

## Origin and Authenticity of Food



WATER

GEOTHERMAL ENERGY

TRACER TESTS

POLLUTANTS

FILTER TECHNIQUES

Food

RENEWABLE RESOURCES

ISOTOPES

GASES

SOLIDS

ANALYSIS

HYDROISOTOP GMBH  
Woelkestraße 9  
85301 Schweitenkirchen  
Germany

Tel. +49 (0)8444 / 92890  
Fax +49 (0)8444-928929  
eMail [info@hydroisotop.de](mailto:info@hydroisotop.de)  
Web: [www.hydroisotop.de](http://www.hydroisotop.de)

accredited according to DIN EN ISO/IEC 17025:2005

Isotopy & Chemistry in Environmental Hydrology & Food



## Food

### Origin and Authenticity

For several years, the determination of isotopes has been used to identify the origin and authenticity of food and food additives.

By using different isotope methods for the analysis of food, following conclusions can be drawn to:

- the geographical origin of food
- authenticity of food and food additives as well as the detection of non-declared additives or testing their nativeness
- consistency with statutory regulations or contract agreements

The analysis of isotopes is an effective, and in many cases, the solely method to identify adulteration of food.

In principle, isotope methods can be applied to any kind of food. Relevant products to which isotope methods have been applied, are

- wine, spirits, sparkling wine
- juice, fruits, vegetables, fruit products
- honey
- milk and milk products
- flavoring and natural food additives.



Due to our long-time experience in the field of authenticity tests of food as well as in other fields of fraud in the food market, we have a large data base available that can be used for comparison.

All isotope measurements are done following the standard specifications. In addition, we process the questions beyond the standards.

### WINE, SPIRITS AND SPARKLING WINE

Isotope methods allow to determine the origin and authenticity of alcoholics.

The analysis of isotopes are used in wine to

- determine the added sugar
- determine the added water
- determine the geographical origin
- determine the botanic origin of the alcohol
- specify the age

in spirits to

- specify the age
- identify the ethanol source material

in sparkling wine to

- determine the origin of the CO<sub>2</sub>

To identify **added sugar** from C3-plants (can sugar) the 2H-NMR-methods is used. In case, the sugar is made of C4-plants, the determination of the  $\delta^{13}\text{C}$ -value is more efficient because herewith very small amounts of sugar can be detected. Mixtures of sugar from C3- and C4-plants are specified by the determination of the  $\delta^{13}\text{C}$ -values and the 2H-NMR-values.

The **addition of water** is evaluated by the analysis of the oxygen isotope ratio.



To validate the **geographical origin** of wine, the isotope ratios of oxygen, hydrogen and carbon are used. For the evaluation, the analytical results are compared with isotope signatures from our data base. In ambiguous cases, the additional examination of the strontium isotope ratio can be helpful.

**Age dating** of wine or spirits can be done in individual cases by the use of the radioactive isotopes tritium ( $^3\text{H}$ ), carbon-14 ( $^{14}\text{C}$ ) or with nuclides originating from nuclear tests or facilities.

The **determination of the ethanol source material**, especially in spirits is conducted by the analysis of the  $^{13}\text{C}$ -content and the  $^2\text{H}$ -NMR-values of the ethanol. To identify synthetic ethanol, the content of  $^{14}\text{C}$  is determined.

To distinguish  $\text{CO}_2$  originating from alcoholic fermentation or from other origin, the  $\delta^{13}\text{C}$ -value and the  $^{14}\text{C}$ -content of the  $\text{CO}_2$  is evaluated.

### Inspection of regional origin

By using the multiple-elements isotope analysis on carbon, nitrogen and oxygen, as well as strontium, the labeled regional origin of food can be validated.



### FRUITS, VEGETABLES, JUICES, FRUIT PRODUCTS AND MILK PRODUCTS

The ratio of the stable isotopes of carbon, hydrogen and oxygen in fruits, vegetables and fruit juices as well as products made from both, is an important tool to determine the origin of the fruits and vegetables, and to evaluate their preprocessing.



### Evaluation of added sugar to citrus-, apple-, and pineapple juice

The analysis of the carbon isotopes allows the identification of

- added C4-sugar (e.g. cane sugar)
- added C3-sugar (e.g. beet sugar)

### Evaluation of addition of water

The addition of water to juices can be determined by the analysis of the stable isotopes of oxygen and hydrogen.

By evaluating the results, NFC juices and juices made from concentrate and blended with water can be distinguished.





### Identification of acidification

By the analysis of the carbon isotopes an additional acidification can be detected in the case of

- addition of citrus acid to juice made of citrus fruits, pineapple and currant
- addition of L-malic acid to apple juice and sour cherry juice
- addition of L-ascorbic acid to juice made of citrus fruits, pineapple and currant

### HONEY

#### Authenticity

Adulterations of honey can be detected by isotopic analyses.

Prevalent adulterations involve

- the declaration of origin
- type of honey
- added fruit syrup

The classical analysis of pollen can be applied to validate the origin. But only the determination of the carbon isotopes from sugars and proteins allows to identify adulterations of honey.



#### Added sugar

By the analysis of the carbon isotope ratio of the sugar and protein of honey, the addition of sugar made from C4-plants (corn or cane) can be detected and quantified.

Sugar and protein of a honey should originate from the identical raw material. Independent from the feed of the bees (orange blooms, acacia or other blooms), the relation between the carbon isotope ratios of protein and sugar is constant. If cane sugar or corn-based sugar is added to the honey, the isotope ratio of sugar is shifted and the adulteration of honey can be identified.

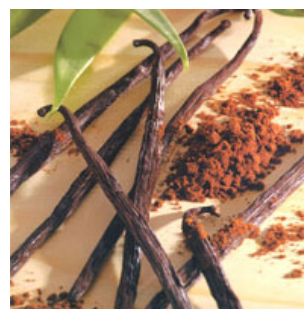
### FLAVORING UND NATÜRLICHE ZUSATZSTOFFE

#### Identification of formation

By analysing isotopes, natural, natural-identical and synthetic flavors can be distinguished. Furthermore, their fermentational production can be identified.

Prevalent substances that have been analysed :

- vanillin
- bitter almond flavor
- fruit flavors, especially aliphatic compounds,



### HYDROISOTOP GMBH

Wolkestraße 9  
85301 Schweitenkirchen  
Tel. +49 (0)8444 / 92890  
Fax +49 (0)8444-928929  
eMail [info@hydroisotop.de](mailto:info@hydroisotop.de)  
Web: [www.hydroisotop.de](http://www.hydroisotop.de)