Asian Journal of Chemistry; Vol. 25, No. 6 (2013), 3517-3518

ASIAN JOURNAL OF CHEMISTRY

http://dx.doi.org/10.14233/ajchem.2013.13785

NOTE

Determination of Formaldehyde in Different Brands of Perfumes by High Performance Liquid Chromatography

WARDA SHEIKH* and NARJIS NAZ

Department of Chemistry, Lahore College for Women University, Lahore, Pakistan

*Corresponding author: Tel: +92 42 99203801-9; E-mail: wardasheikhani@yahoo.com

(*Received*: 24 March 2012; *Accepted*: 29 December 2012) AJC-12633

In this study, formaldehyde was determined in different brands of perfumes available in local markets of Pakistan using high performance liquid chromatography (HPLC), with a pre-column derivatization with 2,4-dinitrophenylhydrazine. Thirty samples of perfumes were taken and their derivatives were prepared to analyze using a C_{18} column with 45 % acetonitrile solution and water (1:1 v/v) as mobile phase and detected at the wavelength of 345 nm. None of the perfumes labelled formaldehyde but the results showed that out of 30 perfumes, 21 of them confirmed formaldehyde release.

Key Words: Formaldehyde, Perfumes, HPLC.

Formaldehyde and formaldehyde releasing compounds are most extensively used stabilizers in personal care goods[1-5] especially in perfumes due to their flexibility, economical and efficiency as they inhibit the microbial and fungal growth[6,7].

There have been a number of observations of formaldehyde harming humans as carcinogenic[8,9], respiratory sensitizers[10,11], an allergen[12], an intense irritant of eyes and mucous membrane[13]. The International Agency for Research on Cancer has classified formaldehyde as group 2A carcinogenic to human[14].

In recent years, the potential carcinogenicity of formaldehyde has led to a movement in the world that has imposed regulations, restrictions and banned its use[6,8]. The maximum allowed concentration as free-formaldehyde being 0.1 % for oral care cosmetics and 0.2 % for all the rest[15] but still the use of formaldehyde as preservative is continued in cosmetics industry.

From ancient times (4000 years), the perfumes are the most popular personal care product among the mankind for self-grooming and social acceptance. Formaldehyde is added in perfumes as preservative and a potential source of harm for human being. Literature reveals[16], that there have been few studies on the determination of formaldehyde in cosmetics such as lotions, hair liquids, nail varnish and eye makeup, *etc.*, but no study has been done on the perfumes. So the present study is conducted to determine the concentration of formaldehyde in different brands of popular perfumes available in the local markets by HPLC in order to obtain information and develop stratagem to keep away from health risks of formaldehyde.

Thirty perfumes were purchased from local cosmetics shops and labelled as P1, P2 … *etc*. All the Chemicals used were of analytical grade and purchased from Merck, UK. The reagents employed were: 37 % formaldehyde as standard solution, 9:1 (v/v) tetrahydrofuran solution, 0.1 % 2,4-dinitrophenylhydrazine, 1 M sodium hydroxide and acetonitrile solution.

Sample derivatives were prepared by mixing 2 mL of perfume (P1) sample, 1 mL of tetrahydrofuran solution (9:1 v/v) with 0.5 mL of 0.1 % 2,4-dinitrophenylhydrazine (DNPH) on a vibrator for few minutes. 0.45 mL of phosphate buffer (pH 7) solution was then added in the above solution with 1.4 mL of 1 M sodium hydroxide solution and subjected for HPLC analysis. Same procedure was done with the rest of perfumes (P2-P30) samples.

The formaldehyde stock solution of 1000 ppm was prepared and standardized by potentiometric titration. The working standard solutions (2, 4, 6… 20 ppm) were freshly prepared by diluting proper amount of stock solution of formaldehyde with water for calibration curve.

