H5 An Analysis of Skin Potential Hydrogen (pH) and Oxidation-Reduction Potential (Eh) on Decomposing Swine Carcasses

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After attending this presentation, attendees will understand that the pH and Eh of swine (*Sus scrofa domesticus*) skin carcasses changes after death.

This presentation will impact the forensic science community by informing attendees of a significant negative correlation that was observed between Postmortem Interval (PMI) and skin pH. This relationship may be used to estimate PMI in medicolegal death investigations, following additional research.

It is well established that the decomposition of human remains is associated with significant chemical changes. For example, soils associated with decomposing remains tend to go through significant pH shifts during decomposition; however, one area that has yet to be explored is the chemical changes of skin during decomposition. Skin is advantageous as physical evidence because it is easily accessible, can be analyzed at the death scene, and can be analyzed non-invasively. The goal of the current study was to analyze the pH and Eh during decomposition to test the hypothesis that these chemical parameters are significantly correlated with PMI. If so, this relationship could provide an investigative tool of a regularly encountered occurrence during medicolegal death investigation.

Three swine carcasses (*Sus scrofa domesticus*), killed via stab wound through the neck, were decomposed on the soil of a tropical savanna ecosystem in Palolo Valley, Oahu, HI, from February 2016 to April 2016. The pH and Eh of carcass skin were collected using a portable meter (Extech® PH100 pH Meter, Extech® RE300 ORP Meter) twice per day (morning and evening) until larval mass migration (eight days postmortem), at which time measurements were collected once per day. Measurements were then collected once per week from 36 days postmortem through 71 days postmortem. Data were analyzed using Prism® 7.0a for Mac® OS X. The relationship between pH, Eh, and postmortem interval was analyzed using Pearson's correlation coefficient.

Skin pH was neutral (7.0 ± 0.2) at the time of carcass placement and gradually became more acidic until 71 days postmortem, at which time it equaled 4.5 ± 0.2. This decrease was relatively consistent with some variation observed on days of increased relative humidity and rainfall. Postmortem skin pH was significantly ($P < 0.001$; $R^2 = 0.427$) negatively correlated to PMI where y = -0.0256x + 6.62. In contrast, postmortem skin Eh was not significantly ($P = 0.949$; $^{R2} < 0.001$) correlated to PMI. Skin Eh indicated an oxygenated environment at the time of carcass placement (111 milliVolts ± 3 milliVolts), which persisted until 14 days postmortem. After this time, Eh was consistently negative until day 24, which indicates an environment low in oxygen where metabolic processes are primarily anaerobic. After this time, skin Eh was consistently positive until the end of the experiment.

This study is beneficial to the forensic community because it may lead to an innovative method to estimate PMI. Better understanding of the correlation of skin pH to PMI may lead to accurate estimates of PMI that are rapid, non-invasive, and inexpensive; however, this potential application requires much more research since, according to research, the current study is the first of its kind.

Taphonomy, Skin Chemistry, Postmortem Interval