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Analysis report 863933

Analysis of tea-bag material

Danish Technological Institute

Title:
Analysis of tea-bag material

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1. Assignment

Sprout Europe wants chemical information about the material used for a combined tea-bag and spoon with a focus on identifying plastics. Three different samples will be analysed on three different spots (area where tea bag is sealed off, directly on tea bag and on white cardboard enclosing the tea bag) with Raman and FTIR spectroscopy. Obtained Raman and FTIR spectra will be compared to reference spectra in available material databases.

2. Conclusion

The obtained Raman and FTIR spectra of the material from all three different spots are very well matched by database reference spectrum of cellulose. Thus, the analysed samples a chemically very similar to cellulose or cellulose derived products. The Raman/FTIR analysis does not indicate the presence of plastics.

3. Sample labelling, preparation and analysis methods

3.1. Sample labelling

Sample number	Description
863933 – 1	Sprout-spoon (Black Tea Vanilla)
863933 – 2	Sprout-spoon (Herbal Tea Blend)
863933 – 3	Sprout-spoon (Herbal Tea Blend)

Figure 1: The three analysed Sprout Spoon samples.

3.2. Sample preparation

Three different samples were analysed on three different spots (Figure 2, area where tea bag is sealed off, directly on tea bag and on white cardboard enclosing the tea bag) with Raman and FTIR spectroscopy.

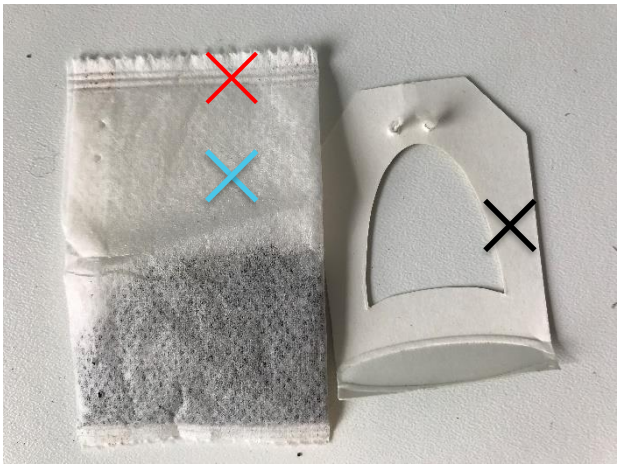

Figure 2: Spots analysed with FTIR and Raman, sealing (red cross), tea-bag (blue cross) and cardboard (black cross).

3.3. Raman spectroscopy

For the Raman analysis, a Renishaw InVia Qontor Raman microscope with a 50x objective and excitation wavelength of 785 nm was used.

The acquired spectra from the material were compared to the entries in Raman databases from Renishaw (polymer, forensic and inorganic) as well as the organic Raman database at DTI.

3.4. FTIR spectroscopy

For IR spectroscopy, a 4500a FTIR-instrument from Agilent Technologies was used. Each spectrum is obtained using the *attenuated total reflectance* (ATR) method with 32 repetitions and a spectral resolution 8 cm^{-1}. The obtained spectra are compared with reference material databases from Agilent, Smiths Detection and Sigma-Aldrich.

4. Results

4.1. FTIR spectroscopy

The obtained FTIR spectra from the three samples on the three different spots were all found to be similar. Thus, a representative spectrum is presented in Figure 3. The best match for this spectrum in the reference database was found to be cellulose. The reference database spectrum of cellulose is also plotted in Figure 3 for comparison. It can be observed by comparing the two spectra, that all peaks in the sample spectra are accounted for in the reference spectrum. Thus, the sample is chemically very similar to cellulose and cellulose derived products. Furthermore, the FTIR analysis does not indicate the presence of other materials, such as plastics, as plastics typically will give rise to a strong FTIR signal.

