Investigation process of crime scenes biology essay

Science, Biology

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\n[/toc]\n \nIn spite of all these parameters hair has gained wide interest of clinical researchers to distinguish and identifying dermatological problems so far. The involvement of hair as evidences in crime scenes and its wide acceptance in courtroom has gained more focus of forensic researchers. During forensic examinations, in current years varieties of non distractive techniques are available and have been emerged due to their accuracy and non destructive nature. Microscopic examination and other destructive techniques like SEM, ICPMS, GCMS, and DNA analysis have observed strong discrimination and established clear identification of species from hair examination but it has made hair unavailable for further identification, provides results in longer durations, and is not cost effective. Other basic techniques including traditional light, stereo microscopy, and morphological examination found to be failed in species identification and also requires specialized expert. So keeping this in mind an attempt has been done to establish identification parameters in alpha-keratin structure vibration spectrum for three domestic animal species from bovidae family i. e. Cow, Goat and Buffalo using horizontal- attenuated total-reflection furrier transform infrared (HATR FTIR) Spectroscopy. The analysis of the α-keratin in

hair using HATR FTIR provides robust method of identifying species of the origin of the hair samples among all the three species studied in current research.

Structure of Hair Keratin and its Biochemistry

Keratin, are a wide class of fibres of proteins including hair, feather, wool etc. (Lehninger 1982), which are found in two different classes i. e. α-keratin and β-keratin. These keratins are fundamentally composed of condensation of α-amino acids, and are linked in planes by electro-covalent salt linkage and by covalent cystine linkages between hydrogen bonds. Keratin fibres are not uniform and can be differentiated in two different types, amorphous and crystalline. Only α-keratins are found in mammals and in reptiles and birds both α and β- keratins are produced. (Alexander and porrkal 1969, espinzo et al, 2008). During current study spectroscopic analysis has done to investigate the structural spectra differences of α-keratin between goat, cow and buffalo tail hairs which are structurally identified by their α-helix structure.

Infrared (IR) Spectroscopy

Various forms of IR Spectroscopy have been used to identify keratin structure since past decades. IR spectroscopy has now gained wide focus in forensic examinations of powder, salts as well as biological sample analysis. Spectroscopic techniques have become the technique of the choice for rapid investigation due to its speedy analysis, non destructive nature of test, Cost effectiveness and accuracy along with reproducibility of the results. The resolution of HATR FTIR has been used in various field of forensic fibre

identification for various parameters, bacterial identification, gun shoot residue etc. Discrimination analysis of the vibration spectra has been successfully extended the limits of inherantness in vibration data. Discrimination analyses to spectroscopic examinations have been reviewed for various forensic and biological materials by espinzoa et al in 2007. In present study we present our results regarding differentiation of the hair keratin structure of cow, goat and buffalo using HATR FTIR, followed by discriminant analysis. The discrimination method proved its application in identification of cow, goat and buffalo by keratin's spectroscopic analysis from hair samples found at crime scene and hair can further be used after FTIR for other destructive and non-destructive techniques including EDXRF, EDS, SEM, ICPMS, and GCMS etc. Further EDXRF elemental analysis of the surface and bonded hair-metals have also provided significant results in identification of geographical regions.(authors unpublished data).

Materials and Methods

A Bruker Tansor 27 FTIR (Opus version 7. 0 Software) with a Miracle HATR Accessory (Pike technologies) was used for the present study and in developing a population database for measuring and comparing the spectral properties of cow, buffalo and Goat. The HATR Miracle accessory enclosed with a Gladiators – Highest Performance Diamond single reflection attenuated total reflection (ATR) Plate with sampling diameter of 2 mm. After routine instrument start up and humidity check calibration of the instrument was done followed by a routine cleaning of the ATR Accessory. All samples were placed in south-north direction and taken in plane with the probe, to

avoid unwanted spectra and differences in parameters of spectral reading differences because of sample placement (Pike Technologies 2010). The micrometer associated with the Smart MIRacle HATR accessory is having a straight-edged metal attachment of tip and the spectral differences of each sample has been recorded after a pressure of approx 800 psi (55 bar) of pressure. The Bruker spectrometer is fitted with a deuterated triglycine sulfate (DTGS) detector along with a (Potassium Bromide) KBr window. The spectra gives best results when the diameter of the sampling window i. e. 2 mm for the current experimental setup was fully covered by the samples of hair, but when a single hair will cover at least 25% of the sample holding window will also provide reliable data (hair diameter ~0. 5 mm). Standard body and tail hair (collected specimens of known species origin) were investigated from the collection and reference repository of Wildlife Forensic Biotechnology Research Laboratory, Institute of Forensic Sciences, Directorate of Forensic Science Gujarat State Campus INDIA. 90 samples from each of two species of cow goat and buffalo from three different regions have been investigated. To remove the contamination due to urine and feces, the hair samples were washed in distilled water. Samples were then sonicated for 10 min in 70% ethanol followed by a 10 min isopropyl alcohol wash. The hairs have been dried at room temperature followed by microwave drying for 30 s before analysis to regulate potentially inconsistent humidity levels in the samples. Spectral collected works parameters have been optimized to generate high spectral precision (Kirk bride & Tungol 1999). The samples were scanned 60 times under auto mode gain control as 60 scans of a single location were averaged for each spectrum. The

concluding setup of the spectral analysis was log (1/R) vs. wave number (cm–1) through a spectrum ranging from 4000 to 840 cm–1. No correction or editing has been done on the produced spectrum of the samples. The log (1/R) for reflection measurements is corresponding to absorbance in transmission dimensions. A setting blank/background spectrum has taken before each sample before analysis.

Results and Discussion