Investigation of Cementitious Properties in FSA Using FTIR and UV Spectroscopy

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Abstract:
Fins Scale Ash (FSA) is derived from the fins and scales of waste and decomposed fishes which is from the fish market. In this paper the FSA sample is examined by using FTIR and UV spectroscopy. The peak values from the FTIR test shows the functional group present in the FSA sample and those functional groups are nomenclature. The UV peak values are then observed and their functional groups are tabled. In this paper gives the clear view of using Fins and Scales of fishes and make them as ecofriendly to environment. Reuse of a large amount of waste materials such as fly ash, Rice Husk Ash, Lime Powder, etc. are done in large extents in the manufacture of cement and Cementitious products. For advance this FSA can reduce the carbon attach, it can be used as a partial supplant for cement.

Keywords: *FSA, FTIR, UV, RHA, Fly ash, Lime powder.*

I. INTRODUCTION

The Fish place a major role in food chain of human beings because it has rich in proteins and nutrients. It was rich in proteins but it cause some hazardous to us by it waste and other decomposing process. When the fish fins, scales and flesh of them make some poor odour it will affect the environment and it is frequently caused in fish market and other places. Fins are usually the most distinctive anatomical features of a fish. They are composed of bony spines or rays protruding from the body with skin covering them and joining them together, either in a webbed fashion, as seen in most bony fish, or similar to a flipper, as seen in sharks. Apart from the tail or caudal fin, fish fins have no direct connection with the spine and are supported only by muscles. Their principal function is to help the fish swim. Fins located in different places on the fish serve different purposes such as moving forward, turning, keeping an upright position or stopping. Most bony fishes are covered with the cycloid scales of salmon and carp, or the ctenoid scales of perch, or the ganoid scales of sturgeons and gars. Some species are covered instead by scutes, and others have no outer covering on the skin. Fish scales are part of the fish's integumentary system, and are produced from the mesoderm layer of the dermis, which distinguishes them from reptile scales. The same genes involved in tooth and hair development in mammals are also involved in scale development. The placoid scales of cartilaginous fishes are also called dermal denticles and are structurally homologous with vertebrate teeth. It has been suggested that the scales of bony fishes are similar in structure to teeth, but they probably originate from different tissue. Most fish are also covered in a protective layer of mucus (slime). Sea shell is a living species in sea and on death of this species the sea shell will left unoccupied and it reaches the sea shore while the waves of sea cause in large scale. Sea shell has a rich in carbon content and it has high strength in flexural properties.

II. LITERATURE SURVEY

Wan Ahmad Soffian Bin Wan Mohammad, Nor Hazurina Othman etal this paper emphasis on various sea shells ash as partial cement replacement and its objective is to create sustainable environment and reduce problems of global warming. Results show that the optimum percentage of seashells as cement replacement is between 4 – 5%. [15]

The main aim of this work is to study the mechanical and chemical properties of the known mollusc shells. It is rich in calcium carbonates and other macromolecules (mostly proteins and polysaccharides). Tensile strength, fineness, fracture property, crushing strength, abrasiveness are done. [06]

The results were used to determine the optimal values for the shape, size and volume fraction of the structural elements with regards to hardness, Young's modulus and fracture toughness. [13]

This paper shows about the mechanical characteristics of oyster shell and how it is replaced in concrete it also shows the properties of fresh and hardened concrete, this paper also shows the

interaction between OS and cement paste. It also shows relation between the fine modulus and substitution rate. [08]

This paper aims to investigate the tensile strength of concrete with 0.50% addition of bamboo fibre based on cement weight. To increase strength of concrete, the mixture of rice husk ash and sea shell ash was used as partial replacement of fine aggregate. The replacement was done in four different percentage based on the fine aggregate. [1]

It shows that Oyster shell and other types of shells has the power of absorbing the sounds and acts as a acoustic materials. It is mainly used in the airport side housing. [07]

Adhityo Wicaksono a , Saifullah Hidayat concluded that characteristics of biomechanical attachment exhibited by two morphologically different mudskipper species, Boleophthalmus boddarti (with fused pelvic fins) and Periophthalmus variabilis (with infused pelvic fins). P. variabilis is a tree and rock climber while B. boddarti dwells in the muddy shallows and is unable to climb. They found the chemical and functional group present in this species and by using the FTIR test. Using FTIR spectroscopy, they found that both species of mudskipper-per secrete monopoly saccharides and using molecular dynamics methods we found that these muco polysaccharides are likely to aid Stefan adhesion in both species. [2]

III. ANALYTICAL WORK

A. FTIR characterization:

Measurement of FTIR spectra of FSA extracted from calibration and Apodization of sample taken from fish wastes is observed using an ABB MB3000 FTIR spectrophotometer in the mid-infrared region of 400-4000 cm-1. This instrument is equipped with deuterated triglycine sulphate (DTGS) detector, with a resolution of 4cm-1 and 45 scanning. Spectra were processed using Horizon MB FTIR software version 3.0.13.1. The samples were placed in good contact with attenuated total reflectance (ATR) accessory using ZnSe crystal at controlled ambient temperature (20°C). All spectra were rationed against a background of air spectrum. After every scan, a new reference air background spectrum was taken. These spectra were recorded as absorbance values at each data point in triplicate.