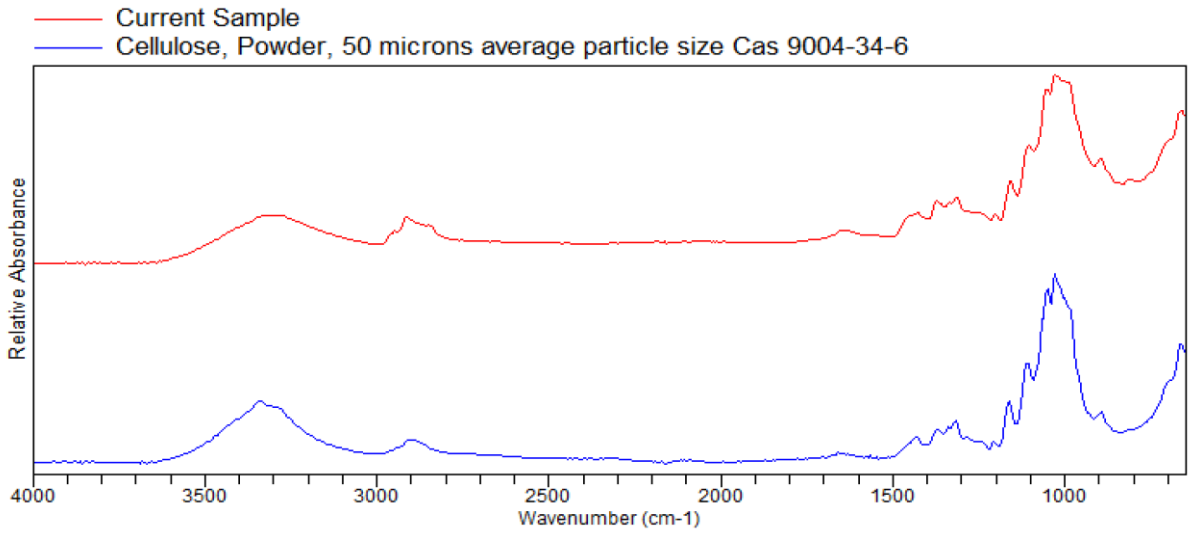

Figure 3: FTIR spectrum of sample 863933-2 obtained on tea-bag (red graph) and database reference spectrum for cellulose (blue graph).

4.2. Raman spectroscopy

Raman spectra were acquired from the same samples and similar spots as for the FTIR-measurements. Similar Raman spectra were obtained for most (6 out of 9) of the analysed spots, whereas three of the Raman spectra contained a few additional peaks.

Representative spectra obtained from sealing, tea bag and cardboard are presented in Figure 4, Figure 5 and Figure 6, respectively. The best match from the reference database for all three cases is cellulose (microcrystalline cellulose "MCC"). This confirms, that the samples a chemically similar to cellulose and cellulose derived products.

The additional peaks found for the three different Raman spectra originate most likely from a material chemically similar to stearate, which is found in numerous applications (e.g. soaps, food flavourings and additives).

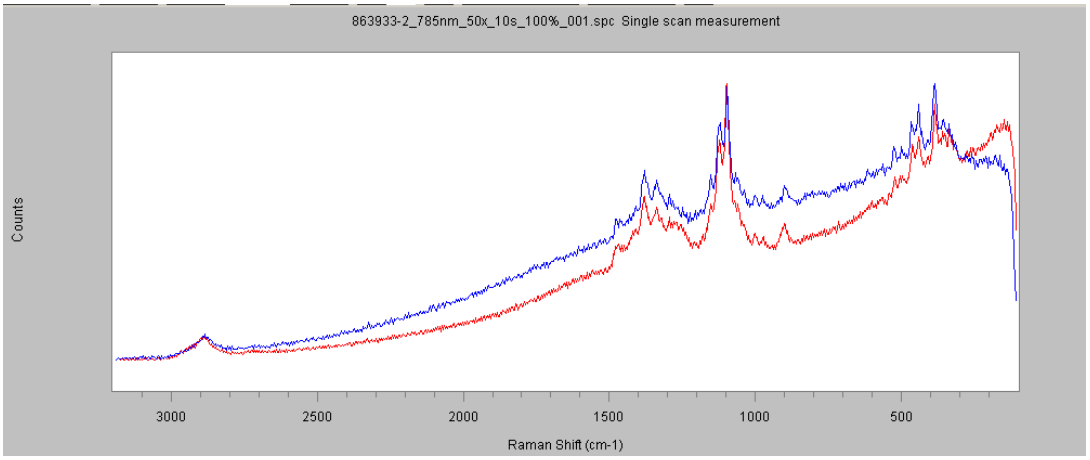

Figure 4: Raman spectrum of sample 863933-2 obtained on sealing (red graph) and database reference spectrum for cellulose (blue graph).

