EVALUATION OF PALF FIBERS COMPONENTS BY INFRARED SPECTROSCOPY*

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Resumo
Como uma boa alternativa a outros materiais, o número de materiais ecológicos está aumentando. As fibras naturais estão substituindo fibras sintéticas, por exemplo, a fibra de vidro. Além dos aspectos ambiental, as fibras naturais são mais baratas do que os sintéticos. A caracterização do FTIR é um indicativo sobre a possibilidade de integração de fibras com as matrizes de polímeros e compósitos ambientais. Portanto, o presente estudo analisou a fibra de PALF por meio de espectroscopia FTIR. O espectro mostrou principais bandas de absorção típicas de interacções moleculares específicas de fibras PALF. A análise FTIR do permitiu a identificação de grupos funcionais moleculares de fibras PALF e as suas características de vibração.
Palavras-Chave: Fibra de PALF; Fibras Naturais; FTIR.

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Abstract
As a good alternative to others materials, the number of environmentally friendly materials is increasing. Natural fibers are substituting synthetic fibers, for example the glass fiber. Besides the environmentally aspects, the natural fibers are cheaper than the synthetic ones. The characterization of the FTIR is an indicative on the possibility of fiber integration with the environmental and composite polymer matrices. Therefore, the present study analyzed the PALF fiber by means of FTIR spectroscopy. The spectrum showed main absorption bands typical of PALF fiber specific molecular interactions. The analyze of the FTIR allowed the identification of molecular functional groups of PALF fibers and their vibration characteristics.
Keywords: PALF Fibers; Natural Fibers; FTIR.

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1 INTRODUCTION

In recent decades, the aerospace and defense related areas have been dominated by materials composites reinforced with synthetic fibers [1]. Known examples of these expensive but effective materials are carbon fiber for automotive industry and aramid armor for soldier protection [2]. Other industrial sectors are investing in synthetics because they are cheaper and simpler than the glass fiber. Natural fibers are substituting the simpler glass fiber even if being high-tech composites still stand as top competitors [1,3]. It is a consequence by some advantages in environmental, economical and technical aspects that the natural fibers show up, mainly those lignocellulosic extracted from plants, against synthetic ones as composite reinforcement.
The characterization of the FTIR is an indicative on the possibility of fiber integration with the environmental and composite polymer matrices. Besides, FTIR could also indicate the effective transformation that happen in the fiber molecular structure due to chemical and physical treatments. Peaks of FTIR spectra are attributed to molecular a contribution that permits to interpret possible interactions and determine the crystallinity index. Table 1 introduces some important infrared absorption bands characteristic of cellulignin samples [4,5].

TABLE 1. FTIR Adsorption bands of lignin

Position (cm^{-1})	Band origin
3450-3400	O-H stretching
3050-2840	C-H stretching (aliphatic+aromatic)
1740-1710	C=O stretching (unconjugated ketone,ester or carboxylic groups)
1675-1660	C=O stretching in conjugation to aromatic ring
1605-1600	Aromatic ring vibrations
1515-1505	Aromatic ring vibrations
1470-1460	C-H deformations
1430-1425	Aromatic ring vibrations
1370-1365	C-H deformations
1330-1325	Syringyl ring breathing
1275-1270	Guaiacyl ring breathing
1230-1220	C-C, C-O stretch
1172	C-O stretching of conjugated ester groups in grass lignins
1085-1030	C-H, C-O deformations
835	C-H out of plane in p-hydroxyphenyl units

Therefore, the present study analyzed the PALF fiber by means of Fourier Transform Infrared (FTIR) spectroscopy. The spectrum showed main absorption bands typical of PALF fiber specific molecular interactions.

2 MATERIALS AND METHODS

The basic material used in this study was the PALF fiber supplied by Designan Natural Fibers. The analysis of the FTIR was conducted in a model IR PRESTIGE 21-FTIR-SHIMADZU. The PALF fibers were milled in a ceramic pestle until powder, which was mixed with KBr particles, suitable for FTIR

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analysis. Then, the compound was pressed to produce a film in the condition required for testing. The fig. 1 shows a small packet of PALF fibers that was used in the procedure.

Figure 1. A small packet of PALF fibers.

3 RESULTS AND DISCUSSION

The Fig. 2 presents the FTIR spectrum of common untreated PALF fiber, where can be observed the absorption bands of specific groups of its components: lignin, hemicelluloses and cellulose.

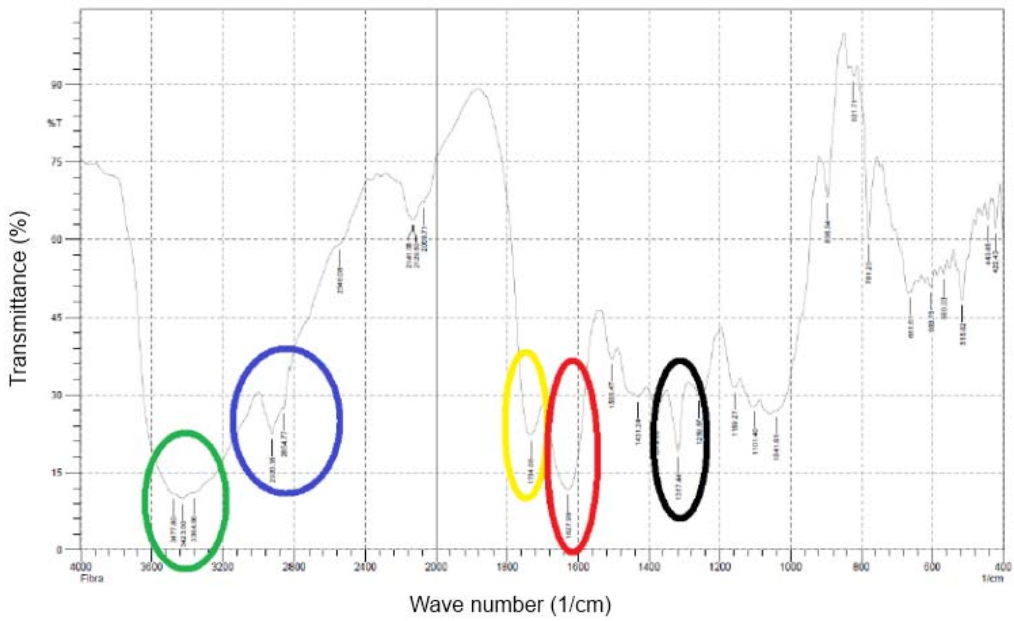

Figure 2. FTIR spectrum of common PALF fiber

The spectrum showed in the figure 2 many absorption bands associated with the molecular vibrations of PALF fiber constituents. The green circle shows the broad absorption band at 3400 cm^{-1}, common to all lignocellulosic [6], typically representing the stretch of O-H bonds. The blue circle in the figure, is the strongest transmission band to 2920 cm^{-1}, showing the peak common corresponding to the stretching of C-H bonds [7]. The yellow circle shows the characteristic peak of the transmission band representative of stretching of C=O bonds approximately 1730 cm^{-1} [8]. The red and black circles are representative of the transmission band at approximately 1630 cm^{-1} to 1320 cm^{-1}, characteristic of the vibrations of structures C=C aromatic and aliphatic chains, and stretching of the CH bonds, respectively [7].

4 CONCLUSIONS

- The analyze of the FTIR allowed the identification of molecular functional groups of PALF fibers and their vibration characteristics.

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