



Intensity Correlation Analysis of Ficoll Raman Spectra



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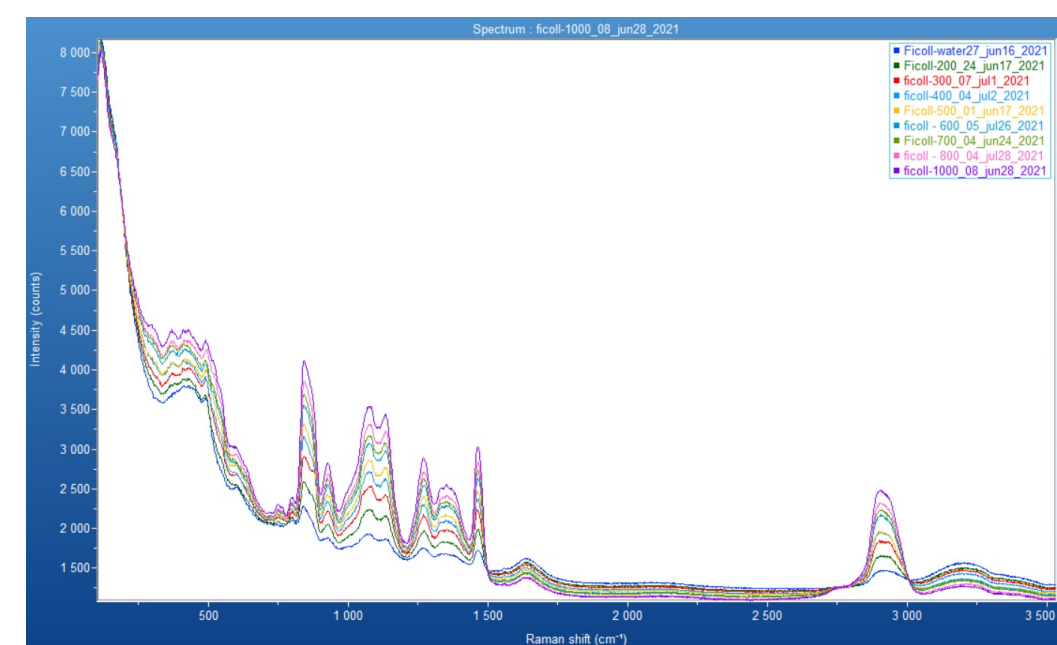
Background:

- *Macromolecular crowding*, the presence of macromolecules in solutions, can alter significantly a wide range of biomacromolecular interactions and activities, especially in cellular systems.
- *Ficoll* is a neutral, highly-branched, water-soluble polysaccharide. It is used in various biomedical applications
- The overall objective is to develop data-driven (spectral and imaging) and physics-Informed models to identify and assess optical signatures.
- *In this poster*, we present measurements of Raman spectrum of Ficoll that can be applied as spectral signatures of the concentrated solutions. The measurements indicate several peaks that can be associated with various vibrational modes of Ficoll, host water, and dissolved oxygen and nitrogen.

Instrument and Materials:



Ficoll PM 70 (~70KDa from Sigma) comes as a white powder, which can be readily dissolved in water at different concentration



- Raman spectroscopy relies on inelastic scattering of photons from molecules and is commonly used to determine the vibrational modes of the molecules.
- HORIBA MacroRam Raman spectrometer
- Excitation beam: 785 nm diode pumped solid-state laser
- Measurements and Analysis with LabSpec6 software.

Results:

