Stability of Perfume Compositions in Alcoholic Lotions —

As a Function of the Water Purity Employed

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Stability tests on perfume raw materials, such as so-called aroma chemicals, essential oils, bases and specialties, number among the routine tasks that a perfumer or applications technologist performs during the course of his professional life. The acceptance of a perfume composition is not determined by fragrance alone. Color stability, good solubility and the maximum possible olfactory stability in the finished product also play a crucial role.

Essentially, the stability of a composition in the product depends upon the following factors:

- The nature and quantity of the perfume raw materials—or, to put it more aptly, the components or fragrance elements—that were employed in creating the perfume composition,
- The chemical and physical nature of the market product to be perfumed, and
- The storage conditions, such as time, temperature and packaging.

Ongoing, and usually very comprehensive, stability tests serve as a good basis for designing stable perfume compositions. The routine stability tests are performed over a total test period of three months at temperatures of +20°C (+68°F) and +36°C (+96.8°F).

The perfumed specimen that is being tested is always assessed in the form of a direct comparison with a freshly perfumed specimen. The crucial aspects in the perfumistic and applications-technology assessment are fragrance (impact and stability), color and solubility values for the composition elements to be queried by the perfumer from his workplace via a computer terminal, in terms of product- and/or substance-related aspects.

On the basis of studies that have been performed, and using alcoholic lotions by way of example, it is possible to indicate the significant impact that the water purities which are employed in the production of lotions can have on the stability of the perfume oils in these products. The investigation in question was restricted to the following three water purities: Tap water, demineralized water and distilled water. Table I illustrates the analytical differences between the individual water purities. The TOC and COD values were identified and the pH and hardness values were measured: The conductivity measurements, as well as the values of the individual water purities are in line with normal data.

Table I. Analytical differences between water purities

	TOC mg/1	COD mg/1	pH	Hardness values
Tap water	18	5.4	6.2	4.10
Demineralized water	6	1.5	6.0	0.08
Distilled water	2	0.5	6.5	0.08

TOC = Total organic carbon
COD = Chemical oxygen demand

Serving, as they do, to represent numerous additional specific investigation methods, the data merely identify general differences between the water purities that are customarily employed in the processing industry. The individual values indicate that there is a considerable difference between the purity of tap water and that of other types of water.

Perfume Oil Types Employed

The test conditions to which the perfume oils to be tested were subjected represent the routine test conditions that are customarily employed at H&R:

- Formulation: 4% perfume oil in ethanol, 15 vol. % water
- Packaging: 20 g in glass flacon (30 ml)
- Storage conditions: (1) 20°C (68°F)/daylight; (2) 36°C (96.8°F)/incubator
- Storage period: 3 months

Within the scope of the investigations, 20 perfume compositions—all with a perfume oil concentration of 4%—were tested in alcoholic lotions that had been prepared with the water purities indicated above. Selection of the perfume oils that were employed was made on a random basis, without any regard to olfactory, price-related, analytical or applications-technology aspects. The following fragrance

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descriptions are representative of the 20 perfume oils that were employed:

(A) Type Brut. Soft, warm Fougère type, very rich background

(B) Modern, masculine fantasy note, pronouncedly sweet-spicy and woody background

(C) Modern, elegant freshness, with a floral, erogenous foundation

(D) Masculine fantasy note, herbaceous, spicy, erogenous

(E) Woody, masculine fantasy note, with a classical Eau de Cologne top note

It was observed that water purities had a strong impact on the olfactory stability properties of perfume compositions.

In both the daylight and incubator tests, the stability properties of the compositions were best when tap water had been employed. Moreover, it should also be noted that the difference in stability between tap water and distilled water is virtually twice as great in the daylight tests than in the comparable incubator tests.

