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# Alcohol Consumption or Contamination: A Preliminary Study on the Determination of the Ethanol Origin by Stable Carbon Isotope Analysis

Hang Chen, Baohua Shen, Sujing Zhang, Ping Xiang, Xianyi Zhuo, Min Shen\*<sup>1</sup>

*Academy of Forensic Science, P.R.China, Shanghai 200063, China*

## Highlights

- The stable isotope analysis technique was applied to the analysis of alcohol in body fluids in medico-legal cases.
- There was a significant difference in the carbon isotopic characteristics between edible alcohol and non-edible alcohol.
- The  $\delta^{13}\text{C}$  values of ethanol may be useful indicators to determine origin determination of alcohol in biological samples

First author: Hang Chen: chenhang@ssfjd.cn

CONTACT: Min Shen: Shenm@ssfjd.cn

## Abstract

The origin of ethanol detected in bio-samples whether it be from the consumption of alcoholic beverages or contamination with disinfectants has been questioned in court cases in China recently. The stable carbon isotope naturally occurs in carbon-containing compounds and can help determine the origin of the compound in question. In total, 42 types of beers and 11 types of disinfectants were analyzed by gas chromatography-isotope ratio mass spectrometry. Consumption and contamination experiments were carried out with 6 volunteers. The  $\delta^{13}\text{C}$  values of ethanol ranged from -29.51 ‰ to -18.36 ‰ for the beer samples, which reflected the botanical features of C3 plants or mixtures of C3 and C4 plants. The  $\delta^{13}\text{C}$  values of ethanol ranged from -17.7 ‰ to -14.4 ‰ for disinfectants, which reflected the different origins of ethanol in disinfectants from those in beer. The  $\delta^{13}\text{C}$  value did not change in vivo after being consumed within the time limit used in this study. These characteristics of the  $\delta^{13}\text{C}$  values will facilitate to interpret whether the ethanol detected in bio-samples originated from consumption or contamination.

## Keywords

$\delta^{13}\text{C}$  values; Ethanol; Origin; Consumption; Contamination; Isotope ratio mass spectrometry

## 1. Introduction

The origin of ethanol may be the key piece of information to define an alcohol-related case. Ethanol content is the most commonly requested analysis in forensic toxicology laboratories [1], including in cases of violence, sexual assault, motor vehicle accidents and other alcohol-related

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