Instrumental Characterization of Bull's (Red Bororo) Bloodmeal from its Fresh Sample

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***Abstract*—** *The chloro compound, Ethene, Amine, Carbonyl compound, cyanide and methylene compounds were assigned 889.9796 cm^{-1}, 1401.735 cm^{-1}, 1627.371 cm^{-1}, 2208.360 cm^{-1}, 2445.666 cm^{-1} and 2600.767 cm^{-1} respectively. Methylene has a weak band, making it less prominent in Bull's bloodmeal. The fresh blood and dried blood of a red Bororo male cattle was subjected to infra-red spectroscopy at Spring board laboratory, Awka, Anambra State, Nigeria. The interactive effects due to the functional groups during drying were responsible for the changes observed in the spectra. It can be deduced that the dried sample has a more stable and sharper bands than those of the fresh sample. The infra-red spectrum of the bloodmeal consists of several peaks. At the region of N-H stretches, the peak looks like a cow udder, confirming the presence of primary amine.*

Keywords*— *Blood, Bloodmeal, Amine, Amino acid, Protein, Functional group, Peak.

I. INTRODUCTION

Bloodmeal is a dry inert powder used as a high protein livestock feed. Bloodmeal contains fat, fibre, ash etc. It also contains lysine, calcium, isoleucine, phosphorus and Methionine. It is imperative to note that the notable feature of raw blood is its high content of moisture. Food materials with high moisture content are liable to deteriorate easily. Raw blood must be processed before being incorporated into animal feeds. Blood from animals has recorded widespread applications especially in the food industry. Blood has been used as emulsifiers, to make blood sausages, blood curd, bread and blood pudding, blood cake and biscuits (Hsieh and Ofori, 2011 and Damba, 2017). As a result of limitation on blood applicability in the food industry from consumers, cultural and religious perceptions, blood has found applications in other industrial applications (Damba, 2017). These applications include animal feed as supplement and dietary enricher, food industry as emulsifier and thickener, fertilizers as pH stabilizer and seed coating, laboratory as culture media and protein source, medical, pharmaceutics as cosmetics and industry as adhesive, insecticide coadjutant, plastic additive, etc. (Davila Ribot, 2007).

Due to the scarcity of protein feedstocks in animal feeds formulation, Bloodmeal adoption, in the formulation of livestock feeds, as a protein source becomes highly imperative. This is majorly because of the availability of blood from abattoirs that can easily be dried. Donkoh *et al*, (1999) posits that the re-appraisal of optimum inclusion rate, and a recognition that balanced amino acid can improve livestock performance. Amine-group-containing species are amino acids and their polymers. The chemistry of amino acid side chains is critical to protein structure. Proteins are large biological molecules made up of long chains of smaller molecules called amino acids. Amino acids are organic molecules that contain an amine functional group ($-NH_2$), a carboxylic acid (-COOH). The presence of amines in bloodmeal makes bloodmeal a high protein animal feedstock.

II. FRESH BULL BLOOD SAMPLE CHARACTERIZATION

The plot of the Fourier transform infra-red spectroscopy of the fresh sample of the cow blood is presented in Fig. 1.