HPLC analysis was carried out by using HPLC Machine Water Gradient (Model: Waters 1525) equipped with Dual λ Absorbance UV detector (Model: Waters 2487) and column C_{18} (250 mm × 4.6 mm, 5 μm particle size). The determination wavelength was 345 nm. The mobile phase was 45 % acetonitrile solution: HPLC grade water (1:1) delivered at the flow

rate of 1.0 mL/min and the volume of sample injected was 10 µL. A standard calibration method was used for quantification and qualification of formaldehyde in different samples of perfumes.

In this study concentration of formaldehyde was measured in different brands of perfumes by high performance liquid chromatography. The derivatization of formaldehyde with 2,4-dinitrophenyl hydrazine is renowned and extensively used for analysis[17,18]. All the standards and sample solutions were analyzed by HPLC and compared with the retention time of the standard formaldehyde for criterion. The retention time of formaldehyde (standard solution) is 3 min as shown in HPLC chromatogram (Fig. 1).

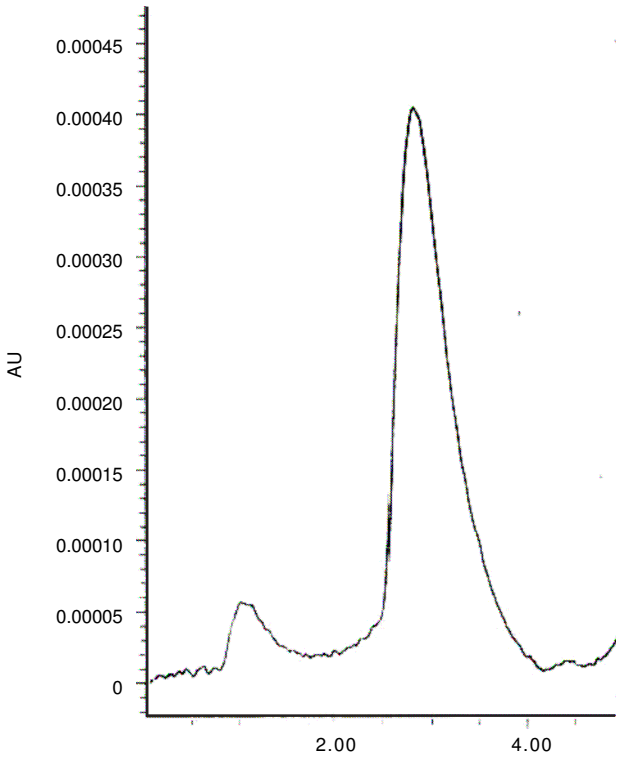

Fig. 1. Chromatogram of standard formaldehyde solution

All the prepared working standards (2, 4, 6 … 20 ppm) of formaldehyde were run on HPLC apparatus and a graph was depicted between peak areas *versus* concentration to get the standard curve (Fig. 2).

Quantitative analysis of formaldehyde in different samples of perfumes is done by the substitution of the peak area of sample solution in the calibration equation of standard curve. Out of thirty samples of perfumes 21 samples have formaldehyde and are potential source of harm for those individuals who use these perfumes. None of the thirty perfumes labelled containing formaldehyde on the bottles or on their packing material but show positives results for formaldehyde. The total amount of formaldehyde in different perfumes was between 1-19 ppm (Fig. 3).

Conclusion

Our study demonstrated that out of 30 perfume samples 21 have formaldehyde in the range of 1-19 ppm which is a potent sensitizing agent for humans.

