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Novel sample preparation approach to investigate C-14 from iron material

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In this study, we present a novel approach for C-14 analyses of iron material.

C-14 contamination of iron material could happen in nuclear reactors, where the neutron flux could produce significant amount of C-14 atoms inside the iron based construction elements (vessel wall, tubes, etc). If those elements are going to be disposed in waste, than the C-14 concentration should be measured, reported. On the other hand, artefacts made from wrought iron, could also incorporate some C content from the applied heating material (charcoal, wood), which also deliver a measureble C-14 content into the iron. This C and C-14 might allow the C-14 based dating of the production of the iron tool.

For all the above listed applications, we need a good sample preparation method, to extract the C from the iron, without any external contamination. As the typical concentration is maximum a few percent C in the iron (m/m%), a complete combustion/oxidation of 0.1 - 1 g iron for this purpose is necessary. We present an elegant way of this preparation, using a LECO C744 type iron - C analyser. The exhaust gas of this automatized oxidizer is applied for trapping the produced CO₂, for further isotope analyses. About 1g of iron is completely oxidized within 1 minute by the C744 unit, and the exhaust gas is collected. C yield, and reproducibility of this preparation method is investigated by AMS C-14 analyses of known age iron artefacts, and several C-14 reference materials.

This method could play a major role, when nuclear power plants are decommissioned and huge amount of iron waste has to be classified according their C-14 isotope content.

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