

There are materials of natural origin in every category of cosmetic ingredients. This is far from being a new trend; at one time, natural materials were all that were available when creating compositions for application to the human body. Then, towards the end of the 19<sup>th</sup> century, petroleum-based materials such as mineral oil, petrolatum and paraffin wax became widely available and the second half of the 20<sup>th</sup> century saw an explosion in the number of synthetic materials offered to the cosmetic formulator. The majority of these were based on carbon and in most cases, this came from the petrochemical industry or animal fats. The two outstanding exceptions were lanolin and its derivatives and the introduction of silicon-based fluids, emulsifiers and elastomers. However, materials of natural origin were still widely in use where these offered benefits in price or performance.

Then, in the last quarter of the 20<sup>th</sup> century, significant numbers of consumers started to react against using materials of animal origin, petrochemicals and against anything sounding vaguely chemical. This has resulted in a host of new materials claimed to be natural, often with additional claims such as sustainable or supporting fair trade. At the same time ingredient suppliers were researching the properties of botanical materials; often looking at their use in folk medicine and then isolating active principals and testing their properties in laboratory and clinic. Previous features have looked at surfactants and emulsifiers [SPC] and silicon alternatives [SPC]. This feature will focus on materials of natural origin with claims for beneficial activity on human hair and skin.

At one time it was thought sufficient to add an aqueous extract of the whole plant and use its presence as an excuse for a pretty label. Now manufactures look for the best way to extract the actives in an eco-friendly manner. **Phenbiox** is a good example with its innovative biotechnologies to enhance bioavailability of plant based active ingredients. Molecular bioliquefaction was developed by the Department of Industrial Chemistry and Materials of the University of Bologna and is exclusively licensed to Phenbiox. Research into the plant discloses molecules of potential interest and by careful selection of enzymes and controlled conditions of temperature and pH these molecules are released from the plant cells. This enzyme-based technology can recover 100% of the plant bioactive compounds in a completely bio-available and active form as water based liquid ingredients. A material created in this manner is W Tr-Active from white truffles and it is shown to improve skin elasticity and skin thickness and reduce the size of wrinkles through its moisturising and gene expression modulation properties.

Physavie [INCI: Physalis angulata extract, caprylic/capric triglyceride] from **Chemunion** is obtained from Physalis angulata, a plant widely known as camapú. It is a Brazilian native plant and supercritical carbon dioxide extraction allows active isolation of highly active phytosterols in a concentrated form. This technology avoids the need of using organic solvents to extract bioactive compounds. In-vitro testing shows it to fight against photoaging and it has the capacity to reduce pro-inflammatory cytokine IL-6 by 39%; to reduce ECM-degradation enzyme MMP-1 by 40% and to substantially increase collagen levels. It also increases the skins content of antioxidant enzymes CAT and SOD by 123% and 278%, respectively. In-vivo testing corroborated the soothing effect of Physavie and its capacity against inflammaging. A second material obtained by supercritical carbon dioxide extraction by Chemunion is REvinage [INCI: Bidens pilosa extract, Elaeis guineensis (Palm) oil, Gossypium herbaceum (Cotton) seed oil, Linum usitatissimum (Linseed) seed oil] that is claimed to have antioxidant properties and retinoids receptors activity to fight against skin aging. It improves skin elasticity and stimulates the synthesis of dermic proteins and growth factors.

Naturals 2017

1<sup>st</sup> published SPC 2017

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Honey sun flower from **Principium** [INCI: Pleurotus ostreatus extract, maltodextrin, Lolium perenne flower extract] is a standardised active ingredient manufactured using a non-solvent process.

Synergy between the mushroom extract rich in film-forming polysaccharides and the extract from Lolium perenne flower rich in essential amino-acids is claimed. It is said to be particularly efficient in treating skin that has been exposed to acute stress linked to sun exposure. Its effective film forming activity helps to prevent further dehydration by water loss. In addition, inflammatory mediators are modulated, and the skin is soothed and re-energised. Typical applications include soothing balms for after shave and after sun exposure.

Natural Deep Eutectic Solvents (NaDES) are a new type of natural solvents that reproduce the plants' intracellular environment. The most active molecules are synthesised at the very core of the plant cell and despite perfect solubility in plant tissues, many of these molecules are poorly soluble in water, lipids, and even the most efficient known solvents. It has been discovered that plants may store and transport these compounds in a third type of liquid phase: the so-called natural deep eutectic solvents (NaDES). **Gattefossé** has developed and patented several natural eutectic solvents suitable for use in cosmetics, using all-natural components such as fructose, glycerin, and water. This new class of solvents is natural and safe and enables the extraction of new active molecules from plants.

