Marine glycobiology to reverse the signs of ageing

**Abstract**

A macroalgae derived extract has been developed for use in cosmetic formulations. Wild-grown Laminaria from Iroise sea were sourced to extract and hydrolyse fucoidan compounds. These oligofucoidans are then purified in order to keep only the very low molecular weight fractions saturated in sulphur which are the most biologically active. The oligo-fucoidans are known for their potential to regulate inflammation as well as their capacity to stimulate cell metabolism and collagen synthesis, act as biological messengers.

This in vivo efficacy on wrinkles reduction and on skin roughness was evaluated on a panel of 42 female volunteers that applied a cream containing 1.3% of Fucoreversetm the face, twice a day for 30 days. The reduction of wrinkles depth was measured at the beginning and after 30 days of treatment. The skin presented an average wrinkles reduction of 9.1% after 30 days compared with placebo, so the anti wrinkle efficacy of the marine ingredient was proved.

**INTRODUCTION**

The marine environment is a rich source of biological and chemical diversity. Interestingly, algae developed adaptive responses to environmental stress (UV, temperature, bacteria, pressure, turbulence...) and thus they are able to produce a chemical diversity. Interestingly, algae developed adaptive responses to environmental stress (UV, temperature, bacteria, pressure, turbulence...) and thus they are able to produce a chemical diversity. The marine environment is a rich source of biological and chemical diversity. Interestingly, algae developed adaptive responses to environmental stress (UV, temperature, bacteria, pressure, turbulence...) and thus they are able to produce chemical diversity. The marine environment is a rich source of biological and chemical diversity. Interestingly, algae developed adaptive responses to environmental stress (UV, temperature, bacteria, pressure, turbulence...) and thus they are able to produce chemical diversity. The marine environment is a rich source of biological and chemical diversity.

**FROM THE IROISE SEA (BRITTANY COAST, FRANCE) TO THE MARINE GLYCOCOLOGY**

Cellular communication: the role of glycobiology

For many years the cosmetic industry has focused its attention on peptides and their capacity to attract themselves to cellular receptors, thereby propagating biological messages. Peptides, however, are not the only molecules to have these properties. Certain specific oligosaccharides such as fucose also play a role in communication.

Algae from the Iroise Sea (Brittany coast): an unrivalled source of essential sugars

Fucose is the major constituent of a high molecular weight polysaccharide called fucoidan. The specificity of the fucoidans present in the cellular membranes of Laminaria from the Iroise Sea is their high sulfated fucose content.

**THE UNIQUE COMPOSITION OF FUCOREVERSETM**

What are Fucoidans?

Fucoidans are polymers composed of sulfated fucose. They are insoluble high molecular weight molecules: 30 to 1000 kDa. They are known to demonstrate a wide range of biological activities including stimulation of the cellular metabolism and immunomodulation.

Fucoidans are a class of non-gelling, sulphated polysaccharides found only in brown macro algae. Their sugar backbone composition, structure and sulphation patterns differ according to their origin and the extraction techniques used.

Glycosaminoglycans (GAGS) are naturally present in the body and are manufactured using 8 essential sugars of which fucose is an important one. Oligosaccharides chains are essential compounds for human skin: they have a key role in processes like cellular protein maintenance, stress recovery and cell to cell communication, and as constituents of cell walls and significant integral membrane proteins, where they influence cellular interaction.

Such molecules mediate the vital adhesion between cells that allows functional tissues as well as cell-substrate unions serving as receptors for adhesion ligands, as it occurs with fibroblasts and fibronectin (1). Some of the major promises made by glycosciences is the identification of communication phenomena via the specific sugars of the cellular membranes and via the sugars of the extracellular matrix, to adapt the specific action of the active ingredients to certain applications. The potential cosmetic applications which we call “glycobiology”.

**CONSEQUENCES ON BIOLOGICAL ACTIVITY**

**FUCOREVERSETM – PROTECT AND REPAIR THE EXTRACELLULAR MATRIX (ECM)**

The passing of the years has negative effects on the skin and its properties, worsening them. There are biochemical, histological and physiological alterations that include ECM functional impairment, collagen and elastin degradation, and slow metabolism. The degenerative changes that come with age can cause facial skin to lose its vibrancy. A major factor in this process is the degradation of the extracellular matrix of the dermal connective tissue. The extracellular matrix in the dermis is composed of a molecular network (collagen, elastin and glycosaminoglycans) between the fibroblasts which ensures the skin’s structure and tone. When the deterioration and the repair of this network are imbalanced, wrinkles appear and the skin loses its firmness. Fucoidans protect this network by blocking the enzymes responsible for the deterioration of the extracellular matrix as well as the pro-inflammatory cytokines which damage the collagen (6, 7).

Fucoreversetm also acts as a repairing agent by stimulating the metabolism of the fibroblasts and collagen synthesis. With these 2 synergistic actions, Fucoreversetm helps to reverse the signs of ageing by bringing back the skin’s structure and firmness.
Fucoreverse<sub>TM</sub> stimulates type 1 collagen synthesis compared with the negative control

**Protocol:** The determination of collagen synthesis is carried out by quantitative dye-binding method. The chromogen agent used in the assay is Sirius Red. The concentration is calculated by means of a linear interpolation on a standard curve obtained with known and increasing collagen concentrations.

Results: The data are reported as the percentage increase of collagen synthesis after cells exposure to the test item respect untreated cells. The treatment with Fucoreverse<sub>TM</sub> has positively modulated collagen synthesis in the considered experimental system. All recorded variations are significant vs negative control (CTR<sup>-</sup>). Fucoreverse<sub>TM</sub> has a significant stimulatory effect on collagen synthesis compared to the non-treated control group: + 23.7% in the 0.15% dose; + 31.1% in the 1.5% dose.

**CLINICAL STUDY**

**Protocol:** The aim of the study is to evaluate the safety of use, the cosmetic acceptability and the efficacy of Fucoreverse<sub>TM</sub>. The subjects who used the product containing Fucoreverse<sub>TM</sub> had good skin tolerance whereas those who used the placebo redness as shown in the above photo. The study showed a significant decrease in irritations and skin irritation. These results show the use of Fucoreverse<sub>TM</sub> to calm sensitive skin.

CONCLUSION

Thanks to its unique composition, Fucoreverse<sub>TM</sub> acts by protecting and repairing the ECM, thereby reversing the signs of ageing. Wrinkle depth is significantly reduced in comparison to a placebo group.

REFERENCES


IN VITRO TESTS

The effect of Fucoreverse<sub>TM</sub> on the fibroblasts proliferation and synthesis of collagen has been evaluated on human dermal fibroblasts. Fucoreverse<sub>TM</sub> was tested at 2 concentrations: 0.15% and 1.5%. Untreated cells were used as negative control (CTR<sup>-</sup>).

Fucoreverse<sub>TM</sub> stimulates fibroblast proliferation

**Protocol:** Culture medium containing tested product was added to the wells containing cells in the G0 phase of cell cycle. At the end of incubation period, the cell viability was evaluated and the increasing proliferating rate compared to untreated control cell culture.

Results: The data are reported as the percentage increase of cell proliferation after cells exposure to the test item respect untreated cells. The treatment with Fucoreverse<sub>TM</sub> has positively modulated cell proliferation in the considered experimental system. All recorded variations are significant vs negative control (CTR<sup>-</sup>). A significant increase in the proliferation of fibroblasts compared to the non-treated group of: +35.5% in the 0.15% dose; 51.1% in the 1.5% dose.