

Bakuchiol: A promising ingredient to help slow down time



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ABSTRACT

Bakuchiol, a phytochemical found in the plant *Cullen corylifolium*, exhibits similar effects on gene expression profile as retinol and therefore acts as its analogue, improving wrinkles and uneven pigmentation, increasing skin firmness and correcting overall skin quality without significant undesirable side effects, such as irritation, dryness and sensitivity.

Keywords: bakuchiol, clinical study, cosmetics, retinol



INTRODUCTION

The cosmetics industry has always been on a never-ending quest to find a magic wand and slow the skin's biological clock or even turn it back. Among such promising cosmetic ingredients, bakuchiol is gaining more and more interest as a natural alternative to the holy grail of anti-ageing, retinol, but without the latter's well-known side effects, such as burning, stinging and erythema.

During the **ageing process** or due to chronic sun exposure, for example, our skin becomes thinner, loses elasticity, and develops wrinkles, uneven pigmentation and textural irregularities. As this, apart from the strictly cosmetic point of view, leads to poor wound healing and increased susceptibility to skin problems and diseases, we can say that this is also becoming an important public health issue in the context of an ageing population (1, 2).

Topical retinoids are widely used today in cosmetic products for the reduction of the signs of ageing and photodamage. Their ability to 'fight time' has been clinically proven, for example, through the stimulation of the production of collagen and glycosaminoglycans, known to bind a substantial amount of water, accelerate cell regeneration and alter melanin synthesis, which can all be seen as an improvement in fine lines, wrinkles and uneven pigmentation (1–3).

However, despite these desirable results, the retinoid application is often accompanied by significant **undesirable dermal effects**, such as skin irritation, dryness, erythema, pruritus, scaling, burning and/or a stinging sensation, all of which restrict their use, especially in subjects with sensitive skin (1, 2, 4, 5).

WHAT IS BAKUCHIOL: THE PROPERTIES

Bakuchiol is a phytochemical from the group of **phenylpropanoids** with the chemical formula 4-[(1E,3S)-3,7-dimethyl-3-vinylocta-1,6-dien-1-yl]phenol (Figure 1). It is found mainly in the seeds and leaves of **Cullen corylifolium** L. Medik, formerly known as **Psoralea corylifolia** L. and also called Babchi or **Bakuchi**, hence the compound name (2, 6). It has also been isolated from other plants, such as *Psoralea gran-*

dulosa (7), *Ulmus davidiana* (8), *Otholobium pubescens* (9) and *Piper longum* (10). Bakuchiol is valuable in both cosmetic science and (traditional) medicine, and has been used widely for centuries in Indian and Chinese medicines to treat a variety of conditions. The dry fruit of *C. corylifolium* also has monographs in both Chinese and Ayurvedic Pharmacopoeias (6).

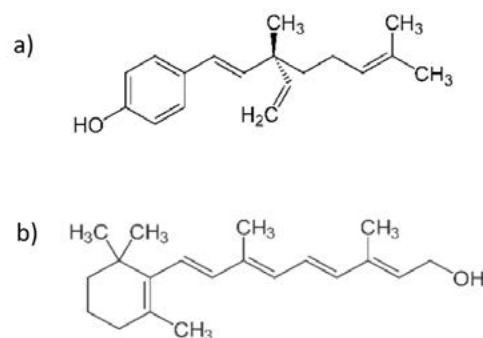


Figure 1: Chemical structures of bakuchiol (a) and retinol (b).

Bakuchiol comes in the form of a **viscous colourless to yellowish oil**, soluble in a variety of organic solvents (e.g. ethanol and DMSO; DMSO is only relevant for scientific research) and lipid emollients, such as vegetable oils and capric/caprylic triglycerides. It is only sparingly soluble in an aqueous media. It shows **good stability** under recommended storage conditions. Bakuchiol as a cosmetic raw material should be stored at temperatures up to 30 °C. It should not be exposed to heat and light (11–13).

IN VITRO STUDIES

In terms of function, bakuchiol acts as retinol's functional analogue, which is also supported by their structural similarity (Figure 1). Chaudhuri et al. showed in 2014 that both retinol and bakuchiol exhibit similar **effects on the gene expression profile**, obtained in an *in vitro* full-thickness human skin model (4). This includes the modulation of retinoic acid receptor genes and genes implicated in the formation of an extracellular matrix and dermo-epidermal junction constituents (4).