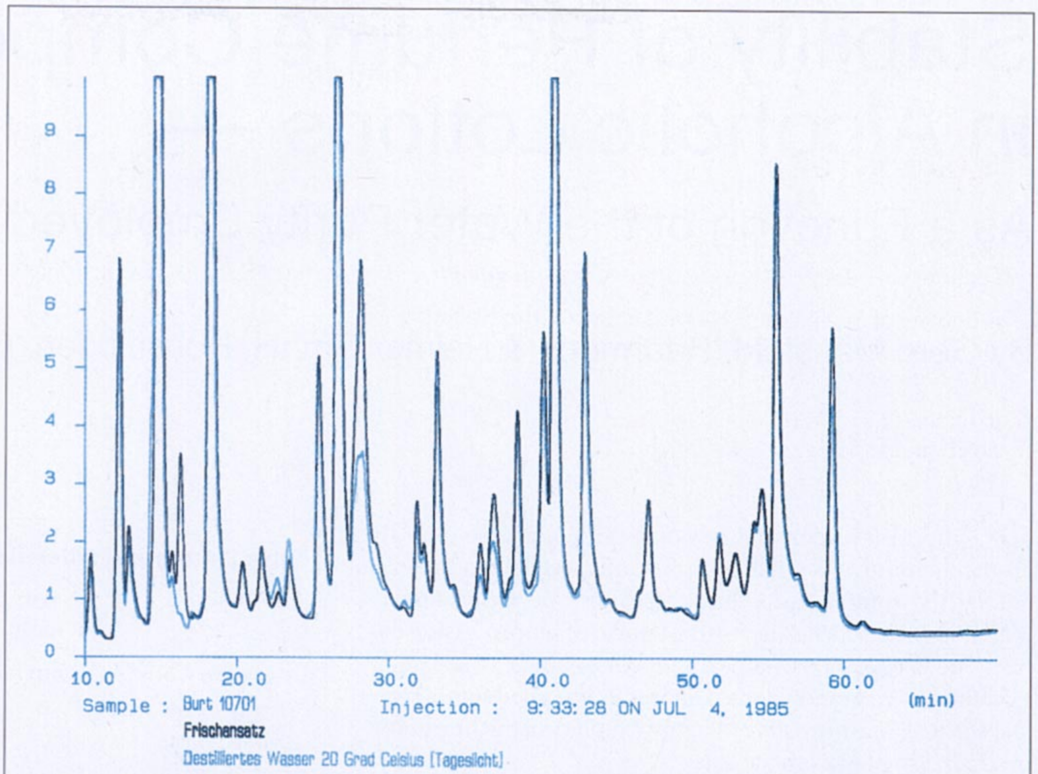

Figure 1. GC of Composition A, test specimen prepared with distilled water, 20°C/ daylight.

Color Stability of the Perfume Compositions

In the incubator tests, the differences in discoloration were minor compared to the daylight tests. In the test performed with Composition "C," especially significant differences in discoloration were observed in the daylight tests. When distilled water was employed, extremely strong discoloration was identified in case of the Composition "D." It is interesting to note that the lotions employing tap water displayed the least discoloration. Those lotions which were produced with comparatively expensive distilled water, on the other hand, displayed very strong discoloration of the perfume compositions. In the tests that were conducted, the specimens that were tested in the incubator suffered less discoloration than those subjected to daylight. However, a basic negative trend can also be identified in the direction of distilled water.

GC Analysis

Following a storage period of three months and employing a perfume oil concentration of 4% in 85% ethanol by volume (with 15 vol. % water), plot comparisons of the Type "A" test specimens clearly displayed quantitative changes in the composition.

The GC plot of Composition "A" shows the maximum variance between the test specimen that was prepared with distilled water and the fresh comparison specimen (Figure 1), especially at the retention times around 16 minutes, as well as at the times around 26 and 28 minutes.

The gas chromatogram was produced through direct injection.

GC-Conditions, Packed Column 4m OV-101—Air flow: 250 ml/min; hydrogen flow: 25 ml/min; carrier gas flow (helium): 20 ml/min; stationary phase: mixture of SE30 and OV-101, 1:1; rate: 70-275°C, 3°C/min; final temp.: 25 min/275°C; injector temp.: 275°C; detector temp.: 275°C; injection volume: 0.8 µl (Autosampler); attenuator: 8; range amps/mv: 10^{-11}; *solution for Autosampler*—perfumoil: 700 µl + 500 µl aceton.

One of the reasons for the differing stability behavior of the perfume compositions in alcoholic lotions when different water purities are employed can be found in the buffering effects of the "mineral salts" that are contained in tap water. This fact alone offers good problem solutions for the future in handling those cases where it is not possible to employ tap water due to olfactory considerations for example.

Reference

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