

Adulteration in Rose oil

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Abstract

Being one of the most highly priced essential oils, rose oil¹ has been subjected to adulteration. Formerly adulteration was carried out in a somewhat crude way, by addition of palmarosa oil, guaiac wood oil and spermaceti – the latter to simulate a normal stearoptene content in the adulterated oil. Such conditions can be detected by careful analysis. Today, however, rose oil is often sophisticated in a very clever manner and the analyst may be faced with considerable difficulties in finding the adulterants. The adulterator now has to his disposal a number of natural isolates of lower priced essential oils. The most important of these are geraniol and rhodinol (*I*-citronellol). If added in moderate quantities, these compounds cannot be detected in rose oil by mere routine analysis. In such cases, the analyst will have to rely upon careful olfactory tests which require much training and experience on a thorough chemical examination of the suspected oil. This then needs to be analyzed on GC-MS for trace analysis of adulterants.

standard commercial rose oil are: specific gravity at 30° C, 0.849-0.865; optical rotation -1 to -5° C; refractive index (at 25° C) 1.452-1.466; congealing point 15-22; alcohols as geraniol, 63-84; citronellol/rhodinol, 24-64; stearoptene 7-25%; acid value 1.5-3.8; ester value 3.7-17.5.

Essential oils such as rose, sandalwood or eucalyptus are traded in excess than their production world over. Artificial oils are in constant use as components of a wide range of perfumes particularly synthetic rose oil. Adding synthetic chemical components, or in some cases low value natural oils, makes a tremendous change in pricing and volume. The price that these essential oils fetch in the market place makes a big profit to the adulterators of these oils. Some purchasers solely buy on the basis of aroma. Artificially rose oil is prepared in such a manner that the constituents should show 0.3 per cent of aldehyde and 15 per cent of stearoptene by the addition of palmarosa oil or citronellol or synthetic stearoptene to 50-80 per cent of steam distilled oil.

Adulterants detection devices

Gas chromatography is not a definitive tool for identification of purity of essential oils. This can be smartly manipulated by adulterator by choosing an adulterant which has similar chemical constituents. The retention time (RT) in the gas chromatographic technique and the optical rotation (OR) can be made to match by adding adulterants with similar values for RT and OR. It is in fact very difficult to differentiate the pure oil and the impure oil by merely these techniques.

Introduction

The genus **Rosa Linn.** (Rosaceae) is widely distributed in the temperate parts of the northern hemisphere and on tropical mountains. About 20 species and hundreds of varieties have been recorded in India in wild state and many have been introduced for cultivation as ornamentals. Mostly hybrid⁵ varieties exhibit a marked fragrance and are suitable for the extraction of Rose water and Rose oil (*attar*). The aroma referred to by perfumes as rose odour is found exclusively in the roses belonging to the so-called *Centifolia* group of family Rosaceae. Rose oil is light yellow in colour, when cooled it congeals to a translucent soft mass, having congealing point between 15 degrees and 22 degrees.

The composition of rose oil is not uniform⁶, the variation being due to a number of influences, the chief being the kind of flower and the place where it grows. The rose oil from plants grown in colder climates contain

a very high percentage of the waxy substance called stearoptene, which is odourless and value less as a perfume. Sometimes this stearoptene is removed by large distillers and the resulting oil is sold at a higher price. Geraniol and citronellol are the chief constituents of rose oil². Citronellol, a fragrant oily liquid, forms about 35 % of the oil. Geraniol, which may be present to about 75%, is a colourless liquid, with sweet rose like odour. It is largely obtained industrially from the oils of Palmarosa and Citronella and is used to adulterate rose oil. It is getting imperative to find out the adulterant in details and to show to the buyers the list of contaminants³.

The rose oil is observed to have the following chemical constituents: citronellol 24-64; geraniol 63-84; nerol 1-10; phenyl ethyl alcohol 0-1; esters of geraniol 0-3.5; eugenol 0-1; stearoptene 7-25; rose oxide 0.5; nerol oxide 0.05; methyl eugenol 2.0; farnesol 1.5; β -damascenone 0.015 per cent. And the recorded chemical and physical constants for



Essential oil should be subjected to both qualitative and quantitative testing for knowing the purity. Oils are tested in 4 stages—the first stage is sensory evaluation in which the viscosity, colour and clarity of the oil. Rose oil which appears too mobile at low temperature is a typical example of oil which would regard as very suspicious. Second stage is an odour test which helps to determine if an oil is really what it purports to be, since certain adulterants can be identified in this. In the next stage physical parameters are tested such as specific gravity, optical rotation and refractive index. After the successful passing through the above mentioned tests the oil is then put for GC-MS evaluation.

GC-MS is a more diagnostic tool⁴ as the mass fragmentation pattern will be different for different compounds even when they have the same RT and OR. The formulae appended contain only the vital constituents of each type and may be elaborated, and perhaps improved, by the use of other aromatics selected from the odour classification. All this is done primarily for reducing the cost factor, which depends largely upon the percentage of genuine oil employed. By mixing the natural oils with synthetic analogs, the resulting blend may have a similar aroma, however the cost based on the percentage of the adulterant would be proportionally lower.

The sensory properties of rose oil components have been studied by Ohloff on the basis of odour units. A satisfactory artificial rose oil cannot be obtained by the exclusive combination of aromatic chemicals, some of the natural oils must always enter the composition of any artificial rose oils, or a purely synthetic oil may be distilled over a certain quantity of rose petals⁷. A striking difference between synthetic and natural rose oils is that the former is almost entirely deodorized by iodine, while the latter is unaffected in this respect.

The principal adulterant is geraniol, addition of this as synthetic compound or in the form of palmarosa oil, which contains it, is either added to the rose petals at the time of distillation or to the final product, which reduces the congealing point. This can be brought up to standard value by addition of spermaceti. Another recent adulterant is guaiac wood oil⁸. This can be recognized as crystals of guaicol, which separate on cooling the oil when it is contaminated with it. Besides addition of guaiac wood oil also raises the congealing point and specific gravity of the rose oil. Addition of palmarosa oil or rose geranium is carried out very intelligently and thus is very difficult to detect.

Crude adulterations may be recognized by determining the following constants, such as specific gravity, optical rotation, congealing point and amount of stearoptene. The adulterant most commonly used at present is rhodinol, it has slight effect upon the rotation of rose oil. Nevertheless even this slight deviation may indicate addition of rhodinol to rose oil.

Other indispensable aromatics such as phenyl ethyl alcohol⁹ and its ester are also added. There are two other substances that are common to many rose compounds, they are trichlor phenyl methyl carbinyl acetate and ionone which contribute to the rosy character to the oil. Moreover, the intensification of rosy characteristic is facilitated by employment of small percentages of phenyl acetic aldehyde

and of undecylenic aldehyde, while an overall richness may be imparted by traces of eugenol or methyl eugenol. Duplication of the fragrance of white roses is a complicated problem, because although the overall perfume is characteristically rosy there is a deep and full background odour which can be matched by the judicious use of patchouli, santal and vanillin.

It is therefore, important to realize and to devise an effective method of quality control for ascertaining the purity of the rose oil, along with traceable protocols which can be audited periodically to ensure that adulteration has not taken place along the whole chain from the producer to the retailer. Even a price sealing is required to be made by the government to let the farmers get ample of financial gains for their product. This would eliminate the necessity of adulteration altogether.

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