Reliable and Safe Replacement of Parabens is Possible

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Abstract

Since parabens were detected in female breast cancer cells in 2004 by Darbre *et al*[1] the cosmetic industry is yearning for alternatives to this benchmark preservative. Marketing people are pushing their colleagues from product development to replace parabens in formulations and 'paraben-free' claims have become popular advertising messages on the packages of cosmetic products. As a consequence, the use of parabens has declined in recent years and preservative suppliers have developed a multitude of alternative products. However, these alternatives do not always provide meaningful solutions for the task to substitute parabens.

From a technical standpoint, parabens are a very versatile species. They show a reliable antimicrobial efficacy in a broad variety of cosmetic formulations, they are easy to incorporate, stable over a broad pH range and compatible with all kinds of cosmetic raw materials. In this respect, any reasonable alternative should provide a similar degree of versatility and compatibility with different cosmetic concepts as parabens.

From a toxicological perspective, it would be a misleading concept to substitute parabens by alternatives based on preserving systems with proven irritation and sensitising potential. Recent findings of an increased number of allergenic effects caused by the preservative Methylisothiazolinone (MIT) which was introduced just a few years ago as a reliable alternative to parabens to the cosmetic industry, are underlining this fact[2]. Therefore paraben-free preservatives on the market containing ingredients belonging to the group of chemically acting preservatives such as isothiazolinones, formaldehyde releasers or halogenorganic components cannot be considered meaningful alternatives, as they all carry the intrinsic risk of adverse effects on the skin.

So does that mean that replacing parabens by safe alternatives is impossible? The present study intends to answer this question. It investigates whether a standard phenoxyethanol/paraben blend could be replaced successfully in different types of cosmetic formulations by a blend of physically acting multifunctional additives with antimicrobial properties without jeopardising the antimicrobial stability and safety of the products.

Introduction

In emulsion type products the preserving molecules will distribute between the water and the oil phase and their efficacy depends to a large extent on the free concentration in the aqueous phase of a cosmetic product (Figure 1 next page). Consequently, factors influencing this free concentration have an impact on the efficacy of an antimicrobial system. For example, it can be observed that polar oils can pull the preserving system out of the aqueous and into the oil phase, resulting in a lower efficacy of the antimicrobial molecules. The emulsifier system also has an influence on the preserving efficacy, as free emulsifier molecules can interact or trap the molecules carrying the antimicrobial action. The deactivation of parabens by lecithins is a phenomenon well-known to cosmetic formulators. Macromolecules employed as stabilisers or actives can interact with preserving molecules as well, leading to a reduction of the free concentration of the antimicrobial system. On the other side, hydrophilic molecules capable of increasing the free concentration of a preserving active in the aqueous phase can have a positive influence on the efficacy of the antimicrobial system. Without possessing antimicrobial properties themselves, they can also contribute to create an unfavourable environment for the growth of microorganisms by reducing the water activity[3]. A promising concept for a meaningful alternative to parabens could therefore be based on one or more effective antimicrobial molecules dissolved in a hydrophilic matrix which helps to retain the active system in the aqueous phase, where it is needed.

The antimicrobial system chosen as an alternative for paraben blends in the present study is based on the well-known multifunctional ingredients Caprylyl Glycol and Phenylpropanol. This combination has been known for a long time as being very effective against bacteria and yeast and to possess synergistic activity against moulds[4]. In addition, both molecules are chemically inert and toxicologically well investigated. The compound selected to form the hydrophilic matrix is the toxicologically well investigated Methylpropandiol. Fully water-soluble, it can help to shift the distribution coefficient of an antimicrobial active towards the aqueous phase. A blend of