Optimization of Bioactive Botanical Extracts

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Abstract

Plant extracts have been used for a variety of purposes in cosmetic products but currently their importance mainly resides in functionality and specific skin effects. 'Mother Nature' is an excellent biochemist and often the activity of a plant extract is tied into the concentration and stabilization of a specific chemical derived from a plant.

It is no longer acceptable simply to apply defined extraction processes to starting plant materials and assume an efficacious extract will result.

In this paper, we will outline our process for developing active plant extracts that includes utilizing *in vitro* and *in vivo* efficacy testing that is tied into compositional analysis during the optimization of the manufacturing process.

We will use several existing and marketed cosmetic raw materials including white and green tea extract, a wheat-based ceramide product and a product in development derived from sorghum.

While typically *in vitro* cell culture or DNA microarray testing is used as a screening method, we use small scale *in vivo* studies to assess preliminary activity of the extracts. These assays are 'maximization' type assays wherein the skin is stressed with extreme conditions and the ability of prototype extracts to reduce the effects of the stressor is examined.

These assays can demonstrate the reduction and prevention of irritation due to the application of contact irritants such as methyl nicotinate, sodium dodecyl sulphate and Balsam of Peru and the prevention and repair of skin barrier function due to chemical or mechanical abrasion of the skin.

We have established that for both white and green tea these stressor assays correlate well with the composition of the extracted products. With the tea products, efficacy correlates well with polyphenol content, which varies depending on manufacturing processes. With the grain extracts, efficacy also correlates with compositional analysis, in this case barrier repair and ceramide content. For sorghum, antioxidant capacity correlates well with extraction efficiency and expected polyphenol content.

Introduction

Mother Nature is an outstanding chemist and has created a diversity of plant extracts with a wide range of biochemical components not duplicable in the organic chemistry laboratory. For example, the tea plant, *Camellia sinensis* has a long historical use as a beverage and topical ingredient. The polyphenols found in tea have demonstrated powerful antioxidant effects and this can result in beneficial properties when ingested or topically applied. These polyphenols include epigallocatechin gallate (EGCG), epigallocatechin (EGC), epicatechin gallate (ECG) and epicatechin (EC). Of these EGCG is the predominant species and can account for more than 40% of the total content[1].

We conducted a series of experiments with both white and green tea to determine if extraction processes could alter the content of polyphenols and whether this variation would translate into differential efficacy parameters when evaluated on the skin. Individual polyphenols were not analyzed; however, total absorbance was used as a measure of total polyphenol content[2]. We also determined whether addition of other antioxidants could maximize product activity. The same types of experiment were conducted with extracts from common sorghum with similar results.

In a parallel series of experiments with a wheat-ceramide containing product we determined whether repair of the skin barrier correlated with ceramide content. Purified wheat derived ceramides were added at increasing concentration to a bio membrane mimic composed of hydrocarbons (squalane), triglycerides and fatty acids (sunflower oil) and cholesterol. In these studies the skin water barrier was made defective by removing epidermal lipids with repeated washing with 20%