Apart from these retinol-related pathways, bakuchiol induces additional ones that may contribute to its anti-ageing effect, most notably **antioxidative** processes (14, 15). Many other actions of bakuchiol have also

been reported, such as **anti-inflammatory** (16, 17), which may contribute to a better side-effects profile, **anti-viral** (18), **anti-tumour** (19), **antibacterial** (20), **antiacne** (21, 22) and **skin-lightening** (10).

CLINICAL STUDIES

Previously conducted scientific studies have provided evidence for the wide range of biological activities of bakuchiol. However, we will focus on the ones that studied **anti-ageing effects and a comparison with retinoids**.

The effects of a skincare product containing bakuchiol were studied in a clinical study where 16 photoaged women used a 0.5% bakuchiol cream twice a day (morning and evening applications to the entire face). After twelve weeks of treatment, clinical assessment of the skin showed improvement in facial fine lines and wrinkles, pigmentation, firmness and elasticity, and an overall reduction in photodamage. Profilometry using silicone replicas indicated a significant reduction in wrinkle depth compared to the baseline. It should be emphasised, however, that the study lacks a vehicle control (4).

To compare the clinical effectiveness and negative skin reactions between bakuchiol and retinol, a randomised, double-blind, 12-week study was conducted, focusing on treating common signs of skin ageing (2). It included 44 subjects, divided into two groups, using either a 0.5% bakuchiol cream twice daily (19 females and two males) or a 0.5% retinol cream nightly (22 females and one male), both formulated in the same vehicle, on the entire face. The application differences were consistent with typical products' regimens and, considering bakuchiol, reflect its well-tolerated daytime use without photosensitivity. Results showed no statistical difference between the effects of bakuchiol and retinol. Both preparations significantly decreased fine wrinkle surface area and improved skin hyperpigmentation compared with the baseline. Subjects from the retinol group, however, reported significantly more scaling and stinging. Bakuchiol was observed to show more redness at week 4, but the difference in redness compared to retinol was no longer significant at weeks 8 and 12. Researchers concluded that the anti-ageing effect

and good tolerability of bakuchiol were confirmed in the study. However, it is important to emphasise that the study blinding design is questionable. The application regimen of the bakuchiol group (twice daily) was different than that of the retinol group (once daily), but researchers did not explain how the blinding approach was provided.

Another study (23) included 60 female subjects with mild to moderately photodamaged skin and self-perceived sensitive skin, who used two products containing bakuchiol (a cleanser and a moisturiser), twice daily (mornings and evenings) for four weeks. The moisturiser contained 1% bakuchiol, while the content in the cleanser was not specified. The aim of this research was to examine tolerability, skin barrier effects and the effectiveness of bakuchiol on sensitive skin. The researchers did not identify any tolerability issues. Some 10% of subjects with eczema reported minor stinging, while a few subjects observed mild tightness. Overall, the subject- and researcher-assessed tolerability was deemed to be excellent, as 1/3 of subjects had eczema or atopic dermatitis, rosacea and cosmetic intolerance syndrome, respectively. Improvements in smoothness, clarity and radiance, and the anti-ageing effect and overall appearance were statistically significant, as determined by researchers. TEWL (transepidermal water loss) measurements showed no changes from the baseline over the four weeks of treatment, which reflects no damaging effects on the skin barrier. Corneometry measurements showed a significant increase in skin moisture content. However, the study was not blinded, nor did it include a control.

The studies described below were conducted on products containing bakuchiol in combination with other anti-ageing ingredients. In the work by Goldberg et al. (24), five clinical studies were performed with a duration from four to 12 weeks and a total of 103 subjects with different skin types using a night serum with bakuchiol (0.5%), melatonin (0.1%) and ascorbyl tetraisopalmitate (10%) once daily. Two randomised studies, each on 24 subjects, focused on skin hydration following the one-time application of a serum on the forearm skin. A significant hydration improvement was reported over 12 hours, while a decrease in TEWL was significant until the peak at six hours. The effectiveness and tolerability study in-

cluded 39 females with moderate skin ageing and at least one pigmented spot on the face, who applied the serum each evening for three months. Instrumental and visual evaluation (performed by a dermatologist or the subjects themselves) confirmed beneficial effects, including significant improvements, such as a decrease in wrinkles, an increase in skin firmness, skin lightening, a reduction in redness and overall improvement in skin quality. In the fourth study, the serum was tested on the oily skin of 31 females with signs of ageing. After 28 days of application every evening, sebum secretion decreased significantly. Subjects in the fifth study (33 females with oily or combination skin with comedones) had fewer comedones after 28 days of use. The serum was thus confirmed as non-comedogenic. The serum was well tolerated. The main limitations are a lack of a placebo and blinding.