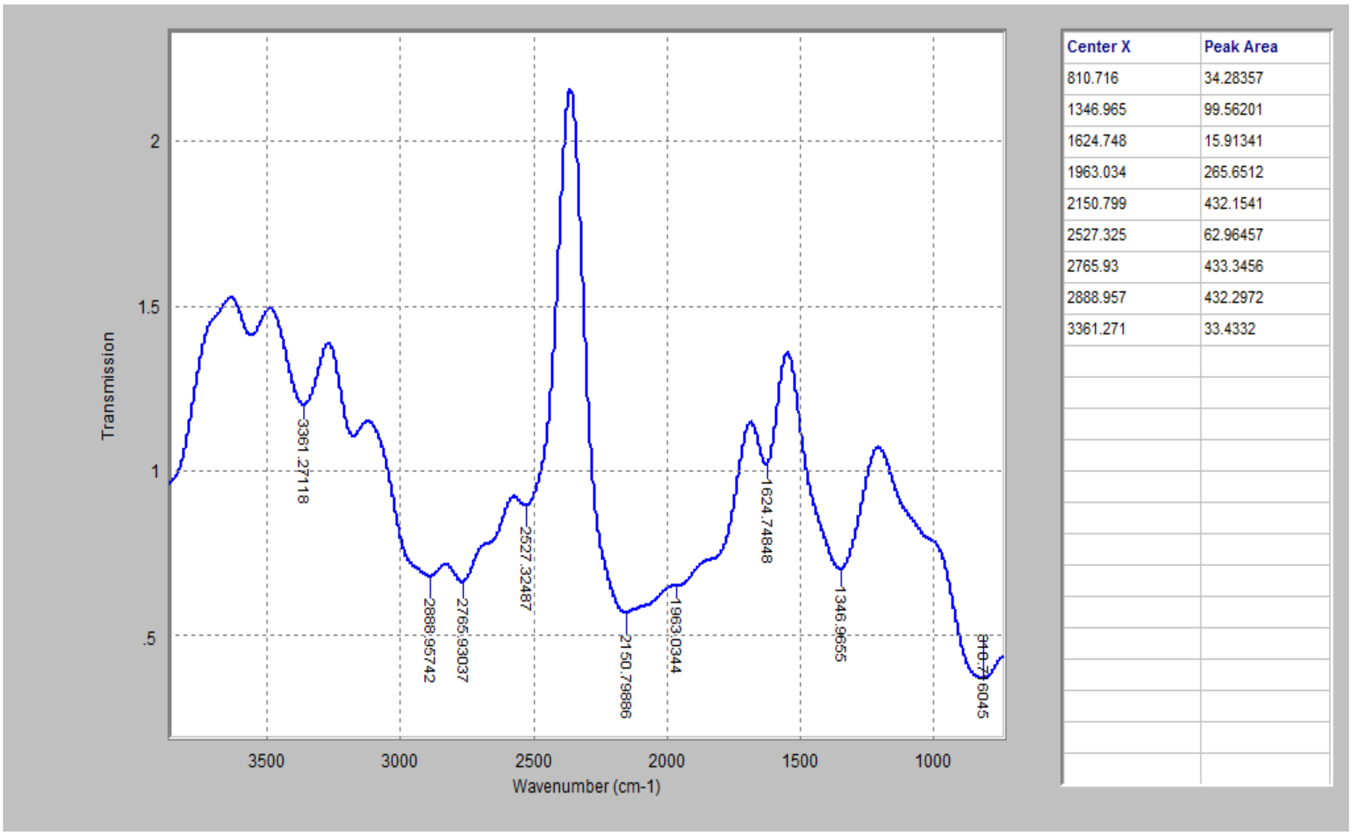

FIGURE 1: FTIR spectrum of fresh cow blood.

Fig.1 shows plots of infra-red transmittance against wave number for fresh cow blood. The Fourier Transform Infra-Red spectra presented were obtained to consider the possible outcome of the interaction between the functional groups. Functional groups were assigned to distinct peaks as shown in the figure.

From Fig.1 representing the fresh cow blood sample, the peak of 816.716cm^{-1} was assigned to C-CI stretching vibration of Chloro compound. The absorbance of 1348.966cm^{-1} was assigned C=C stretching vibration of ethene compound. The medium band at 1624.746cm^{-1} was assigned to NH stretching vibration of 1^{o} amine compound. The wavelength around 1963.034cm^{-1} was assigned to SCN anti-symmetric stretching vibration of thiocyanate compound. The absorbance around 2150.799cm^{-1} was assigned to CO stretching vibration of carboxylic acid. The peak around 2527.325cm^{-1}was assigned to CN anti-symmetric stretch of nitrile compound. The weak bands around 2765.930cm^{-1} and 2866.957cm^{-1} were both assigned to CH stretching vibration of methylene compound respectively. The strong band around 3361.271cm^{-1} was assigned to OH stretching vibration of 2^{o} alcoholic compound.

