PREPARATION OF GRAPHITIC CARBON BY CATALYST-FREE PYROLYSIS OF LIGNIN TO REDUCE VOLATILE ORGANIC COMPOUND OF THE WORK ENVIRONMENT

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1 Introduction

In the last decades the chemical industry has intensified its efforts to reduce, prevent and eliminate the environmental impacts. At the same time, there is a growing concern for human well-being. Monitoring the work environment is increasingly common, thus ensuring the safety and health of the worker. Emissions of volatile organic compounds have motivated several research activities to develop efficient and low cost technologies for their capture. The preparation of a carbonaceous material from lignin, the second most abundant biopolymer in the nature and sub product of the paper industry, appears as an alternative to this demand. Mesoporous graphitic materials can be obtained from lignin pyrolysis at 800°C and deposited in polymer matrices or quartz plates for the physical adsorption of these harmful substances thus a filter is created to prevent diseases and ills caused by VOC's and the most important, using an industrial waste[1, 2].

2 Methodology

The synthesis of the graphitic carbons was carried out at 800°C using Lignin as a carbon source. In a typical synthesis, 2.00g of Lignin was heat-treated in a furnace, under air, at 800°C with a heating rate of 5°C/min. Fourier-Transform Infrared Spectroscopy (FTIR) was performed with a Varian 600 FTIR spectrometer with the number of scan times of 256 as showed in Figs. 1 and 2. Raman spectroscopy was performed with WITec and using a 532nm laser excitation source. X-Ray Diffraction was performed with a PANalytical X'Pert diffractometer using a angular detector. Formaldehyde quantification followed the method NIOSH Manual of Analytical Methods (NMAM), with high performance liquid chromatography with UV detector (HPLC-DAD).

3 Results

This section shows the experiments results before and after pyrolysis, exhibiting differences in the morphology like crystallinity, present phases and changes in the nanostructures.

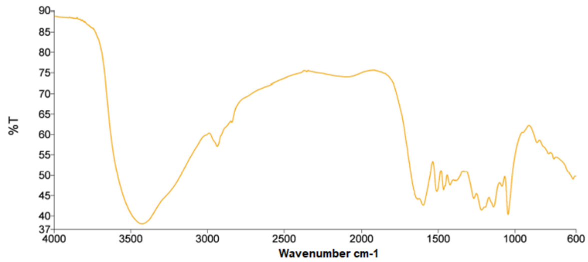

Figure 1: FTIR spectra of commercial Lignin as received.

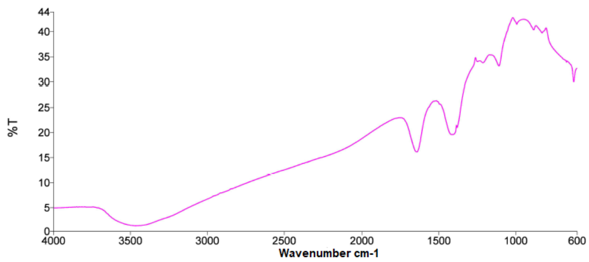

Figure 2: FTIR spectra of commercial Lignin pyrolyzed at 800°C.

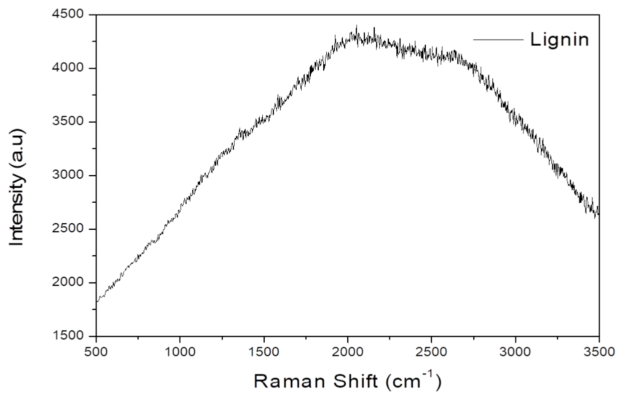

Figure 3: Raman spectra of commercial Lignin as received. Spectra were obtained using a Raman spectrometer with a 532nm laser excitation source.