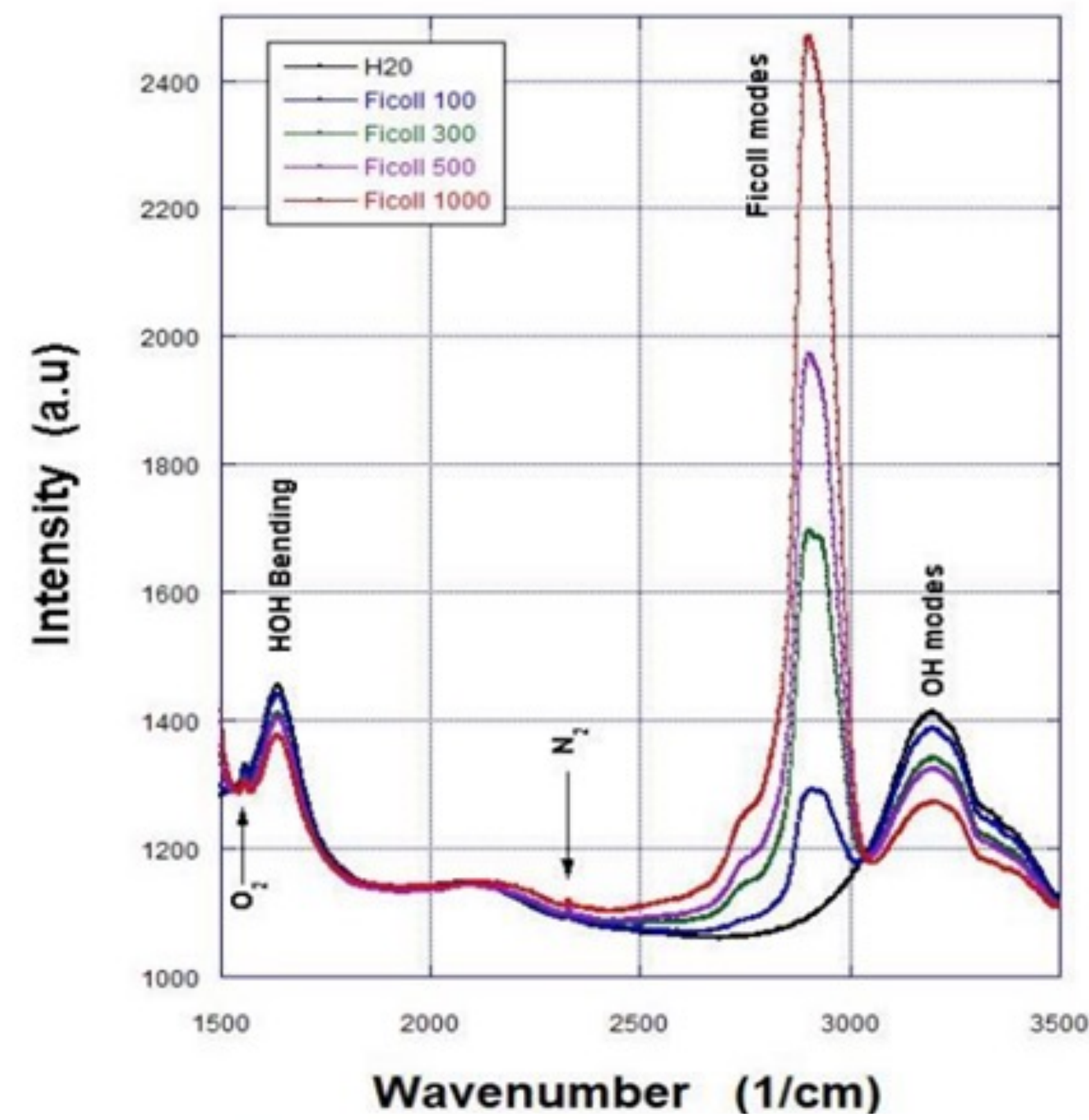
