

Determination of Formaldehyde in Commercially Available Baby Shampoos and Skin Care Cosmetics by a Validated HPLC Method

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Formaldehyde (FA) and formaldehyde-releasing preservatives are used in many personal care products, such as baby shampoo, baby soap and body washes. FA in cosmetics is widely understood to cause allergic skin reactions and rashes in some sensitive people. Furthermore, it is considered a known human carcinogen by many expert and government bodies, including the United States Department of Health and Human Services and the International Agency for Research on Cancer. Concerning that, the European Cosmetics Directive (76/768/EEC) allows the use of FA in cosmetics up to a concentration of 0.2%. Therefore, the aim of our study was to develop a sensitive and accurate method for the determination of FA in shampoos and skin care cosmetics. Firstly, FA was reacted with 2,4-dinitrophenylhydrazine (2,4-DNPH) to form a Schiff base (FA-2,4-DNPH), which has an absorbing maximum at 345 nm. The separation of the derivatization product was carried out at room temperature ($24 \pm 2^\circ\text{C}$), on a reversed-phase Purospher® STAR RP-18e column (150 X 4.6 mm I.D.; particle size 5 μm) with a mobile phase constituted of acetonitrile:water, 50:50 (V/V). The elution was carried out at a flow rate of 1.50 ml /min. The injection volume was 20 μl . The column effluent was quantified with a photodiode array detector (DAD) set at a wavelength of 345 nm. The proposed method was validated by determination of linearity, precision, accuracy and sensitivity. Calibration curves for formaldehyde were obtained using standard solutions of FA with concentrations ranged from 0.00088 to 0.0074 %. Correlation coefficient was 0.998. The precision of the method was confirmed by assessment of repeatability and reproducibility. The limits of detection and limit of quantification for FA were 0.0006 % and 0.0022 %, respectively, which indicates an excellent sensitivity of the proposed method. The method was applied for determination of the FA content in baby shampoos and other skin care cosmetics, commercially available in the Macedonian market. The obtained FA levels in the tested baby shampoos and baby skin care cosmetics were much less than 0.2%, with a maximal level of 0,0744 %. In conclusion, we recommended the proposed (2,4-DNPH) derivatization method followed by HPLC separation as a method of choice for determination of FA in the commercially available shampoos and skin care cosmetics.

Keywords: Formaldehyde, RP-HPLC, HPLC-DAD, Cosmetics, 2,4-Dinitrophenylhydrazine (2,4-DNPH)