Before we discuss the skin lighteners, a brief review of skin color and melanin biosynthesis would be helpful. Skin color is mainly determined by the amount of melanin present in the skin. Melanin is synthesized in melanocytes that are normally found in the epidermal basal layer. Within the melanocytes melanin is bound to a protein matrix to form melanosomes, where tyrosinase converts tyrosine to eumelanin (black pigment) or pheomelanin (yellowish and reddish pigment). Fig.1 illustrates the pathways of melanin biosynthesis in the melanocytes, which are a chain of oxidative reactions catalyzed by enzymes. It is clear from Fig.1 that tyrosinase plays a critical catalytic role in multiple reaction steps of the melanin biosynthesis process. By inactivating the tyrosinase activity, or blocking the chain reaction at the various points of the pathways, skin lighteners can inhibit or even reverse melanin biosynthesis, and are thus useful in whitening or lightening the human skin. Skin lightening agents can also be used to treat local hyperpigmentation or spots that are caused by a local increase in melanin synthesis or uneven distribution.
Features and Benefits

Deoxyarbutin (dA), a synthetic form of arbutin synthesized without the hydroxyl moiety, provides a promising treatment for reducing skin hyperpigmentation [1]. dA shows reversible inhibition of tyrosinase activity with associated skin lightening in both a hairless guinea pig model system and in human skin. The reversibility of dA’s impact on skin pigmentation suggests that the compound does not permanently destroy melanocytes [2,3,4]. In addition to the reported efficacy, Hamed et al. have found that dA is less cytotoxic/cytostatic than HQ in treatment of cultured human melanocytes [5]. Chawla et al. have reported that dA and associated second-generation derivatives, dose-dependently inhibit tyrosinase hydroxylation and DOPAoxidase activity of tyrosinase. This may be attributed to the chemical structure of dA, as the deoxysugars may increase skin penetration and binding affinity for tyrosinase [2,3].

Hubei Artec Carbohydrate Chemistry Co., Ltd.
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**In vitro test**

Effects of Deoxyarbutin and Hydroquinone of tyrosinase inhibitor

An assay was developed to measure the conversion of tyrosine to DOPA by mushroom tyrosinase with quantitative detection by high-performance liquid chromatography (HPLC).

This assay was used to determine the effective concentration range and strength of inhibition (Ki).

- 20 ml of mushroom tyrosinasesolution added to 10 ml of DOPAsolution
- 4 Lightening active ingredient (ranging from 0.1 to 10.0 µM) plus 200 ml of tyrosine (10 µM)
  - Deoxyarbutin
  - Hydroquinone
  - Arbutin
  - Kojic acid

They added and incubated for an additional 22 min. Detection by high-performance liquid chromatography (HPLC).

**In vivo test**

Skin lightening Test

Skin lightening activity of Deoxyarbutin with the other brightening ingredients

- Evaluation for topical effect on skin pigmentation of a guinea pig model.
- 4 Lightening active ingredient
  - Deoxyarbutin 3%
  - Hydroquinone 3%
  - Arbutin 3%
  - Kojic acid 3%
- Guinea pig skin were treated daily with lightening active ingredient for 9 week
- The measurement by Chromameter

Photographs at the 9-week time point of skin areas treated with vehicle, dA, Hydroquinone, Arbutin, and Kojic Acid respectively.
The reversibility of Deoxyarbutin’s impact on skin pigmentation suggests that the compound does not permanently destroy melanocytes after treatment discontinued.

Skin lightening recovery Test
Skin lightening activity of Deoxyarbutin various dosage.

- Evaluation for topical effect on skin pigmentation of a guinea pig model.
- 4 various dosage.
  - Deoxyarbutin 0.1%
  - Deoxyarbutin 0.3%
  - Deoxyarbutin 1%
  - Deoxyarbutin 3%
- Guinea pig skin were treated daily with lightening active ingredient for 6 week
- The measurement by Chromameter

Safety Test

Viability and morphology of normal human fibroblasts and keratinocytes were less significantly affected by Deoxyarbutin compared to Hydroquinone Test.

- Evaluation for topical effect on Human fibroblasts and keratinocytes cultures.
- 3 Ingredient
  - Deoxyarbutin 25 µM
  - Hydroquinone 25 µM
  - DMSO 25 µM (vehicle alone)
- Human fibroblasts and keratinocytes cultures were treated daily with Deoxyarbutin and Hydroquinone for 5 day
- The measurement by Photographs of viability and morphology of normal human fibroblasts and keratinocytes

Acute Toxicity Test of Deoxyarbutin

- Deoxyarbutin dispersed in (propylene glycol).
- 6-7 rats per one group were used in the test.
- 2 group
  - 6 females
  - 7 males
- Single-dose oral toxicity of dA
- Test acute toxic after 7 days of administration

Results
- LD50 = 367 mg/kg in males
- LD50 = 314 mg/kg in females
Packaging

Packaging sites:
- 1kg/bag, aluminum foil bag and PE bag lining.
- 20bags/drum, paper fiber drum.

Storage

Storage conditions:
- Keep container tightly sealed.
- Store in cool, dry conditions in well sealed containers.

Notes:
- Store away from oxidizing agents.
- Shield from light.

References:


