

Lab 3, Fourier Transform Infrared (FTIR) Spectroscopy
Lab report information

Make sure that your report addresses the following questions, based on the series of FTIR lab experiments. Include the spectra that you measured. (Probably this will arise in answering questions; overlapping spectra are fine and may even be better for answering the questions.) Adding comments to spectra using a pen is fine with me. Also **include any observations** that you made during the experiment. (Did anything happen to each sample during the measurement, for example.)

The software on the instrument has a “find peaks” tool that you may find useful for identifying peak positions. First load a spectrum, and then click “Find peaks”. In the new window, you can adjust the *threshold height* for which peaks are labeled (click just below the smallest peak you want) and the *sensitivity* about how small a peak is labeled.

Experiments 1 and 2: Poly(vinyl acetate) and Polymethylmethacrylate

1. Describe how varying the number of scans affected the infrared spectrum you measured. Support your description with a figure.
2. For each polymer, explain what main peaks were present and what functional groups they represent. (Label the peaks on a spectrum; using a pen is fine.) You may need to go back to the INBRE lab to use the software attached to the instrument.
3. For functional groups that are found in both polymers (particularly the ester group -O-C=O and potentially the methyl group CH_3 and methylene group CH_2), how do the spectra compare in the two polymers? Why are there similarities and/or differences?
4. Hydrogen bonding is indicated in an infrared spectrum by potentially overlapping peaks: one corresponds to the non-hydrogen bonded species (such as a carbonyl or ester) and the other (at a frequency that is lower by 5 to 10 cm^{-1}) corresponds to the same functional group but in a hydrogen bond. Do the C=O peaks in your spectra appear to be hydrogen bonded or not?
5. Which polymer led to more intense peaks (i.e. higher absorption)? Why do you think that happened?

Experiments 3 and 4: Polyurethanes from the Mackal Gym Floor

6. For both samples, explain what main peaks were present and what functional groups they represent. (Label the peaks on a spectrum or spectra; using a pen is fine.) You may need to go back to the INBRE lab to use the software attached to the instrument. Focus particularly on peaks that correspond to possible functional groups in a polyurethane, such as urethane -NH-(C=O)-O- , unreacted isocyanate -N=C=O , amine -NH_2 , urea, unreacted alcohol -OH , etc.
7. What changes in spectra do you observe between the degraded and undegraded samples? What chemical changes could correspond to these spectrum changes? What new compounds may be present in the degraded sample? (Yes, this is a tough question!)
8. Do you notice evidence for hydrogen bonding in the peaks of the C=O , N-H , and/or O-H stretches? Why or why not? (Caveat: a peak in a system in which everything hydrogen bonds can look the same as a peak in a system in which no hydrogen bonding occurs.)