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Subject: Email report-CEN19LA049 (Unknown material) Sioux Falls, SD
Date: Wednesday, March 18, 2020 10:17:09 AM

Jennifer,

An unknown material was found in the cheek area and stomach of a zoological sample found on scene. The sample retrieval was performed by a zoologist at the Smithsonian Institute. These two bulk samples of the material were then submitted to the Materials Laboratory for examination. The material from both samples consisted of a mixture of brown, tan and off-white fibers with a few brown particulates trapped within the fibers. Representative samples of the fibrous material and particulates were selected from the bulk samples. These samples were examined using a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance to ASTM E1252-98 (2013) (American Society for Testing Materials E1252-98: *Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis*). The spectrometer was used to collect and process infrared wavelength absorbance spectra of the unknown material(s).

The spectra from all sources (fibrous and particulate) were found to match indicating that these materials were all the same. These spectra contained spectral peaks that corresponded to particular functional groups found within the molecular structure of the material. The presence of a large, broad peak at $\sim 3300\text{cm}^{-1}$ is indicative of an oxygen-hydrogen (O-H) bond as well as a carbon-hydrogen (C-H) stretching bond in aromatics. A doublet peak at $\sim 2920\text{cm}^{-1}$ and $\sim 2853\text{cm}^{-1}$ corresponds to a carbon-hydrogen stretching bond. A peak at $\sim 1730\text{cm}^{-1}$ is indicative of a double bonded carbon-oxygen stretching bond. Two peaks at $\sim 1600\text{cm}^{-1}$ and $\sim 1500\text{cm}^{-1}$ are indicative of a double bonded carbon (C=C) stretching bond. A single peak at $\sim 1430\text{cm}^{-1}$ is indicative of a methyl (carbon-hydrogen₂) group bending bond. A single peak at $\sim 1234\text{cm}^{-1}$ is indicative of a carbon-oxygen rocking bond. A single peak at $\sim 1140\text{cm}^{-1}$ is indicative of a carbon-oxygen-carbon symmetrical stretching bond. A single peak at $\sim 1020\text{cm}^{-1}$ is indicative of a carbon-oxygen-carbon asymmetrical stretching bond. This pattern of peaks indicates that the unknown material is carbonyl (possibly a carbohydrate) and phenolic based. A spectral library search was done on a representative spectrum and it was found to be a very strong match to cellulose, hemicellulose, and lignins consistent with wood. The spectra were then compared to the spectrum of a known sample of pine wood. All spectra were matches indicating that the unknown materials in both bulk samples were wood. This was verified visually by the examiner.

If you have any questions, please let me know.

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Chemist

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