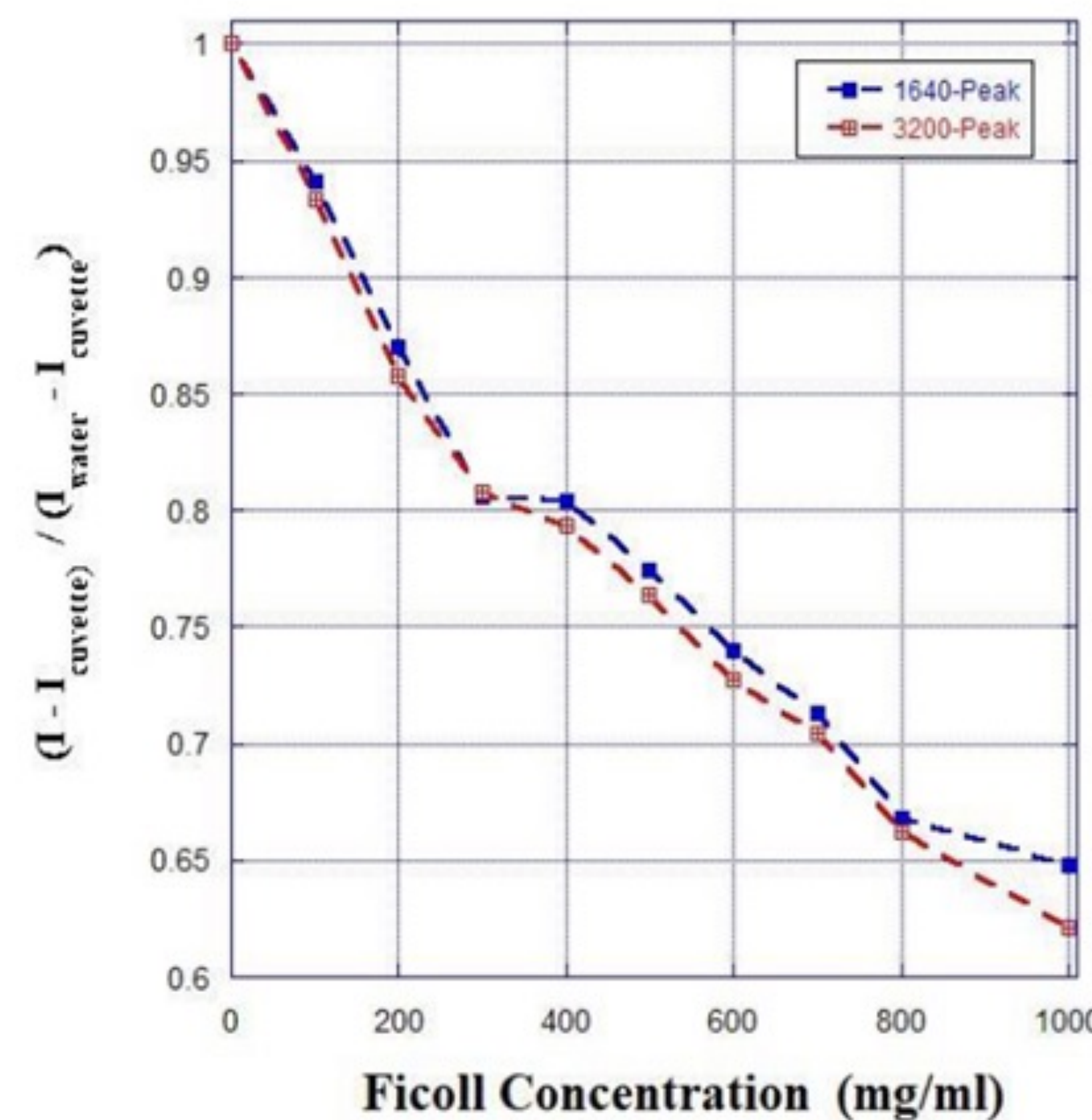


