Stable isotope analysis

Clear evidence of **origin**

The continuing boom in bio-cosmetics is forcing companies to adopt new methods to determine the purity and source of their ingredients. Alongside the classic QA procedures, stable isotope analysis could, according to Dr. Markus Boner of Agroisolab, Jörg Lickfett of Authento Solutions and Michael Pfeiffer of Pfeiffer Consulting, in future represent a safe, certifiable QA method for determining the purity and origin of raw materials.

No longer a dream: identifying the origin of rose oil?

photo: Pixelquelle.de

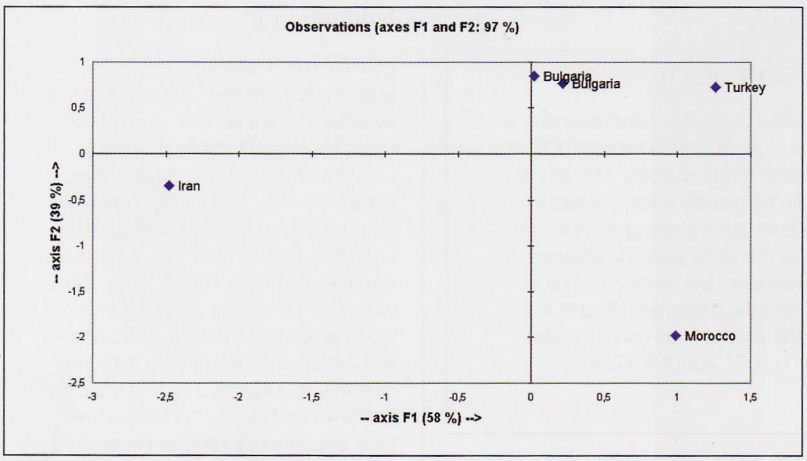
An extensive research project, now nearing its conclusion is being conducted to examine the extent to which stable isotope analysis can contribute to modern quality assurance procedures. Partners in the project are a well-known German manufacturer of natural cosmetics and member companies of the Bulgarian National Association for Essential Oils, Perfumery and Cosmetics (BNAEOPC). Stable isotope analysis is not simply a question of checking raw materials against new quality requirements, but also of analysing raw materials such as rose oil in order to be able to guarantee their high quality and purity worldwide. A further focus of the research is to be able to definitely distinguish organic products from conventional raw materials.

New ways of determining product origin

All living animals and plants consist of carbon, hydrogen, oxygen, nitrogen and sulphur. These bio-elements appear in various forms or isotopes. The radioactive carbon isotope C-14 is often used, for example, in archaeology to determine the age of natural objects. It differs from the normal carbon isotope C-12 in its mass, i.e. the heavier C-14 isotope holds two additional neutrons. These additional neutrons lead to an instability of the carbon and hence to a decay of its radioactivity. The carbon isotope C-13, which is present in all living things, has one extra neutron but does not decay. Such heavy, and stable, variants are also found in the other bio-elements. Because they occur naturally only in small quantities and react in exactly the same way chemically they have been the subject of relatively little attention. For 500 carbon isotopes of normal weight there will be only one C-13 isotope.

This tiny difference however plays an important part in determining origin and authenticity, because although the stable yet heavy variants of the bio-elements may occur everywhere, they occur in different quantities. For instance the water in Munich is differentiated by having less heavy sulphur isotopes than the water in Hamburg. Plants and animals growing in the two cities, and absorbing the water as part of their nutritional intake, reflect this same difference. They exhibit an unmistakable regional characteristic, rather like a fingerprint. The possibilities of using this phenomenon have been recognised for some time by the food industry. There is, for example, a European wine database that uses the heavy oxygen variants as evidence of origin and the possible use of additives in the water. In the food industry the use of stable isotope analysis to determine the source of raw materials is becoming more and more important.

Initial results have shown that this phenomenon can also be used in the analysis of raw materials for cosmetics products. It is possible, using heavy hydrogen, oxygen and carbon, to determine the origin of rose oil with meaningful results (see illustration). Even where the rose oils are chemically



Differentiating rose oil from various coutries using stable isotopes of the bio-elements

identical there are differences in the basic elements from which they are formed. Rose oils from plants contain differing amounts of the heavy bio-elements taken from their environment and depending on their point of origin.

If today, following the controversies surrounding the sale of spoiled meat and genetically modified soya, and intensive livestock farming, consumers are increasingly concerned about the origin, quality and authenticity of the products they buy, then stable isotope analysis can be a useful, verifiable and affordable quality assurance tool. ■

Michael Pfeiffer
Managing Director
Pfeiffer Consulting GmbH,
Pforzheim, Germany

Jörg Lickfett
Managing Director
Authento Solutions GmbH &
Co. KG, Lauenburg, Germany

Dr. Markus Boner
Managing Director
Agroisolab GmbH,
Jülich, Germany