Distribution and Speciation of Arsenic in Poultry Particulate Emissions

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The use of organo-arsenicals such as roxarsone in poultry production is quite common. These compounds are primarily used as anticoccidials, as growth promoters, and to increase feed efficiency. Such usage has raised a variety of environmental concerns such as the accumulation of arsenic in poultry excrement and the release of arsenic into air, soil and water resources. Confined animal feeding operations (CAFOs), such as broiler poultry houses, are sources for airborne particulate matter (PM) emissions and have become major environmental and human health concerns. Many growers and their families are the primary operators of these CAFO facilities, and can spend anywhere from 25-45 hours per week working on the farm. Farm workers who average as little as two hours per day inside of a CAFO may develop acute and chronic respiratory diseases associated with the long term exposure to the particulate matter. Studies have indicated that there is a presence of toxic metals and metalloids, such as arsenic found in the poultry litter; however, it is not well known whether the re-suspended PM from these poultry houses carries such toxic contaminants, which could be harmful to human health. This presentation will focus on the chemistry and metal(loid) speciation of airborne emissions of both $PM_{2,5}$ and PM_{10} from confined broiler operations. The samples were analyzed using traditional wet chemistry techniques, such as inductively coupled plasma-mass spectrometry (ICP-MS) to determine total heavy metal and metalloid concentrations. More advanced, state-of-the-art, synchrotron-based spectroscopic and microscopic techniques, such as SEM-EDX were applied to determine arsenic and other metal speciation and distribution, and thus shed light on the potential toxicity. The results of this research suggest that arsenic concentrations vary depending upon location, size fraction, and period of growout cycle. In addition, u-XANES results suggest that the arsenic present in both PM_{10} and $PM_{2.5}$ fractions can be in organic and inorganic forms, and is widely distributed across the filtered samples of the particulate matter.

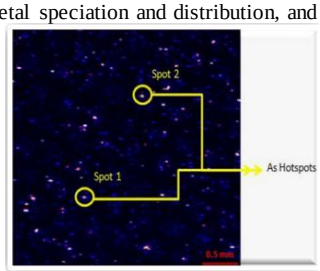

Figure: 3mm x 3mm micro X-ray fluorescence (m-XRF) map of As from a PM10 sample. The bright "hot" spots indicate an area where there is higher intensity of As present.