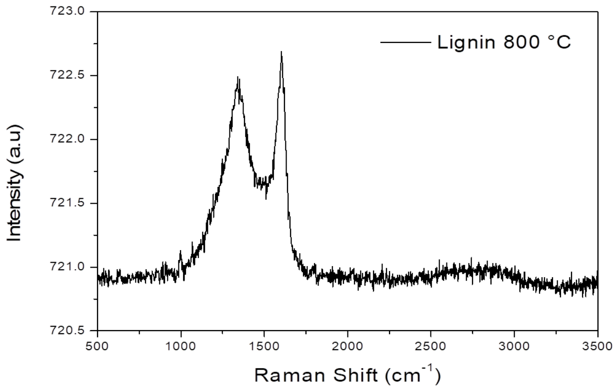

Figure 4: Raman spectra of pyrolysed at 800°C. Spectra were obtained using a Raman spectrometer with a 532nm laser excitation source.

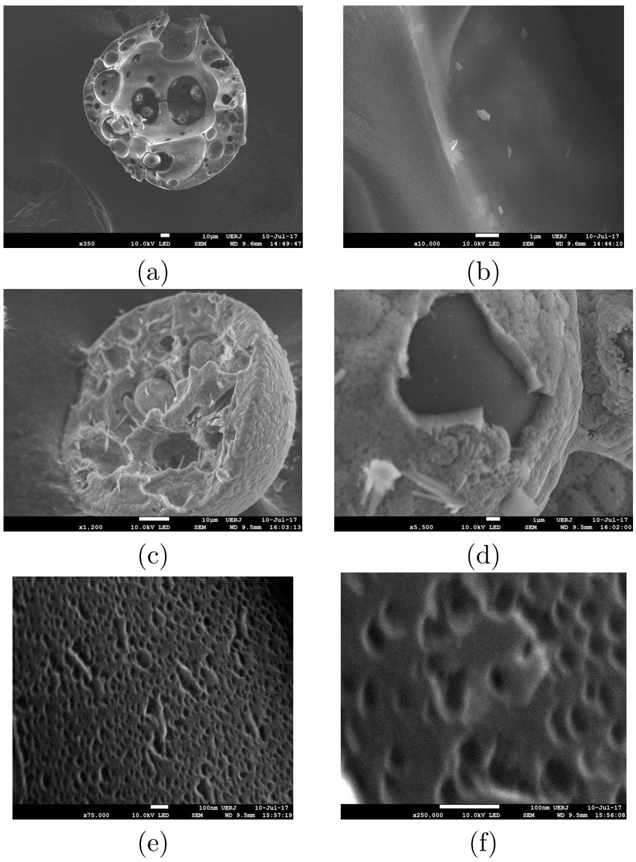

Figure 5: MEV - FEG images showing the differences between surfaces of Lignin as received (a),(b), and pyrolysed at 800°C (c), (d) and (e), (f) showing the appearance of pores at 800°C

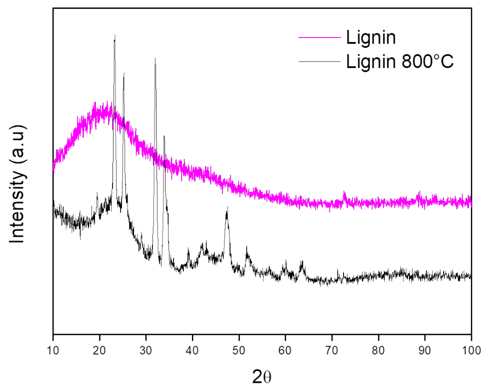

Figure 6: X-ray diffraction results of commercial Lignin and pyrolyzed at 800°C.

4 Conclusions

Preliminary results after characterization of lignin as received and pyrolyzed at 800°C showed an increase crystallinity as shown in Raman spectroscopy Figs. 3 and 4 and X-ray diffraction Fig. 6. Increasing the surface area with the appearance of pores in the material (Fig. 5) this increase is very important for the physical adsorption that will be the majority mechanism in the lignin. The next step will be another characterization and adsorption tests on different types of lignin for a quantification of the amount of VOC's, like formaldehyde, can be adsorbed then after these characterization tests will be initiated studies for the formation of films by CVD (Chemical Vapour Deposition) process.

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References

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