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The Relationship Between Tyrosinase Inhibitory Action and Oxidation-Reduction Potential of Cosmetic Whitening Ingredients and Phenol Derivatives

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The oxidation-reduction potentials of cosmetic raw materials, showing tyrosinase inhibitory action, and phenolic compounds structurally similar to L-tyrosine were determined by cyclic voltammetry. The voltammograms obtained could be classified into 4 patterns (patterns 1-4). Pattern 1, characterized by oxidation and reduction peaks as a pair, was observed with catechol, hydroquinone or phenol, and pattern 2 exhibiting another oxidation peak in addition to oxidation and reduction peaks as a pair was found with arbutin, kojic acid, resorcinol, methyl p-hydroxybenzoate and L-tyrosine as the substrate of tyrosinase. Pattern 3 with an independent oxidation peak only was expressed by L-ascorbic acid, and pattern 4 with a reduction peak only at high potentials, by hinokitiol. The tyrosinase inhibitory activity of these compounds was also evaluated using the 50% inhibitory concentration (IC_{50}) and the inhibition constant (Ki) as parameters. Hinokitiol, classified as pattern 4, showing the highest inhibitory activity (lowest IC_{50} and Ki). Hydroquinone showing the second highest activity belonged to pattern 1, which included compounds showing no inhibition of tyrosinase activity. The inhibitory activity of compounds exhibiting pattern[2] was relatively low with Ki value being in the order of 10^{-4}M. Although there was no consistent relationship between oxidation-reduction potentials and tyrosinase inhibitory action, the voltammetry data can be used as an additional index to establish the relationship between the structure and the tyrosine inhibitory activity.