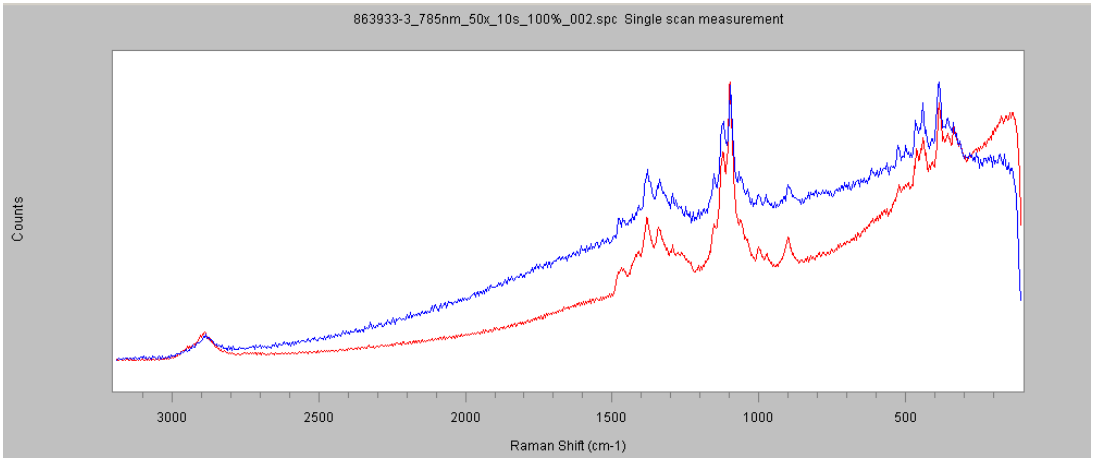

Figure 5: Raman spectrum of sample 863933-3 obtained on tea-bag (red graph) and database reference spectrum for cellulose (blue graph).

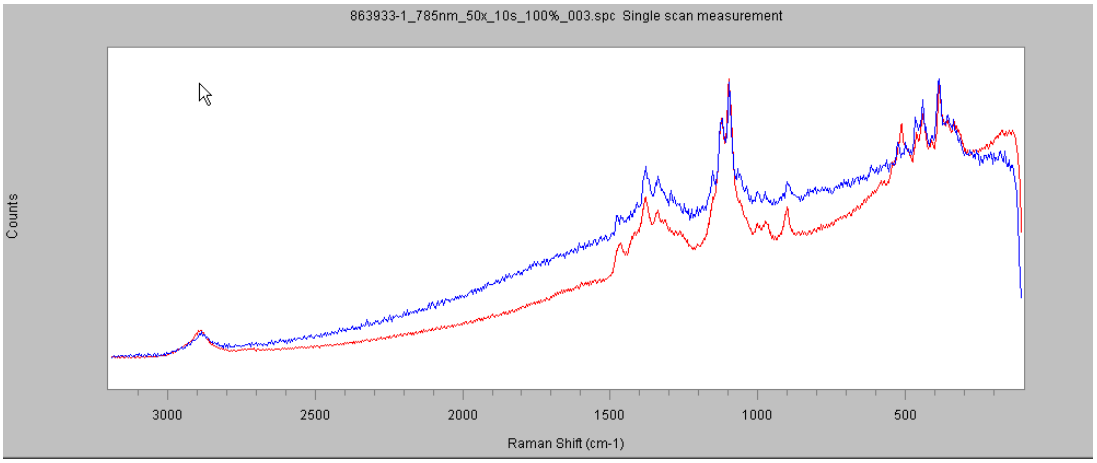

Figure 6: Raman spectrum of sample 863933-1 obtained on cardboard (red graph) and database reference spectrum for cellulose (blue graph).