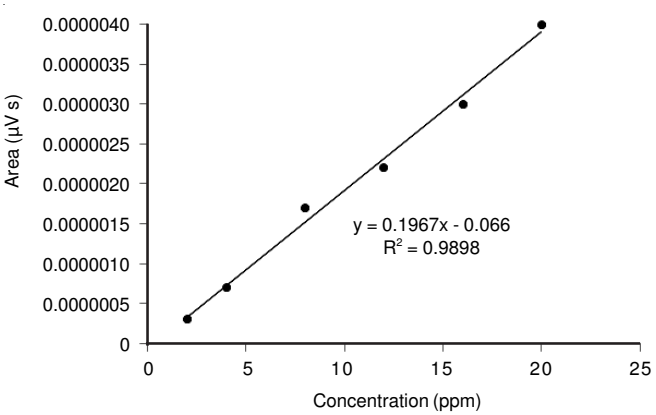

Fig. 2. Standard curve for formaldehyde

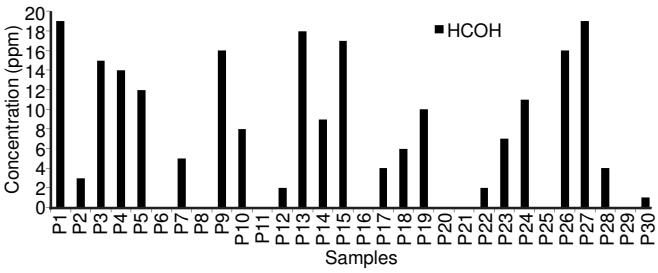

Fig. 3. Distribution of formaldehyde content

ACKNOWLEDGEMENTS

The authors gratefully acknowledged the assistance and support of Mr. Talib Mehmood at the Central Laboratory of Lahore College for Women University, Lahore, Pakistan during the analysis work.

REFERENCES

1. H. Joshua and E. Hillebrand, *Application Note*, **42**, 14 (2010).
2. D.C. Steinberg, *Cosmet Toiletries*, **123**, 47 (2008).
3. C.H. Wilson, *J. Soc. Cosmet. Chem.*, **25**, 67 (1974).
4. M. Hogeling and M. Pratt, *Dermatitis*, **19**, 86 (2008).
5. J.N. Moennich, D.M. Hanna and S.E. Jacob, *J. Dermat. Nurses' Assoc.*, **1**, 211 (2009).
6. R.T. Rivero and V. Topiwala, *J. Cosmet. Sci.*, **55**, 343 (2004).
7. M.A. Flyvholm and P. Andersen, *Am. J. Ind. Med.*, **24**, 533 (1993).
8. F. Gasparini, P.T. Weinert, L.S. Lima, L. Pezza and H.R. Pezza, *J. Braz. Chem. Soc.*, **19**, 1531 (2008).
9. N. Nelson, R.J. Levine, R.E. Albert, A.E. Blair, R.A. Griesemer, P.J. Landrigan, L.T. Stayner and J.A. Swenberg, *Environ. Health Persp.*, **70**, 23 (1986).
10. D. Sasseville, *Dermatol. Ther.*, **17**, 251 (2008).
11. D.I. Orton and J.D. Wilkinson, *Am. J. Clin. Dermatol.*, **5**, 327 (2004).
12. E.M. Warshaw, H.J. Buchholz, D.V. Belsito, H.I. Maibach, J.F. Fowler, R.L. Rietschel, K.A. Zug, C.G.T. Mathias, M.D. Pratt, D. Sasseville, F.J. Storrs, J.S. Taylor, V.A. Deleo and J.G. Marks, *J. Am. Acad. Dermatol.*, **60**, 23 (2009).
13. L. Feng, C.J. Musto and K.S. Suslick, *J. Am. Chem. Soc.*, **132**, 4046 (2010).
14. S.A. Vaizoglu, S. Aycan, L. Akin, P. Kocdor, G. Pamukcu, O. Muhsinoglu, F. Ozer, E.D. Evci and C. Guler, *Tohoku J. Exp. Med.*, **207**, 157 (2005).
15. L. Gamiz-Gracia and M.D. Luque de Castro, *Analyst*, **124**, 1119 (1999).
16. T. Doi, K. Kajimura and S. Taguchi, *J. Health Sci.*, **56**, 116 (2010).
17. M.T. Oliva-Teles, P. Paiga, C.M. Dlerue-Matos and M.C.M. Alvim-Ferraz, *Anal. Chim. Acta*, **467**, 97 (2002).
18. P. Wu, C. Chang and S. Chou, *J. Food. Drug Anal.*, **11**, 8 (2003).