isopropyl Palmitate. Thanks to its light touch, EMotion® Light is indicated for skin, sun and hair care as in make-up products.

Development: Evidence of Efficacy

Which criteria can be used to assess the esters activity in Hair care? You can begin to answer this question by observing the chemical-physical parameters such as density, viscosity and the refractive index. The measurement of these values allows, from the theoretical point of view, to predict what performance of the cosmetic formula containing the ester will be.

There is a correspondence between density and weightless of the ester. The lower the density, the greater will be the feeling of lightness that the ester will give to the hair. A low viscosity helps the application of the product on the hair.

Starting from an ester with a refractive index closer to the hair in a normal state of health, make it able to give brightness to the damaged hair.

By comparison with the silicones on the market, our EMotion® Esters show values of density, viscosity and refractive index comparable and in some cases even better.

An *ex vivo* study, aimed to assess the combing properties of EMotion® Esters in comparison to silicones, was carried out on natural hair locks and products' effects were instrumentally evaluated by means of DIA-STRON fibra.one in an independent laboratory.

Commercially available human brown hair locks were used for the study according to the following study design:

proDERM

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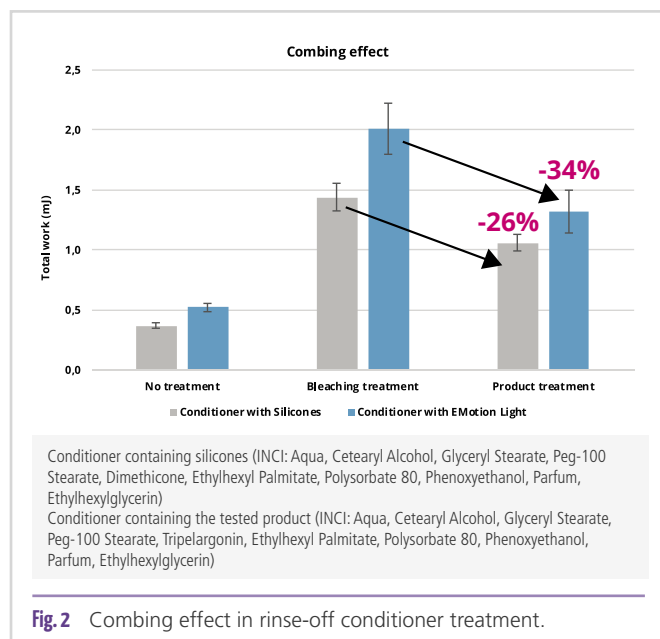
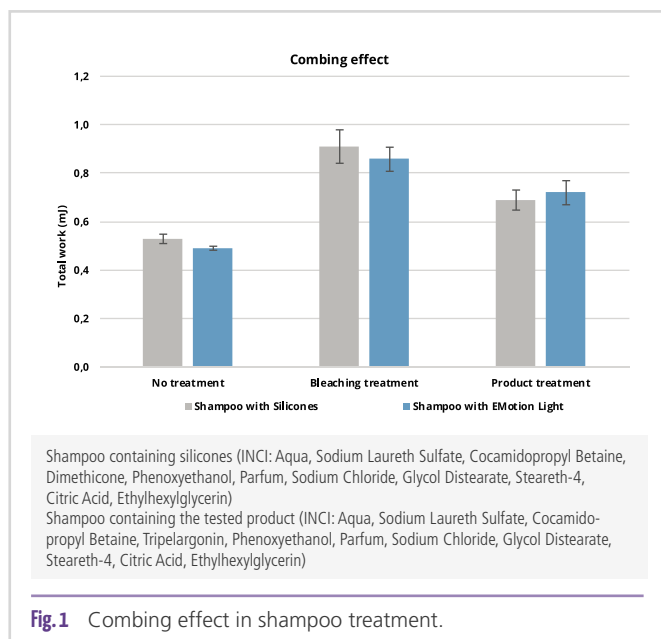
25 YEARS proDERM

+10,000 STUDIES CONDUCTED

+50,000 PRODUCTS TESTED

+225,000 SUBJECTS ENROLLED

Research to rely on.



- 3 hair locks are treated with shampoo containing silicones
- 3 hair locks are treated with shampoo containing the tested product
- 3 hair locks are treated with conditioner containing silicones
- 3 hair locks are treated with conditioner containing the tested product

Hair locks were damaged with a bleaching treatment (30 minutes exposure to 20 volumes hydrogen peroxide + 50 minutes exposure to 30 volumes hydrogen peroxide) with commercially available products (dott. Solari COSMETICS Oxidizer in perfumed cream; HP FIRENZE Bleaching free-hand).

Three grams brown hair locks were prepared using an analytical balance (KERN ALJ 160-4NM, KERN & Sohn GmbH). After preparation hair locks are washed as follows: i) hair lock was made wet for 10 seconds using tap water, ii) 1 ml of neutral shampoo was distributed all over the hair lock length using a graduated pipette, iii) the neutral shampoo was rubbed all over the hair lock length during 20 seconds, iv) hair lock was rinsed during 30 seconds using tap water, v) hair lock is dabbed with a paper towel and dried using a hair dryer.

