Fusion Technology: The Microbial Fermentation of Small Molecules for Skin Care

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Abstract

Recent developments in cosmetic and personal care have imitated ideas from the food, nutritional and pharmaceutical industries for crossover applications. Until recently, skin care and skin health was mainly restricted to cosmetic applications as topical creams rather than through internal nutrition. However, with increasing consumer awareness and education, the perception is now common that the skin is a reflection of internal and external health and well-being. The recent trends in probiotics, are a good example to observe the potential cross-over success or overlap that can occur between the multiple industries.

Our company has developed 'Fusion Technologies' that combine technological insights from the nutritional, cosmetic and pharmaceutical sciences into developing new skin care actives. The development of a unique biotechnological ingredient platform intended for topical application will be reviewed which has been obtained through the fermentation of resveratrol with the yeast microorganism, *Pichia pastoris*.

Confirmation of the ability of *Pichia pastoris* to metabolize resveratrol has been demonstrated through Liquid Chromatography-Mass Spectroscopy (LC-MS) analysis. The topical benefits of the fermentation of resveratrol were investigated using MatTek® full thickness tissue models *in vitro* to examine the ability of the ferment to reduce expression of the anti-inflammatory enzyme Cycolooxygenase 1 [COX1] as well as its ability to promote the synthesis of Type IV collagen. *In vivo* human studies examined the ability of the ferment to reduce the visible signs of ageing.

Introduction

Fusion technology concepts were developed by our company to integrate expertise from three key sciences: Cosmetics, Nutrition and Pharmaceutics. The objective was to synergistically combine selective ideas from these industries to develop products for topical applications. The challenge was to evaluate these sciences and create a coherent concept that would provide cutting edge skin care products by targeting anti-ageing at the cellular level. By incorporating fusion technology concepts into product development for skin care, it was shown that new, potent ingredients for topical applications could be created that could help diminish the visible and invisible signs of ageing. The concepts of fusion technologies are shown in greater detail in Figure 1.

Fusion Technologies is the synergy of technologies such as:

1. Positive stress and beneficial microorganisms
2. Use of purified phytochemicals like resveratrol
3. Small Molecule Fermentation

Fermenting resveratrol with the yeast *Pichia pastoris* applies positive stress, as opposed to a stress that upregulates defences in the microorganism such as UV radiation or ozone, and emphasizes a novel approach of incorporating more holistic practices for product development. It was anticipated that resveratrol fermentation by *P. pastoris* would influence the microorganism to create new metabolized derivatives of the resveratrol, isolated as microorganism-free ferment extracts, that might make both the molecule and the yeast perform synergistically when applied to the skin.

Resveratrol is an ideal target for fermentation for several reasons. The molecule has a potent anti-inflammatory