It can be deduced that the fresh bull blood sample has more chloro compounds and also contains alkenes with moderate band. The amine compound (NH) responsible for proteins changes bond length, this goes to show that the protein in the fresh cow blood is not digestible (Donkoh *et al*., 1999). The Thiocyanate compound in the fresh cow blood sample has one of the bonds increasing and the other decreasing showing its instability and underscoring the inedibility of the fresh cow blood. The fresh cow blood sample has traces (small amount) of carboxylic acid and nitrile compounds. The higher the wavelength, the lower the frequency of compounds. The least compound in the fresh cow sample is the alcoholic compound. The presence of Hydroxyl group goes to emphasize the presence of water molecules in the fresh cow blood sample.

III. CHARACTERIZATION OF COW BLOODMEAL

Based on the proximate analysis carried out by Bari, *et al*. (2015) on bloodmeal. Bloodmeal will be useful and effective in livestock feed formulation and other agricultural purposes. The chemical composition of convective oven dried bloodmeal showed that it contained more ash, fat, protein, carbohydrate and fibre than the fresh cow blood sample. The fresh sample is only higher in moisture content. The values reported by National Research Council (NRC), (1994) tend to agree with the values presented here for the proximate composition. The results indicate a very high concentration of Carbohydrate and Protein in the convective oven dried bloodmeal. Donkoh *et al.* (1999) and Bari *et al*. (2015) posited that Bloodmeal contains substantial amounts of essential (indispensable) amino acids. The difference in the proximate compositions of the fresh and dried samples can be attributed to the drying process. Processing of bloodmeal increases the nutrient contents and its digestibility. Overheating during drying of bloodmeal can substantially lower digestibility and availability of the nutrients in the product (Donkoh *et al*. 1999). This goes to say that the processing conditions used in the preparation of bloodmeal can adversely affect the nutritional quality of the product. Bari *et al*. (2015) recommended that Bloodmeal is hygroscopic and less than 10-12% db moisture is allowable to prevent it from deterioration.

IV. FOURIER TRANSFORM INFRA-RED SPECTROSCOPY OF BLOODMEAL

Results of FTIR spectra of the bloodmeal is recorded in Fig. 2. From the plot, the peak value of 889.9796cm^{-1} was assigned to C-CI stretching vibration of Chloro compound.

