CHEMICAL AND EXTRACTIVES COMPATIBILITY OF EMPTY BUNCH FRUIT OF *Elaeis guineensis*, LEAVES OF *Ananas cumosos* AND TETRAPAK WITH WOOD USED IN PARTICLEBOARDS IN TROPICAL AREAS

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Abstract— Tropical countries produce a great variety of lignocellulosic residues from small-area planted crops. Large amount of “Tetra Pak” packages are also produced without any disposal treatment. In order to give solutions for waste management, residues must be incorporated in other processes, such as the manufacture of particleboards. The main objective of this work was to evaluate chemical compositions, extractives in different solvent, chemical characterization of extracts in polar and un-polar solvent utilizing infrared spectrum analysis. A second aim of this study was to test the compatibility between chemical composition and extractives of empty bunch fruit of *Elaeis guineensis* (BPF), the leaves of *Ananas cumosos* (PL) and “Tetra Pak” packages with three timber species (*Gmelina arborea*, *Tectona grandis* and *Cupressus lusitana*). Results showed that cellulose, ashes and lignin content of BPF, PL and “Tetra Pak” differ from those of the woody species. Similar result was obtained for pH and for the amount of substances extracted with different solvents. Infrared spectrum of water (polar), and ethanol-toluene (un-polar) solutions showed that the greatest differences in extracts were found in BPF and PL, this in relation to the studied woody species. Finally, HCMA showed that residues from BPF and “Tetra Pak” packages are slightly different, considering chemical compositions and extract content, to other woody species used for particleboard manufacture. Moreover, PL has the least compatibility with the woody species.

Keywords— Tropical species, infrared analysis, lignocellulose residues, agricultural crop.

I. INTRODUCTION

Several tropical countries have a suitable climate for a great variety of single crops and multi-purpose crops such as coffee and timber trees. “Tetra Pak” packages are a beverage and liquid food system widely used all over the world as an aseptic packaging material.

Agricultural crops and “Tetra Pak” packages can be linked through the following disposal characteristics:

1. In crops, post-harvest residues are not being disposed or recycled appropriately (Bertsch, 2006, Ulloa et al., 2004).
2. Some crops have been blamed for environmental problems (Kissinger and Rees, 2010).
3. The amount of waste generated by “Tetra Pak” packaging and the low percentage of recycling.

An attractive option would be the possibility of combining the residues coming from sawmills, pineapple production, oil palm fruit processing and “Tetra Pak” waste. Although these crops are composed by lignocelluloses materials, their chemical composition is different, which reduces their compatibility. Lignocelluloses materials are formed of cellulose, lignin and extractives, and the amount and composition vary between them (John and Thomas, 2008). Extractives affect many processes where lignocellulose residues are utilized, for example pulp production or heat production (Tamaki and Mazza, 2010). They are natural substances whose chemical composition varies widely (Reddy and Yang, 2005).

Particleboards were traditionally produced from wood residues. However, in the last 20 years, a variety of raw lignocelluloses materials have been introduced as a complementary option (James, 2010). Particleboards made from pure agricultural residues or from the combination of wood residues with other materials have shown excellent physical and chemical properties (Hashim et al., 2010; Onurah, 2005). Chemical compatibility of these residues has not been studied previously.

The objective of the present study was to determine the chemical composition the extractives in different solvents and the chemical characterization of extracts in polar and un-polar solvent using infrared spectrum analysis. In addition, compatibility was established by means of using the chemical composition and extractives content, this for the empty bunch fruit of *Elaeis guineensis*, the pineapple leaves (*Ananas cumosos*), and the “Tetra Pak” packages. At last, lignocelluloscic residues were compared with the wood of the three main timber species used for commercial plantations in Costa...