



Canadian Association
of Physicists

Association canadienne
des physiciens et physiciennes

Contribution ID: 100

Type: Oral (Non-Student) / Orale (non-étudiant(e))

Measurement of elements in toenail clippings using portable X-ray fluorescence

Wednesday 9 June 2021 16:20 (5 minutes)

The analysis of human nail clippings to determine the concentration of certain elements of interest is now fairly common. Results can be used to assess exposure to various elements and their absorption into the body. When nail clippings are used as a biomarker in this way, they are typically analyzed by a method such as inductively coupled plasma-mass spectrometry (ICP-MS) or instrumental neutron activation analysis. Our group has recently explored the use of a portable X-ray fluorescence (pXRF) technique as an alternative approach to assessing elements within nail clippings. The pXRF method allows rapid measurement using a single nail clipping. We report on results from single toenail clippings from 60 individuals living in Atlantic Canada. Samples were obtained through the Atlantic PATH initiative, part of the Canadian Partnership for Tomorrow's Health. Energy spectra resulting from irradiation of the clippings were analyzed for characteristic X-rays from zinc, arsenic, and other elements. Following non-destructive assessment by pXRF, the clippings were measured for elemental concentrations using ICP-MS. Results will be presented from the pXRF detection of zinc and arsenic in the clippings, and correlations examined between the pXRF and ICP-MS measurements. Overall, the results suggest that pXRF is a sensitive and accurate method when used with a single nail clipping. Limitations and challenges relating to the pXRF technique will also be reviewed.

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Session Classification: W3-4 Molecular and Cellular Biophysics (DPMB) / Biophysique moléculaire et biophysique cellulaire (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)