A UV-Vis spectroscopic method for monitoring of additive particle properties during polymer compounding

Main objective. Determine the dispersion characteristics/or morphology of additives in polymer melts by fast, reliable and accurate on-line methods.

Materials.

Matrix	Ingeo 4043D	Purasorb 9620
Additive	P228S (mean particle size (D50) - 4.99 µm)	P322S SD (mean particle size (D50) - 31.4 µm)

The β-TCP powder was dried at 80 °C before being accurately weighed then tumble mixed with the PLLA. All PLLA/β-TCP powder mixes were then dried in a desiccant drier at 70 °C overnight prior to extrusion.

UV-Vis spectroscopy.

UV-Vis spectra were recorded at 10 s intervals through the melt using a FOSAS (FOS-Messtechnik, Germany) fibre optic spectral acquisition system consisting of a broadband halogen light source and a usb spectrometer unit. The fibre optic probes were mounted into the slit die channel located directly after the extruder barrel (Fig. 1).

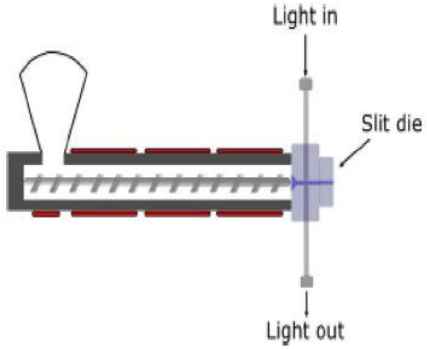
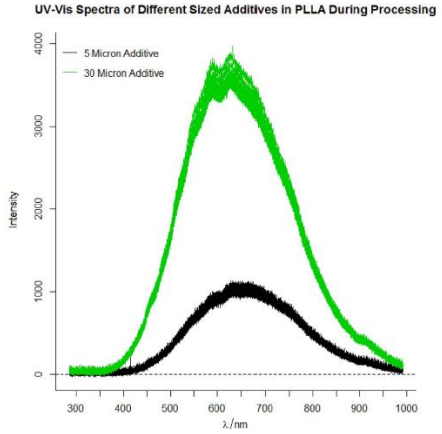
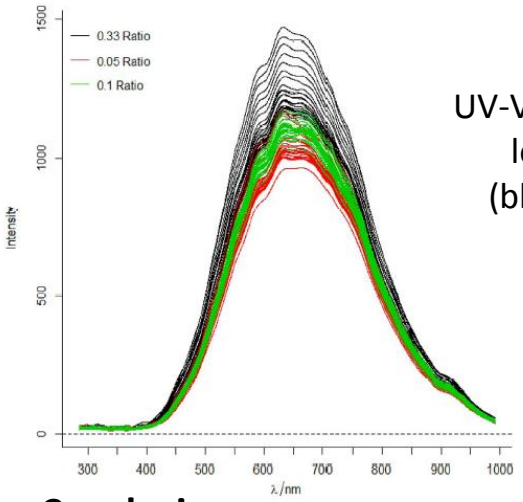


Fig. 1. Schematic of extruder with UV-monitoring.



UV-Vis spectra through the melt of PLLA containing different ratios of 5 µm:15 µm β-TCP premixed with PLLA. The β-TCP particle size had a noticeable influence on the UV-Vis spectra. Larger particle sizes result in a greater amount of light reaching the detector and thus a larger peak



UV-Vis spectra of 20% w/w loading of 5 (green), 30 (black) µm particle size – TCP in PLLA matrix

Conclusion.

UV-Vis spectroscopy coupled with multivariate analysis has been shown to be effective at classifying particles of different sizes within a molten polymer matrix.