A rose by any other name

'Fragrance or aroma chemicals' form a product area of great commercial significance in biotechnology. These compounds (not including flavour enhancers such as the ubiquitous monosodium glutamate) command an annual market of $2 000 million and are mainly, though not exclusively, used in the cosmetics, toiletry and detergent industries. Recently J. Schindler and R. D. Schmid of the Biotechnology Department at Henke GaA, Dusseldorf, have provided a brief and fascinating overview of the literature on fragrance production by microorganisms, together with a survey of some enzymatic transformations, including racemate resolution, of odoriferous terpenoid compounds[1].

In many cases, the chemical structures of the volatile organoleptics produced in the microbial cultures have been established, and Table I gives a selected listing of the variety of fragrances that may be emitted by microbial cultures[2]; where more than one fragrance is listed, the proportions of the various chemicals depend rather finely on the cultural conditions.

Often, agricultural or synthetic chemical production of particular fragrances may be more suitable than 'biotechnological' production, but the former is subject to seasonal fluctuations and the latter has the great disadvantage that it usually lacks stereoselectivity. For instance, the world demand for L-menthol (much used in confectionery and tobacco products) is approximately 3 000 tonnes per annum[2], and a variety of immobilized yeasts, or enzymes derived from them, have been used to effect the resolution of synthetic DL-menthol by stereospecific esterification or de-esterification reactions. Optical purities of 100% may be obtained, and methods have been described which include reactions on the 800 kg scale.

Owing to both the complexity of the synthetic pathways involved and the polynuclear structure of many of the organisms capable of producing fragrant chemicals, the more novel biotechnologies have so far made relatively little impact in this area; it is clear, as Schlindler and Schmid conclude[2], that 'microorganisms provide an interesting opportunity to improve on existing technologies of fragrance production'.

TABLE I. Some microbially produced fragrances of known chemical structure (modified from Ref. 1).

Microorganism	Fragrance	Chemical structures (some)
Ascoidea hylacoeti	Rose, fruity	β-Phenylethanol, furan-2-carboxylate
Ceratocystis moniliformis	Banana, peach, pear, rose	3-Methylbutylacetate, geraniol, citronellol, linalool, α-terpineol
Ceratocystis variospora	Geranium	Citronellol, geranial, geraniol
Inocybe corydalina	Jasmine, fruity	Cinnamic acid methyl ester
Penicillium decumbens	Pine, rose, apple, mushroom	3-Octanone, 1-octen-3-ol, β-phenylethanol
Sporoholomyces odorus	Peach	γ-Decalactone
Trametes odorata	Honey, rose, fruity, anise	Trans-1,10-dimethyl-trans-9-decalol 2-exo-hydroxy-2-methylbornane
Trichoderma viride	Coconut	6-Pentyl-2-pyrone

References

1 Schindler, J. and Schmid, R. D. (1982) *Process Biochem.* 17[5], 2–8
2 *Chem. Abs.* (1970) 73, 75662h

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