Wrinkles are among the earliest and most visible marks of skin aging. They are a long-term accumulative effect resulting from repeated and habitual contractions of the underlying muscles of facial expressions. The dermal-epidermal junction (DEJ) provides structural integrity and mechanical resistance to the skin but it loses its elasticity with age. At the same time the dermis of mature skin fibroblasts is characterised by reduced contractile forces as well as reduced migratory capacity. Using NaDES technology Gattefossé has extracted active flavonoids from horse chestnut flowers to give Gatuline Link n Lift, [INCI: Fructose, glycerin, aqua, Aesculus hippocastanum (Horse Chestnut) Extract]. It is claimed that Gatuline Link n Lift directly acts underneath the eye contour wrinkles, at the dermal-epidermal junction and in the dermis, reinforcing DEJ integrity and functionality by stimulating the synthesis of all major components involved in epidermal-dermal cohesion and communication. In-vivo testing on eye contour wrinkles in a clinical study using instrumental techniques, clinical scoring and self-assessment showed an improvement in eye contour in just two weeks.

Limnanthes alba or meadowfoam is a low growing herbaceous winter annual that is adapted to poorly drained soils. Limnanthes means marshflower and the common name "Meadowfoam" arose due to the appearance, at full bloom, of its solid canopy of creamy white flowers. The seeds are harvested and crushed to yield 20 to 30% oil. The oil is over 90% C20 to C22 fatty acids and contains three previously unknown long chain fatty acids. **Elementis Specialities** supplies Meadowfoam Oil for cosmetic applications and use it as a source of derivatives including Meadowderm [INCI: Meadowfoam Delta-Lactone]. This is described as an optimised derivative created to contain the ideal ratio of bioactive components that provide measurable and meaningful anti-aging benefits. In-vivo data was presented at Formulate, Coventry 2016, that showed significant improvements in skin texture, total wrinkle surface area and appearance in close-up and silicon-replica images.

Eye bags and dark circles are an unwanted visible sign of ageing and the focus of several actives. The cause is local inflammation caused by fatigue, exposure to UV and pollution and its impact on microcirculation. MeiYanol from **Exsymol** is an extract of elderberry flowers [INCI: Sambucus nigra flower extract] said to counteract the reactive oxygen species (ROS), which are a principal cause of inflammation. It also decreases the expression of VCAM-1 and ICAM-1 that are attachment proteins

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leading to a build-up of white blood cells and a disruption of the epithelial barrier in the delicate skin under the eyes. This allows the formation of so-called eye bags and dark circles are caused by a leak of red blood cells into them, a process that is inhibited by the anti-oxidant and iron chelating properties of MeiYanol.

Vitamin E, tocopherol, is a material of natural origin with cosmetic benefits but exhibiting problems of instability. **Showa Denko** has taken the oxygen-sensitive hydroxyl group of tocopherol and chemically modified and protected it with a phosphoryl group to give TPNa, INCI: Sodium tocopheryl phosphate. On application, it is readily converted to the active tocopherol via hydrolysis catalysed by phosphatase present in the dermis. Tocopherol scavenges ROS and prevents lipid peroxidation, inflammation and damage to DNA. Tests show that gene expression of enzymes working on digestion of pigments like biliverdin (HO-1) and bilirubin (UGT1A1) is enhanced, suggesting its use for prevention of dark circles and uneven skin tone around eyes.

Vitamin C, ascorbic acid, occurs naturally but is more likely to be synthesised so probably best described as nature-identical. Although having significant antioxidant activity it is relatively unstable, so derivatives are used to deliver the same benefits without loss of activity. APPS from **Showa Denko** is an amphiphilic derivative of ascorbyl 2-phosphate (AP), conjugated with a long acyl chain (C16: palmitoyl residue), INCI: Trisodium ascorbyl Palmitate Phosphate. It is supplied as a powder, is water soluble and recommended usage level is 0.1 – 0.5%. Its moderate hydrophobicity enables APPS to penetrate effectively into dermis where it is enzymatically converted to ascorbic acid. Tests show that it significantly enhances collagen synthesis in a dose dependent manner and the appearance of wrinkles is reduced.