Abstract

Platinum group metals (PGMs), *i.e.*, Pd, Pt and Rh, are found at pollutant levels in the environment. PGMs accumulate in plant and animal tissues, and little is known about their toxicity. Our previous studies have shown that chick embryos exposed to 1.0 mL PGM solutions of 5.0 ppm (LD$_{50}$) and higher exhibited severe skeletal deformities. This work hypothesized that 1.0 ppm sublethal doses of PGMs would negatively impact the mineralization process in tibiotarsi. One milliliter of 1.0 ppm of Pd(II), Pt(IV), Rh(III) aqueous salt solutions and a PGM-mixture were injected into the air sac of the eggs on the 7$^{th}$ and 14$^{th}$ day of incubation. Control groups were also included. On the 20$^{th}$ day, embryos were sacrificed to analyze the PGM effects on tibiotarsi using micro-Raman imaging. Hyperspectral data analysis was performed using custom-written MatLab codes. The univariate Raman images that were created from the $v_1$(PO$_4^{3-}$) integrated areas of hydroxyapatite revealed anomalous mineral inclusions within the bone marrow cavity for the PGM-mixture treatment, and explained the observed pathological changes. The age of the mineral crystals ($v$(CO$_3^{2-}$)/$v_1$(PO$_4^{3-}$)) was found to be statistically lower for all treatments when compared to controls ($p \leq 0.05$). The abnormal mineral distribution and the younger tibiotarsi may be explained by a delay in the endochondral ossification process as a result of PGM exposure.