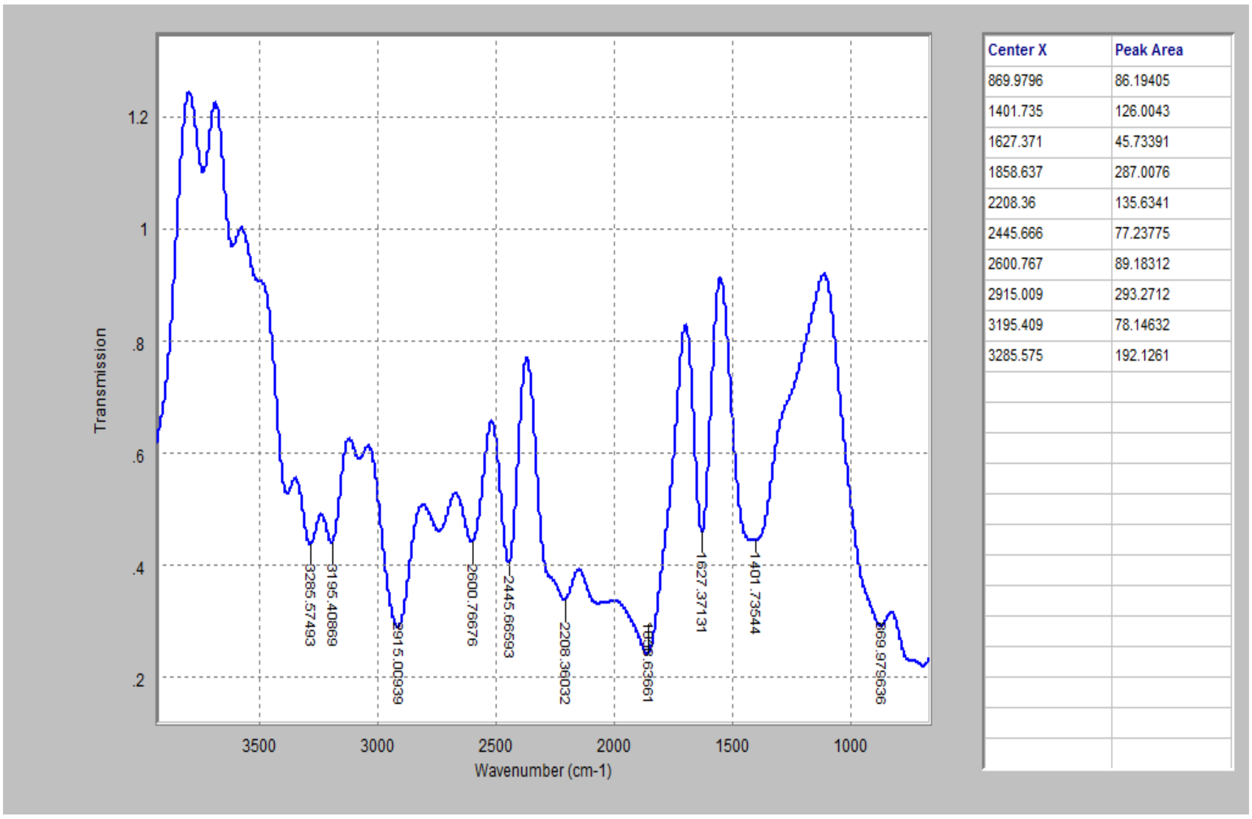

FIGURE 2: FTIR spectrum of bloodmeal.

The absorbance around 1401.735cm^{-1} was assigned C=C stretching vibration of ethene. The peak value around 1627.371cm^{-1} was assigned to NH stretching vibration of 1^{o} amine compound. The wavelength around 1858.637cm^{-1} was due to CO stretching vibration of cyclic ester compound. The peak around 2208.360cm^{-1} was assigned to CO anti-symmetric stretch of carbonyl compound whereas the band around 2445.666cm^{-1} was assigned to CN anti-symmetric stretch of nitrile compound. The weak band around 2600.767cm^{-1} was assigned to CH symmetric vibration of methylene compound. The value at 2915.009cm^{-1} was assigned to SCN stretching vibration of thiocyanate compound. The broad band around 3195.409cm^{-1} and 3285.575cm^{-1} were both assigned to OH stretching vibration of 1^{0} alcohol respectively.

The changes observed in the spectra represent interactive effects due to the functional groups during drying (Fig. 2); thus, some modifications are likely to have occurred. There are glaring differences in the Fourier transform infra-red spectroscopy of the fresh blood sample (Fig.1) and dried blood (bloodmeal) sample (Fig. 2). Different peaks were assigned to the Chloro compound in the two samples even though the two samples contain more chlorine compounds. The dry sample has a higher peak of Chlorine compounds; this shows that there is more in the number of chlorine compounds in the fresh sample than in the dried sample. The absence of the vibration in the amine (NH) compound in the dried sample underscores the availability of proteins in bloodmeal and its digestibility in the dried form (Donkoh, *et al.*, 1999). The bloodmeal still contained traces of water. The Carboxylic acid and Cyanide are contained in the bloodmeal at a very negligible quantity.

The results also showed that some peaks were shifted from what they were in fresh blood. Some peaks even disappeared while new peaks were detected. These changes observed in the spectra show the interactive effects due to involvement of those functional groups during drying.

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