

GloMeca # 1 - Visco-elasticity

Context

According to a physicist, skin is considered as a multi-layer material composed by dermis, epidermis and hypodermis.

Skin mechanical properties are mainly linked to the dermis which is composed by collagen fibers networks and elastic fibers. During aging, these

fibers tend to deteriorate themselves involving loss of elasticity in aged skin.

This multi-sheets' structure exposed to several factors (age, health, environment, gender...), has been studied and qualified as anisotropic, non-homogeneous, non-linear and viscoelastic.

Visco-elasticity allows to identify two behaviours :

- Viscosity, describing the behaviour of a viscous liquid ; this principle could be associated to hydration measurement
- Elasticity, characterizing the behaviour of a solid having elasticity and tension properties

Mechanical behavior of the skin

elastic behaviour
(it's as solid)

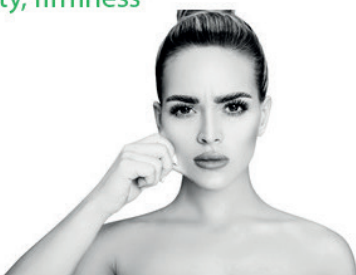


Visco-elasticity



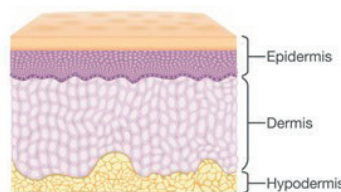
Viscous behaviour
(it's as liquid)

Elasticity, firmness



Elastic properties

Normal Skin Layer



Hydration



Viscous properties

Quantitative measurement of mechanical properties of the skin by **AFM** (Atomic Force Microscopy)



Figure 1 : skin behaviour in terms of visco-elasticity



Why AFM ?

Atomic Force Microscopy (AFM) allows to characterize visco-elastic properties of biological samples as skin, before and after treatment with an active ingredient or product.

AFM consists in a micro scale cantilever with a sharp tip at its end that is used to scan the surface sample

and carry out visco-elasticity tests (we also can talk about dissipation energy measurements).

Typically, the deflection is measured using a laser spot reflected from the top surface of the cantilever into a photodiode (figure 2).

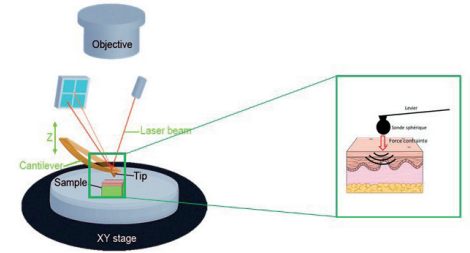


Figure 2 : acquisition principle of energy dissipation data with AFM

Measuring visco-elasticity allows to measure the capacity of a sample to restore its original shape. It is revealed in a clear **hysteresis** between the approach and retraction parts of curves ; the observations of force relaxation at constant indentation depth and the creep at constant loading force (figure 3).

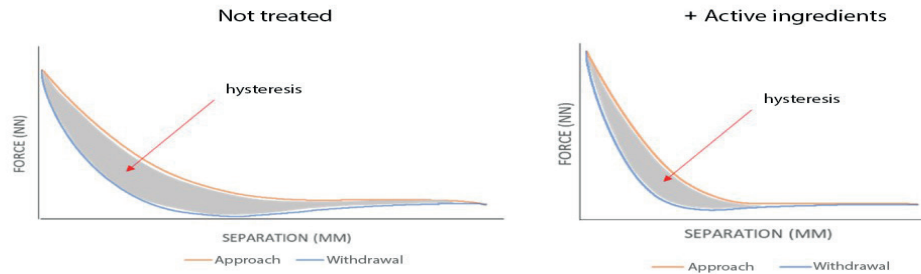


Figure 3 : Hysteresis analysis



These data allow to access active ingredient's efficacy while tissue's mechanical properties are an important indicator of the active ingredient's impact on skin visco-elasticity

