



## **Detection of Counterfeit Scotch Whisky by ${}^2\text{H}$ and ${}^{18}\text{O}$ Stable Isotope Analysis to Determine Provenance.**

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Every year the European Union (EU) produces in excess of 4.2 billion litres of spirit drinks, with EU consumers spending  $\sim$  30 billion Euros on these drinks annually (CEPS, 2010) and generating over 13 billion Euros in tax revenue. Scotch whisky generated £.1 billion for the UK balance of trade in 2008, was exported to over 200 countries and supports 65,000 jobs, many in rural areas [1]. However, the EU Liquor Association estimates that 25% of all European spirit brands sold in both China and the EU are counterfeit [2].

Attempts have been made to compare congeners (flavour compounds) to distinguish genuine and counterfeit whisky [3]. This method relies on a database of reference values and crucially that specific whiskies have a consistent congener concentration range. Here, we present a study of  ${}^2\text{H}$  and  ${}^{18}\text{O}$  stable isotope signatures of neat spirits, as a proxy for geographic provenance and thus as an exclusion criterion for authenticity. A two-dimensional stable isotope plot of counterfeit and genuine Scotch whisky analyzed blinded as well as the corresponding Principal Component Analysis show the potential of this method to quickly detect counterfeit Scotch whisky originating from geographically diverse regions.

[1] SWA. 2008. Scotch at a Glance.

[2] CEPS. 2010. The European Spirits Organisation. <http://www.europeanspirits.org/>

[3] Aylott R I, Clyne A H, Fox A P and Walker D A. 1994. Analytical strategies to confirm Scotch whisky authenticity. *Analyst*, 119:1741-1746