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Neutron activation analysis for assessment of beef origin

Consumer confidence in beef has been hampered by epidemics such as bovine spongiform encephalopathy (BSE) and foot and mouth disease (FMD). Legislation has increased restrictions on beef trade worldwide. For example, the beef trade in the European Union requires traceability throughout the supply chain, allowing the consumers to be aware of the origin of meat available in the market. Nevertheless, the traceability is usually based on labeling and information technology, rather than on intrinsic characteristics of the meat. Analytical methods determining essential and non-essential chemical elements are potential tools to establish the geographical origin of meat, since certain regions may provide specific fingerprints, especially for trace elements. Here, instrumental neutron activation analysis (INAA) was used to assess the origin of beef produced in 3 different countries. For this evaluation, 85 samples of top sirloin were acquired from the local market of Piracicaba, including meat from North, Southeast and South regions of Brazil, in the states of Pará, Minas Gerais and Rio Grande do Sul, as well as from Argentina and Australia. The meat samples were minced in a knife mill, freeze-dried and ground in a ball mill. Analytical portions of approximately 300 mg were weighed into high purity polyethylene vials and irradiated in a thermal neutron flux of $10^{13} \text{ cm}^{-2} \text{ s}^{-1}$, followed by four measurements of induced radioactivity by HPGe detectors. For quality control, reference material NIST RM 8414 Bovine Muscle Powder and IAEA A11 Trace Elements in Milk Powder were analyzed. The k_0 -method was used to provide results for seven chemical elements, i.e. Br, Cs, Fe, K, Na, Rb and Zn. Four elements (Fe, K, Na and Zn) presented low variability among the meat samples analyzed, despite the different origins. Br, Cs and Rb showed a greater variability and a good potential to be used as indicators of origin. However, further studies with a more comprehensive sampling are needed to fully demonstrate this assumption. Moreover, additional chemical elements should be investigated to improve the applicability and the confidence of the proposed methodology for assessment of beef origin.

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