After bleaching treatment, a fixed amount of test products were distributed all over the hair lock length as follow: 1 ml of the test product on wet hair lock treated with shampoo formulas (benchmark and tested product); 500 mg of the test product on wet hair lock treated with conditioner formulas.

The evaluation of hair locks' combing properties was carried out using DIA-STRON fibra.one, a multi-functional tress testing instrument which allows to objectively evaluate combing properties of the hair locks before and after products application. In this study the total work parameter, calculated as the area under the curve (AUC) and expressed in mJ, is evaluated. This parameter represents the total work carried out by the comb to comb the whole hair lock.

Fig. 1 and **Fig. 2** report the mean data of the Total work parameter obtained for each study product. The data reported here below are the mean value calculated on 8 repeated measurements. Data are expressed as mJ.

In shampoo treatment, comparable results performed by cosmetic rinse-off formulas containing Tripelargonin in respect to silicones-based formulas.

Considering that the performances of the ester and silicones are evaluated in the last step (when the product is applied on strands of bleached hair), it is possible to notice that, in the conditioning treatment, the total work necessary to comb the strands decreases more after the use of Tripelargonin, compared to the conditioning formula based on silicones, reduction of 34% vs 26%. This result shows that Tripelargonin is able to provide a better combing effect of the hair compared to silicones.

An internal panel of no. 20 volunteers has tested two different cosmetic formulations to evaluate the sensorial feelings of sustainable emollients toward a benchmark:

- A hair serum containing 2% Tripelargonin has been compared versus the same formulation containing the same dosage of Caprylic/Capric Triglyceride.
- A hair serum containing 2% Neopentyl Glycol Dipelargonate has been compared versus the same formulation containing the same dosage of Isononyl Isononanoate.

Volunteers positively score the product pointing out: the higher softness sensation, the pleasant absence of greasy effect helping combing hair ability as well as a glossy hair appearance. **Fig. 3** summarizes the average score.

Further Developments

Continue developments of ingredients, in light of sustainability, are intended to enlarge the portfolio of emollients in

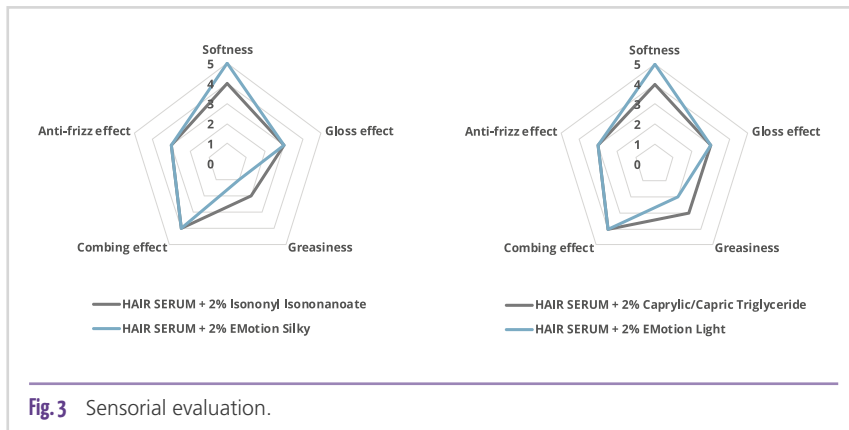


Fig. 3 Sensorial evaluation.

the next future. Protection of local biodiversity is becoming more and more important in the development of Personal Care ingredients. Through the ultimate frontier for botanical extracts, in line with Circular economy and welcoming the Nagoya protocol, coming from an innovative extraction process, using only sustainable solvents (Glycerin and Triperlargonin from non-edible native fractions (Tab. 1)), is now possible to create a responsible choice for natural herbal treatments.

Linking tradition and responsibility as major development drivers, Méditerranée Line represents phytotherapeutic and aromatic plants extracts for future cosmetics. Hydrosoluble or liposoluble extracts that could be used in all water and

(NIP) applies to all products and technologies, and it stands as a mission for every process focusing on Quality, People safety and Environment preservation.

In fact, we are approaching the future through innovation and evolution. We aim at protecting the value of Nature and People in product manufacturing. We care about the environmental impact of our productions by adopting eco-sustainable processes and renewable raw materials. We aim at keeping high quality standards as well as high efficacy.

We are strongly working in this direction when we develop new projects as well when we ameliorate existing processes. However, the single action becomes winning thanks to the interaction within a community. Join with us the sustainability. Join the NIP®.

Glycerin from non-edible olive fractions	Triperlargonin from local crops
Italian expertise in farming and olive processing technique	Integrated agricultural value chain for territorial regeneration
Non-edible sources of food supply chain reflecting circular economy model	Typical EU crops, grown on uncultivated and marginal lands
Soft technologies maintaining natural profiles	Innovative mechanical process for seeds crushing

Tab. 1

oil-based cosmetic formulations with a varying dosage, depending on finished product.

Conclusions

We believe that only the daily action with respect for the Environment could lead to a durable result. Following this leitmotiv, represented by a drop in our corporate logo, we perform sustainable innovation: a real step forward on the sustainability road. Our program NO IMPACT IN PROGRESS®

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