Fig 1: Raman spectra of Ficoll solution between the 1500 – 3500 wave range. Notice:

- Increase of ~2900 cm⁻¹ (CH & CH₂ stretching modes) with Ficoll concentration
- Decrease of ~3200 cm⁻¹ peak of OH modes and 1640 cm⁻¹ peak of HOH bending from water
- Presence peaks for dissolved O₂ and N₂



- OH (~3200 cm⁻¹)
- HOH (~1640 cm⁻¹)

Fig 2: Decrease of both water peaks concurrently, indicating systematic reduction of water contents as Ficoll is increased.

Intensity- Intensity Plots:

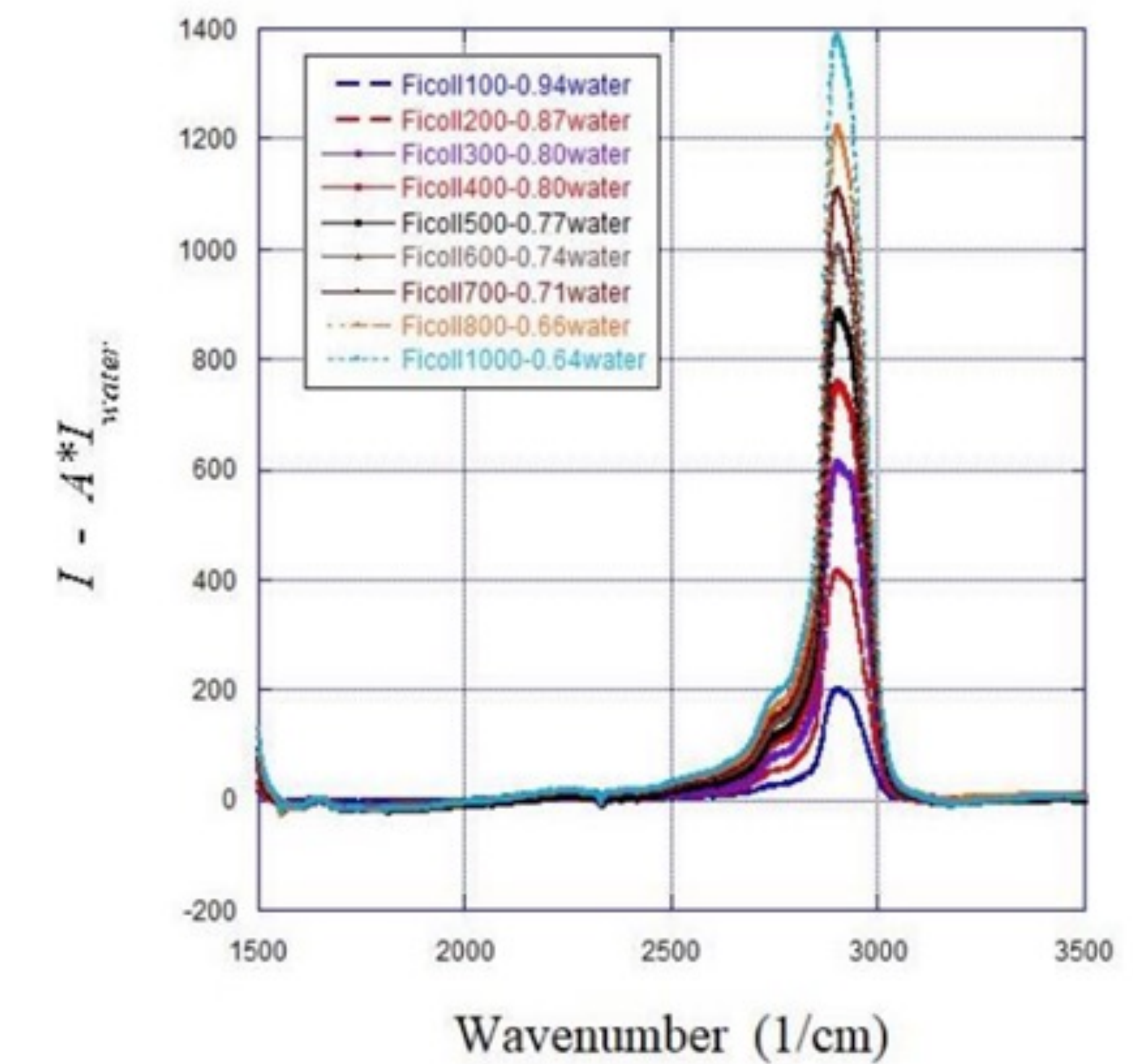


Fig 3: Corrected Raman spectra with systematic subtraction of water+cuvette contribution using plot in Fig.2,

