

## **GREEN CHEMISTRY & SUSTAINABLE COSMETIC BIOTECHNOLOGY & COSMETIC APPLICATIONS**

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### **Plant stem cells as biofactories that produce bioactive natural compounds**

Plants are able to synthesize an enormous variety of compounds known as secondary metabolites, which have biological activity, and therefore, are considered bioactive compounds. Traditionally, these bioactive compounds have been directly extracted from raw plant material or obtained by chemical synthesis. A biotechnological alternative for its production is the use of plant stem cell cultures defined as meristematic cells which have the ability to self-renew (by cell division) such that the number of stem cells is maintained for indefinite periods in culture or can give rise to specialized cells or tissues (1). Plant stem cells never undergo aging process, and are totipotent cells equipped with regenerative powers that facilitate plant growth and development. Plant stem cells contain minerals, vitamins, essential fatty acids and bioactive compounds that provide defense against free radicals as they possess antioxidant activity, and increase the skin's natural protection against ultraviolet light (2). Therefore, plant stem cells are an excellent ingredient for conditioning and regenerate skin and hair, and therefore, can be an ideal ingredient of many products for hair care and cosmetics. One strategy to increase the large-scale production process of these bioactive compounds by using plant stem cells is the elicitation, which consists in the induction of metabolites by elicitors that introduced in small concentrations in a living cell system, improves the biosynthesis of specific compounds (3). Thus, using elicitors on plant cell cultures, we have developed innovative patented procedures (4,5), where high levels of bioactive metabolites are accumulated, and easily recovered directly from the culture media without cell biomass destruction. The present study focuses on this biotechnological strategy showing different successfully examples, where it has succeeded in increasing the levels of resveratrol, ellagic acid and their derivatives, phytosterols and polyphenols using different stem cell cultures. In this way, stem cell cultures and bioactive compounds produced from them would make excellent components in cosmetics due to their anti-aging properties, skin regenerative effects by cell repairing and strengthening, and revitalizing action, contributing to prevent skin cancer. Some of these compounds have also whitening effect and skin whitening, which is very effective against stains without skin irritation or sensitization.

1. Verdeil et al., 2007.TRENDS in Plant Science 12:245 2. Fraser and Bramley 2004.Progress in Lipid Research 43:228 3. Radman et al., 2003.Biotechnol. Appl. Biochem.37:91 4. Belchi-Navarro, S., Almagro, L., Bru, R., Pedreño, M.A. (2009) WO/2009/106662. Combined use of methyl jasmonate and cyclodextrins for the production of resveratrol. 5. Sabater-Jara, A.B., Almagro, L., Bru, R., Pedreño, M.A. (2010) WO 2010/049563. Use of cyclodextrins for the production and extraction of phytosterols in plant cell cultures.