Harmful skin whitening with green chromatographic.

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Abstract

The current study focuses on the simultaneous detection of four skin whitening chemicals in facial creams and body lotions, including hydroquinone (HQ), resorcinol (RS), catechol (CC), and 3,3′-dichlorobenzidine (DCB). Because the first three are dihydroxybenzene positional isomers, simultaneous separation using the traditional reverse-phase high-performance liquid chromatographic technique is problematic (RP-HPLC). Using micellar liquid chromatography and a photodiode array detector, the selected skin whitening agents were detected in facial cream and body lotion (MLC-PDA). The approach was optimized utilizing response surface methodology (RSM) and a central composite design in the current work (CCD). The analysis of variance (ANOVA) was used to test the variance (ANOVA) was used to test the second-order polynomial model for forecasting the best chromatographic run time, and 3D response surface plots for the interactions between three variables were created. The concentration of surfactant (SDS), the percentage of organic modifier (OM), and the pH of the mobile phase were chosen as independent variables. The analysis of variance (ANOVA) was used to test the second-order polynomial model for forecasting the best chromatographic run time, and 3D response surface plots for the interactions between three variables were created. The concentration of surfactant (SDS), the percentage of organic modifier (OM), and the pH of the mobile phase were chosen as independent variables. 0.15 M SDS and 7% 1-butanol were used in the optimized mobile phase, which was buffered at pH 7 using 0.01 M NaH2PO4.The chromatographic run time for simultaneous determination of selected analysts was 7.5 min. The correlation coefficient (r2) values were satisfactory between 0.998–0.999 over the linear concentration range. Limits of detection (LODs) and the limits of quantification (LOQs) for the four skin whitening agents were in the range of 0.05–0.07 µg/mg and 0.11–0.14 µg/mg, respectively. Trueness (98.4–102.7%) and precision (< 4.3%) were acceptable. The developed method was fast, cost-effective, and green which could easily analyze complex matrices (facial creams, body lotion) without any pretreatment other than filtration.

Keywords: Skin tone, Hydroquinone, Resorcinol, Melanocytes, Catechol.

Introduction

For simultaneous measurement of chosen analysts, the chromatographic run duration was 7.5 minutes. Over the linear concentration range, the correlation coefficient (r2) values were good, ranging from 0.998 to 0.999. The four skin whitening agents have limits of detection (LODs) and limits of quantitation (LOQs) in the range of 0.05–0.07 g/mg and 0.11–0.14 g/mg, respectively. Precision (4.3 percent) and trueness (98.4–102.7 percent) were both satisfactory. The new approach was quick, cost-effective, and environmentally friendly, and it was capable of analyzing complex matrices (facial creams, body lotions) without any pretreatment other than filtration. The MLC-PDA approach found to be more suitable for the simultaneous separation of selected positional isomers.

Skin tone is an intriguing topic for women of all ages. In Asia, women's skin tone is still regarded as one of the most essential characteristics of their appearance. In the early 1990s, skin whitening agents were only utilized by women with dark skin, but more recently, fair-skinned women have begun to use them to tone their skin color. These skin tone lightening chemicals are now being used not just by women, but also by men [1].

Melanin pigment, which is produced by melanocytes, is primarily responsible for controlling skin color in humans. Synthetic skin whitening chemicals such as hydroquinone (HQ), resorcinol (RS), and catechol (CC) suppress the formation of melanocytes, resulting in a decrease in the amount of melanin, resulting in skin discoloration. Antiseptics, disinfectants, medicines, and polymers are all made with these compounds. Many national and international laws exist around the world to ensure that only allowed skin whitening substances are used in fairness creams and body lotions. The use of authorized (salicylic acid, kojic acid, arbutin, corticosteroid) and non-

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permitted (hydroquinone, resorcinol, catechol) skin whitening chemicals in cosmetic products was regulated by the European Union (Directive 2013/655). Apart from heavy metals, there are no specific standards in India for testing these harmful substances in cosmetic items. According to EU guidelines, skin whitening goods (branded and non-branded) marketed on the Indian market as cosmetics or pharmaceutical preparations comprise approved and prohibited chemicals. Because they enter the body through cutaneous and subcutaneous dermal effects (if used regularly), all of these products can provide a health risk. Fairness-enhancing agents can cause renal and neurological consequences, as well as cataracts, glaucoma ochronosis, dermatitis, leucoderma, and other skin conditions, and can potentially affect the development of a foetus in pregnant women [2-3].

Apart from these negative effects, these skin whitening treatments may cause malignant development, DNA damage, gene mutation, and immune system impairment if subjected to chronic UV irradiation. Aside from these primary compounds, 3,3′- dichlorobenzidine, which can form during the manufacturing of cosmetics or be used to impart a specific color, is an aromatic amine that can cause toxicity when exposed to the skin and has been classified as a carcinogen by the Scientific Committee for Consumer Safety. The Indian cosmetics market has been increasing at a rate of 15–20 percent faster than that of the United States or Europe, and it now ranks second in the world. A wide range of beauty products are available on the market, with skin whitening goods accounting for around half of the market. In recent years, counterfeit or substandard cosmetic items have found their way into the Indian market, and there is no strict legislation or simple method to detect them. As a result, a rapid and sensitive method for simultaneous analysis of skin whitening agents and related chemicals should be devised. The analysts of interest in this investigation include hydroquinone, resorcinol, catechol, and 3,3′- dichlorobenzidine. Hydroquinone (benzene-1,4-diol) is a benzene derivative that is used to treat skin hyperpigmentation in a variety of cosmetic products. The 1,3 isomer of benzenediol, resorcinol, aids in the removal of hard, scaly, and roughened skin. Catechol, also known as 1,3 dihydroxybenzene, inhibits melanin pigment synthesis by reducing the synthesis of the enzyme tyrosinase, which catalysis the synthesis of melanin pigment [4].

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