

Study of skin irritations caused by perfumery materials

Hayato Hosokawa and Takayuki
Ogawa & Co., Ltd., Tokyo, Japan

Consumption of cosmetic and toiletry products has been increasing steadily. The variety of cosmetics has also become much more complex. Thousands of chemicals and essential oils are used to prepare the fragrances for cosmetic products today. There are approximately 200 kinds of essential oils and over 3,000 chemicals used as fragrance ingredients.^{1,2} Recently, however, some problems have arisen in the use of some of these chemicals and oils which appear to cause skin irritations.³⁻⁵ In this study, we tested chemicals and oils commonly used in fragrances for cosmetics by the "closed patch method" in order to investigate the safety of each material.

Method

All chemicals and essential oils used in this study were obtained commercially and used without further treatment. 270,000 closed patch tests of fragrance materials were made on a pool of approximately 200 volunteers employed by Ogawa & Co., Ltd., over the last eight years. Ten materials were tested on each person at one time.

The fragrance materials were mixed into cold cream or white vaseline (0.5-1.0%) and applied to the forearm and inside of the upper arm for 24 hours using a patch such as the one shown in figure 1. Reactions were observed 30 minutes after the patch was removed. The results were graded as follows:

- No visible reaction
- ± Slight erythema
- + Erythema
- + + Erythema and swelling or marked erythema

Reactions were judged by Professor F. Saito, M.D., Department of Dermatology, School of Medicine, Toho University, and Professor K. Minami, M.D., Department of Dermatology,

Kansai Medical School.

Results and discussion

Season and skin reaction

Change of season is an important factor in Japanese life. Seasonal changes have been known to trigger illnesses in certain people; e.g., some asthmatics suffer an increase in frequency of attacks and other persons are increasingly susceptible to colds as seasons change. We examined the influence of seasonal changes on

Table I. Results of patch tests conducted each month on 14 subjects for the last eight years.

Month Number of Tests	January 984		February 994		March 836		April 792		May 972		October 578		November 1070		December 978	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Number and % of + and ++	21	2.13	25	2.52	15	1.79	13	1.64	13	1.34	23	3.98	27	2.52	18	1.84
Number and % of ±	49	4.98	41	4.12	49	5.86	40	5.05	41	4.22	28	4.84	43	4.02	36	3.68
Total	70	7.11	66	6.64	64	7.65	53	6.69	54	5.56	51	8.82	70	6.54	54	5.52

patch test reactions. Ten men and four women who had volunteered for patch tests over the last eight years and who are considered to be more or less sensitive toward skin irritants were selected. Table I shows the results of their patch tests conducted each month for the last eight years. We did not test in the summer (June-September) as the amount of perspiration made it impossible to obtain satisfactory results. Somewhat higher positive results were obtained in March and October which are the months in which seasonal changes from winter to spring and summer to autumn occur, respectively. It remains necessary, however, to conduct tests in the summer as well before concluding that there is a relationship between skin reaction and season. In our experience, some objects experience more itchiness on humid days; this is partly due to the plaster in the closed patch.

Sex-related differences

Forty men and 43 women were chosen to submit to patch tests over a 36 month period; Table II shows the results obtained from these men and women. The results indicate that men were more sensitive than women toward the samples used. The percentages of grades + and ++, relative to total number of samples tested, were 0.54 for men and 0.19 for women.

Table II. Sex-Related Differences

	Men	Women
Number of patch tests	8264	8914
Number of + and ++	45(0.54%)	17(0.19%)
Number ±	150(1.81%)	72(0.80%)
Total	195(2.3%)	89(0.99%)

Chemical structure and skin reaction

Two hundred twenty-three chemicals were tested in order to investigate the relationship between structure and skin irritation. Table III shows the results obtained from the above test. The results indicate that there is no relationship between the structure of chemicals and skin reaction. The results for lactones, acetals, ethers, and hydrocarbons were inconclusive because the number of samples examined was too small.

Summary

Over 10% of the volunteers did not react to any chemical in the eight year period. About ten subjects have reacted to every test even though the samples were different each time. These subjects apparently possess skin which is susceptible to irritation from any kind of foreign material. Some people suddenly became sensitive toward chemicals following changes in lifestyle (i.e., marriage, change of employment, pregnancy, and nursing, etc.). Generally, subjects who were sick or undergoing medical treatment were more sensitive than those who were not.

Table III. Chemical Structure and Skin Reaction

Chemical Group	Number of samples tested	Number of + and ++	% of + and ++
Ester	104	9	8.6
Aldehyde	32	3	9.3
Alcohol	51	4	7.8
Ketone	14	1	----
Lactone	5	1	----
Acetal	8	1	----
Ether	6	0	----
Hydrocarbon	3	1	----

We have tested most of our fragrance ingredients by the patch test method and obtained fairly clear results. Each material is tested on at least 200 people. Any material which produced adverse reactions in more than 1% of the people tested is excluded from any of our compositions.

References

1. S. Arctander, *Perfume and Flavor Materials of Natural Origin*, private publication, Elizabeth, NJ, 1960
2. S. Arctander, *Perfumer and Flavor Chemicals*, private publication, Elizabeth, NJ, 1969
3. J. C. Mitchell and G. Dupuis, *Brit. J. Derm.*, **84**, 139 (1971)
4. H. J. Maibach, *Am. Perf. Cosm.*, **80**, (1965)
5. K. Sipos, *Dermatologica*, **135**, 421 (1967)