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UNDERSTANDING THE PERTECHNETATE COMPLEXATION ON ENGINEERED BIOCHAR FOR ITS DETERMINATION BY AMS

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^{99}Tc (T1/2 = 2.1·10^{5} y) is an abundant product of the nuclear fuel cycle which is lying at the low-mass peak in the ^{235}U fission fragment spectrum. ^{99}Tc accounts for 6.1% of the fission product mass in (^{235}U-enriched) nuclear fuels following burn-up in a reactor. In the environment, Tc also occurs due to nuclear bombs atmospheric testing and nuclear medicine. Tc is taken up by several plant species. Lichens and mosses retain technetium from airborne emissions, algae and seaweeds accumulate Tc from sea waters. TcO_4^- is the most common and the most environmentally mobile chemical species of Tc. Concentrations of Tc in the environment may vary depending on various factors (pH, microbial activity, amount of precipitations etc.).
Many measurements of ^{99}Tc in the environment have been published which provide points of reference. These methods include decay counting, radiochemical neutron activation analysis, inductively coupled plasma mass spectrometry, thermal ionization mass spectrometry, laser resonance ionization mass spectrometry, and accelerator mass spectrometry (AMS). The most sensitive method is the AMS. However, the detection of ^{99}Tc represents some challenges. The most significant is the lack of stable isotope. Re as a chemical analog of Tc could be added in the sample preparation to act as a chemical carrier. A second difficulty is the stable isobar ^{99}Ru.
A solid sample must be prepared for AMS measurement. The Tc obtained in solution is then chemically converted to a solid phase, the target matrix. There are currently several general approaches for TcO_4^- immobilization from waste such as evaporation, extraction-chromatographic methods, sorption onto carbon-based materials, and their modified forms, i.e. biochar, etc. A sorption is an effective approach to TcO_4^- sequestration because it is a simple, convenient, and economical in its own process.
In this study we focused on the description of the interactions of pertechnetate and biochar using potentiometric titrations. The data were fitted with the surface-complexation model which includes multi-dimensional non-linear regression procedure. As the results show the main sorption mechanism of TcO_4^- on biochar surface is the ion exchange and chemical bonding.

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