

*Addendum*

## **Quasi-Drugs Developed in Japan for the Prevention or Treatment of Hyperpigmentary Disorders. *Int. J. Mol. Sci.* **2010**, *11*, 2566–2575**

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*Received: 5 July 2010 / Accepted: 8 July 2010 / Published: 12 July 2010*

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One additional skin lightening or whitening quasi-drug (QD) has been developed and officially approved by the Ministry of Health, Labor and Welfare of Japan. The active ingredient niacinamide should be included in this review [1]. Its mechanism of skin lightening is based on the inhibition of melanosome transfer from melanocytes to keratinocytes. Niacinamide is listed in Table 1, which classifies compounds according to the mechanism of skin lightening QDs registered in Japan.

### *2.15. Niacinamide (Obtained by Procter & Gamble Company in 2007)*

Niacinamide (also termed nicotinamide), a derivative of vitamin B<sub>3</sub>, has been shown to act as an anti-inflammatory agent in acne [2]. Niacinamide had no effect on the tyrosinase activity and melanin synthesis of cultured normal human melanocytes, however, it was found that niacinamide significantly decreased hyperpigmentation, such as melasma and solar lentigines, via inhibition of melanosome transfer from melanocytes to keratinocytes [3,4].

**Table 1.** Mechanistic classification of skin lightening QDs approved by the MHLW of Japan.

<i>Target</i>	<i>Mechanism</i>	<i>Detail</i>	<i>Skin Lightening QD</i>
<b>Melanocyte</b>	Inhibition of tyrosinase activity	Anti-oxidation	Ascorbic acid/derivatives
		Chelating copper atoms	Kojic acid    Ellagic acid
		Competitive inhibition	Arbutin      Rucinol® 4MSK        4-HPB
	Decrease of tyrosinase protein level	Acceleration of Tyr degradation	Linoleic acid
		Inhibition of Tyr maturation	Magnolignan®
<b>Keratinocyte</b>	Inhibition of KC-MC signaling	Inhibition of UV inflammation	Chamomilla extract Tranexamic acid/derivative
<b>Melanocyte and Keratinocyte</b>	Inhibition of melanosome transfer	Inhibition of melanin dispersion	Niacinamide
<b>Epidermis</b>	Acceleration of epidermal turnover	Desquamation of melanin	Placental extract Adenosine mono-phosphate

KC: keratinocyte; MC: melanocyte; Tyr: tyrosinase; UV: ultraviolet light.

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