

Elemental analysis of nasolacrimal duct tissue using Total reflection X-Ray Fluorescence spectroscopy

Gabriella Mankovskii ^{1*}, Andrej Gvozdić ¹, David Howarth ² and Ana Pejović-Milić ¹

¹ *Department of Physics, Faculty of Science, Ryerson University, 350 Victoria Street, Toronto, Ontario, M5B 2K3, Canada*

² *Pathology and Lab Medicine, Mount Sinai Hospital, 600 University Avenue, Toronto, Ontario, M5G 1X5 Canada*

*[*gmandovskii@ryerson.ca](mailto:gmandovskii@ryerson.ca)*

The application of cosmetics is a common routine for many women. These cosmetics may contain elements that can be harmful to the health of the user. In particular, with eye cosmetics, there is a potential for the harmful elements to accumulate in the tissue surrounding the eye. We propose the use of Total Reflection X-ray fluorescence (TXRF) to evaluate the presence of these elements and examine possible correlation with the health of the eye. TXRF is a spectroscopic analytical tool that uses the unique characteristic x-ray fingerprint of each element to identify and quantify elemental make up of samples. It is a sensitive and powerful tool that is capable of detecting amounts of sample as little as nanogram.

In this work, we developed a TXRF-based evaluation of eye tissues for possible absorption of cosmetic products. We investigated sample preparation of tissue and several cosmetic products such as mascara, eye shadow and eyeliner. Chicken breast sections were utilized in method development to mimic eye tissues. All measurements were performed using a commercial TXRF spectrometer (S2 PicoFox, Bruker-AXS, USA) coupled to a molybdenum target X-ray tube and SDD detection system. A dacryocystorhinostomy procedure was performed to collect nasolacrimal duct tissue from patients. Tissues were then analyzed with TXRF to assess the presence of cosmetic elements. Cosmetic products commonly used by the patients were also analyzed by TXRF to compare the composition of elements in the tissue and cosmetics, to determine the elements potentially absorbed by the tissue from cosmetic's exposure.