B. FTIR Spectral Analysis:

FSA obtained from fish (fins and scales) was analyzed using FTIR spectrophotometer at mid infrared region (4000–400 cm–1). FTIR spectroscopy can be an ideal technique for analysis of samples, due to its property as fingerprint technique allowing an analyst to differentiate among samples. IR spectra can be used as means for identification functional group present in the samples. Figure 1 revealed FTIR spectra of FSA extracted from Fins and scales of fishes. The assignments of major peaks and shoulders were shown in Table 1.

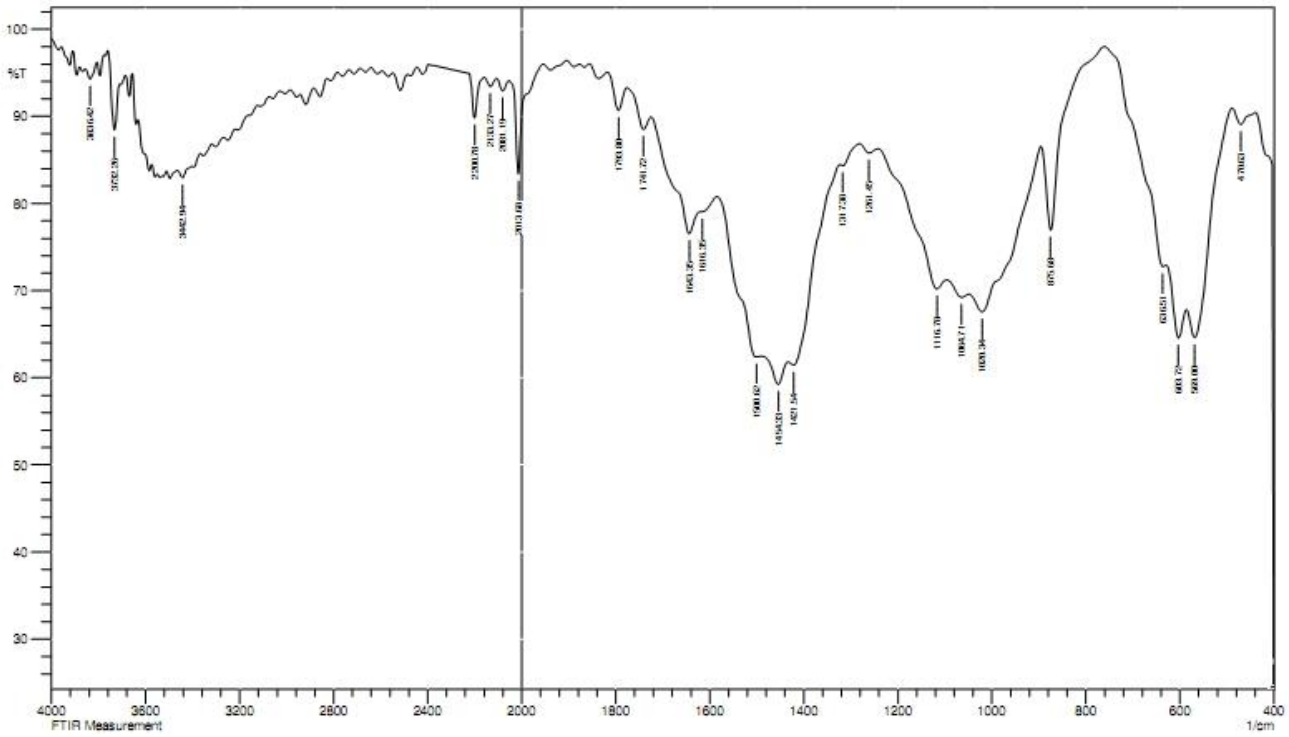
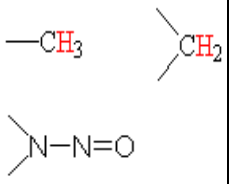
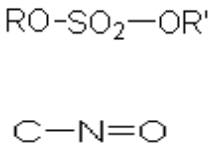
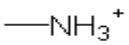
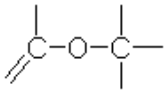
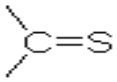
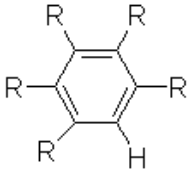
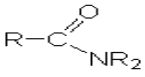
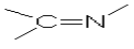
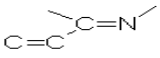
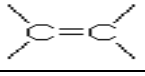
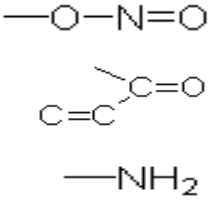
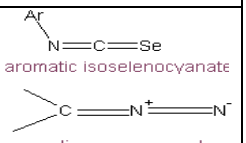