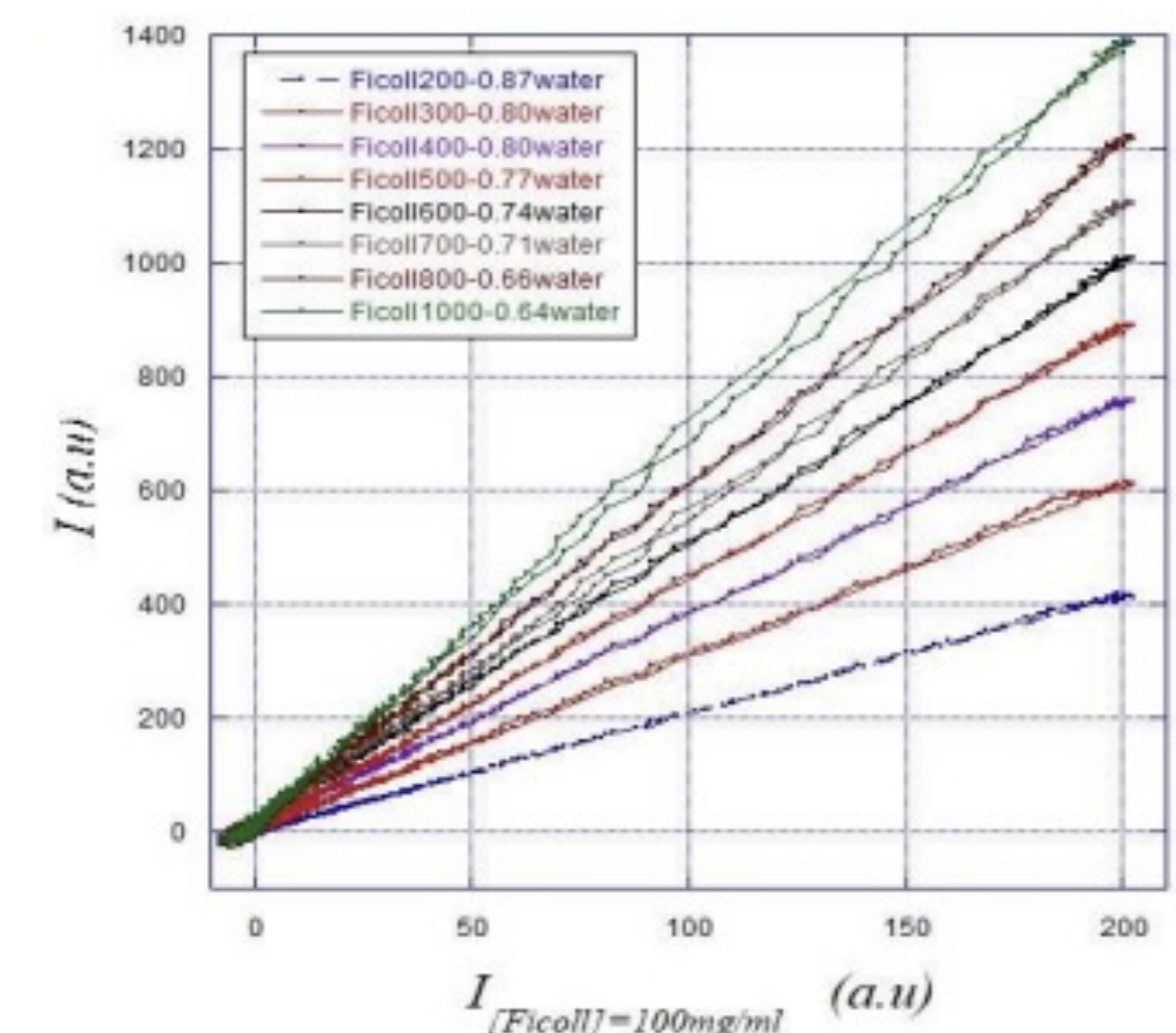


Fig 4: Linearity of Intensity vs. Intensity plots indicates strong correlation between the Ficoll peaks measured at different concentrations. **NOTE:** At 1000 mg/ml an apparent closed loop appeared, indicating possible small peak shift

Conclusions:

- We measured systematic changes of Raman spectra of Ficoll solutions with increase of Ficoll concentration.
- The spectra show various peaks associated with the vibrational modes of water molecules (OH and HOH bending), nitrogen and oxygen molecules dissolved in the solutions, and Ficoll molecules.
- As the Ficoll concentration is increased, the intensities of the Ficoll-associated peaks (e.g. ~2900 cm⁻¹) increase systematically whereas the intensities of the water-associated peaks decrease due to reduction of amount of water.
- Linearity of Intensity-Intensity plots of the Raman spectra indicate no measurable effect on the Ficoll 2900 peak, with possible exception of [Ficoll] = 1000 mg/ml.

- The appearance of the loop at Ficoll 1000 mg/ml indicates possible small shift of the peak.
- That is, Intensity Correlation Analysis may be applied to quantify possible changes of the Raman spectrum of biomacromolecular systems.

Acknowledgements:

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