The same research group continued the examination of the same product on 24 subjects, with a focus on additional, detailed clinical and histologically confirmed effects (25). An overall improvement in wrinkles, photodamage and hyperpigmentation was confirmed after nightly application over a 24-week period. The most favourable histological results after skin biopsy on five subjects included increased dermal and epidermal thickness, and a significantly increased level of collagen III. The same limitations as the above-mentioned apply to this study.

These are some of the recent clinical studies conducted that show bakuchiol's retinol-type functionality, without retinol-like unwanted skin reactions. Nevertheless, **further studies of longer periods, on expanded populations and with better study designs are needed to show the clear, evidence-based clinical effects of products containing bakuchiol.**

SAFETY PROFILE

Even though both the topically applied retinoids and bakuchiol typically express marked improvements in various anti-ageing skin parameters, there are a few major advantages of bakuchiol over retinol (and its derivatives). These include better **skin tolerability, stability and safety** profile (2, 4, 23–25).

In terms of adverse skin reactions observed in the study by Dhaliwal et al. (2), for example, significantly more scaling and stinging were reported for retinols, while redness was more pronounced in the bakuchiol group, although not at significantly higher levels compared to the retinol group.

Along with the increased use of cosmetic products containing bakuchiol as a relatively new ingredient, individual **case reports about irritation reactions** in the form of contact dermatitis have become available. Positive reactions in patch tests were confirmed for 0.1% bakuchiol in a 33-years old female (26) and for 1% bakuchiol in a 23-years old female (27).



EVIDENCE-BASED FORMULATING

Scientific research of bakuchiol's effects, summarised in the 'In vitro studies' section (6, 8, 10, 14–20), intensified after 2007 when bakuchiol was introduced to the market as a cosmetic ingredient under the trade name Sytenol® A by Sytheon (28). According to CosIng, the European Commission database for information on cosmetic substances and ingredients, bakuchiol is classified for cosmetic use due to its antimicrobial, antioxidative, skin conditioning and emollient properties (29).

Based on data from the presented studies and specifications of bakuchiol ingredient manufacturers (13, 28), **recommended bakuchiol concentrations in finished formulations range from 0.5 to 1% (w/w)**, the former being the most commonly evaluated in clinical studies and demonstrating good cosmetic activity (2, 4, 24, 25).

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Many different skin types may benefit from its use, including subjects with normal, oily, combination, dry and even sensitive skin. **Sensitive skin** is especially prone to irritation when using topical retinoids and could therefore find anti-ageing products with bakuchiol as a more suitable alternative. Above all, **aged and photoaged skin** may benefit most from the use of cosmetics containing bakuchiol (24, 25). Unlike retinoids, bakuchiol can be used during daytime due to its **photostability** and may also stabilise retinol to some degree when used together (2, 4).

Bakuchiol shows **miscibility with a wide variety of lipid emollients**, such as capric/caprylic triglycerides and vegetable oils, alkyl benzoates (C12-15, C16-17), mineral oils and silicones (dimethicones, cyclomethicones). Please note that some are not accepted in terms of the concept of natural cosmetics. Bakuchiol is suitable for incorporation into emulsion systems and lipid solutions, such as oil serums. In order to incorporate it into an emulsion, it must be separately

dissolved in a lipid emollient/vehicle and added to the emulsion at a temperature of approximately **50 °C or below**. If not exposed to higher temperatures for a longer period of time, it can be added directly into the lipid phase. An **acidic pH below 6.5** should be maintained. In addition, bakuchiol is **not compatible** with metal ions, such as iron or copper, due to a consecutive colour formation, as it is a phenolic compound. However, chelators may be used to avoid colouration issues (22).

Finally, formulators need to be aware of the fact that other bakuchiol-containing or Babchi plant extract-containing ingredients are available on the market. They typically contain furanocoumarins (also known as furocoumarins) such as psoralen, which induce phototoxic skin reactions (30).

CONCLUSION

Because it exhibits similar effects on the gene expression profile, bakuchiol shows retinol-like anti-ageing functionalities. Most importantly, they are delivered without significant unwanted skin reactions related to the typical use of retinoids, especially in sensitive skin. Further clinical studies of good methodological quality are undoubtedly needed to confirm clinical effectiveness. We can, however, conclude that even though bakuchiol is not a magic wand to slow down time, it is surely a great rival of retinoids in terms of younger, smoother and plumper skin.

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