Fig : 1 FTIR Graph

Table:1 FTIR Functional group

S.No	Wave length (cm^{-1})	Functional Group
1	1470 – 1430, 1460 - 1430	
2	1425 – 1370, 1440 - 1350	
3	1600 - 1500	
4	680 – 515, 830 - 560	C-Cl (alkyl) C-Br (alkyl)
5	1075 - 1020	
6	1075 – 1030, 1100 - 1030	C-Br (aromatic) C-Cl (aromatic)
7	1150 – 1070, 1270 – 1100, 1200 - 1050	C-F (aromatic) 
8	900 - 800	
9	1655 – 1635, 1670 – 1630, 1690 – 1640, 1660 – 1630, 1680 - 1620	0-amino- or o-    hydroxyarylketones 
10	1625 – 1610, 1640 – 1590, 1650 - 1560	
11	2000 – 2200, 2000 - 2050	 aromatic isoselenocyanate diazo compounds
12	3250 - 3450, 3400 – 3450	----NH2 ---N

The table.1 shows clear view of the wave length and their functional group. The FSA sample contains peak wavelength of 1454 cm^{-1} this peak point shows the functional group of C-H bending (alkane). The peak value of 1500 cm-1 shows the functional group of N-O stretching (nitro compound). The graph gives a third peak value of 1421 cm^{-1} show the functional group of O-H bending (alcohol). The wavenumber of 570 cm^{-1} shows the functional group of C-I stretch (halo compound). The wavenumber 603.72 cm^{-1} shows the functional group of C-Br stretching (halo compound). The wavenumber 2013.68 cm^{-1} shows the functional group of N=C=S (isothiocyanate). The wave number is 3442.94 cm^{-1} (O-H stretching). These are the peaks points obtained from the FTIR test for the FSA sample.

C. Ultraviolet–visible spectroscopy Analysis

Ultraviolet–visible spectroscopy or ultraviolet–visible spectrophotometry (UV–Vis) refers to absorption spectroscopy or reflectance spectroscopy in the ultraviolet-visible spectral region. This means it uses light in the visible and adjacent ranges. The absorption or reflectance in the visible range directly affects the perceived color of the chemicals involved. In this region of the electromagnetic spectrum, atoms and molecules undergo electronic transitions. Absorption spectroscopy is complementary to fluorescence spectroscopy, in that fluorescence deals with transitions from the excited state to the ground state, while absorption measures transitions from the ground state to the excited state. The fig.2 shows the graphical representation of UV for FSA sample.

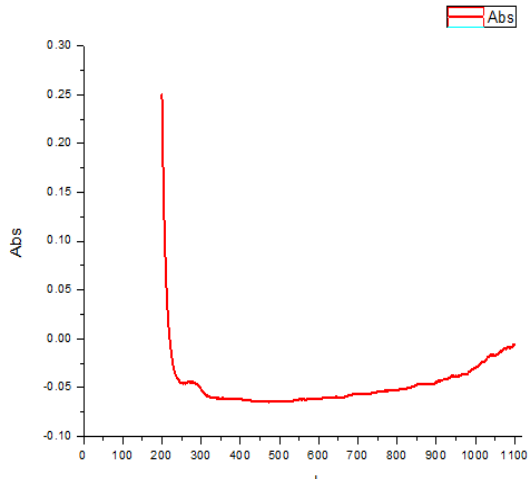


Fig :2 UV Graph

The Fig 2 shows the peaks values of FSA from UV spectroscopy test. The functional group of the peak values are 260 nm this wave number shows the presence of Cyclohexadiene in the sample. The wave number 252 nm shows the presence of HO- (Hydroxyl Group) in the sample.

IV. CONCLUSION

The decompose of fish makes poor odour in the environment , it is reduced by converting it to ash for getting the cementitious particles. FTIR test is carried out to find the functional group present in the FSA, UV test also carried out and the functional group are tabled to get the clear view of the functional group present in the FSA sample.

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