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WhitePaper: Polymer UV-Vis Absorption

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Background

Block copolymers in which the poly(ethylene glycol) (PEG) block is either similar in size to the polyester (either polylactide (PLA), polylactide-co-glycolide (PLGA), or polycaprolactone (PCL)) block or larger than the polyester block can dissolve directly in water to form micelles. A popular means to measure drug concentration is to use UV-Vis absorption however the polymer itself provides some UV absorption and it is important to compensate for this during UV-Vis method development.

Method

For each polymer ~500 mg was dissolve in ~20 ml of deionized water (Easypure II, Barnstead) with vortex mixing and gentle rotational agitation (15 RPM, Southwest Science) at low temperature (10 – 20 °C) until no solid polymer was observed. Each sample was passed through a 0.45 um PVDF syringe filter and scanned using a Genesys 10S (Thermo Scientific) from 190 – 900 nm at 2nm increments against a deionized water blank.

Results

Pre-filtration both solutions were largely whitish in color and a portion of the larger, nanoparticulate form of each polymer was removed though more of AK030 was removed than AK009 likely due to its larger overall Mw.

Figure 1 shows the scanned spectra Figure 2 shows the visual image of the indicated samples.

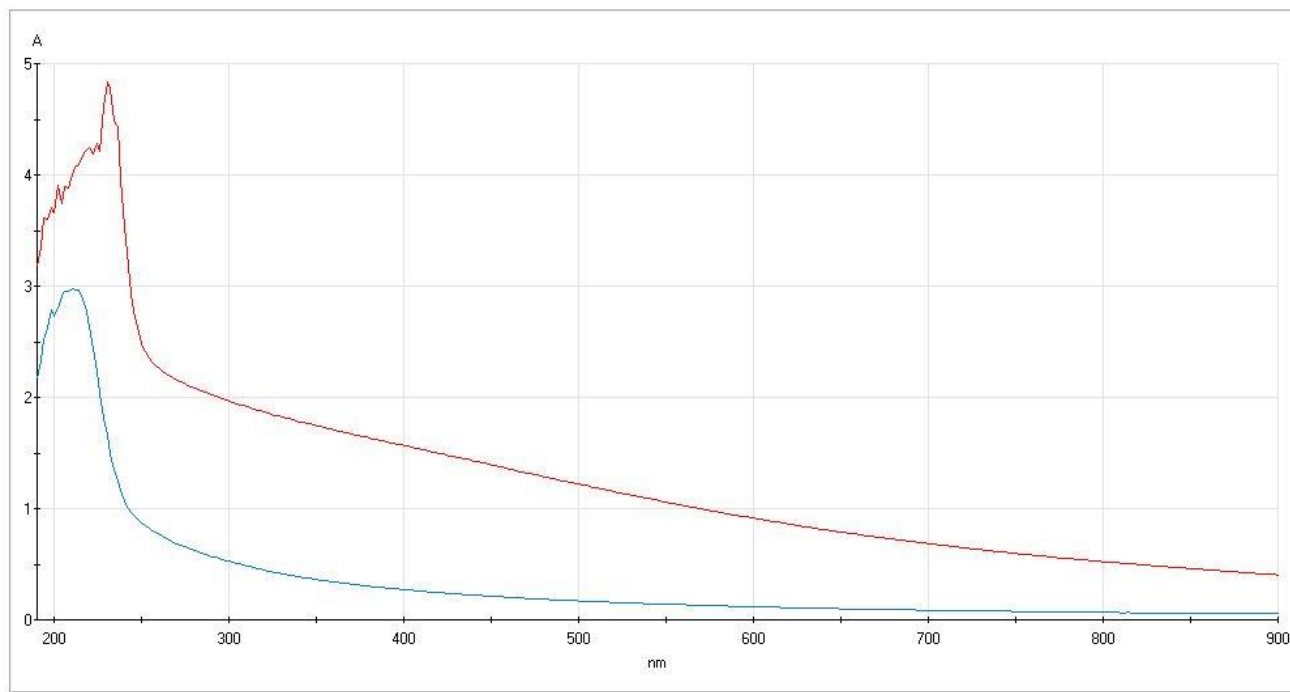


Figure 1. UV-Vis absorption spectra of samples PolyVivo AK030 (mPEG-PLGA, 5000 – 4000 Da) (lot# 191118RAI-B, ~25 mg/ml) (blue) and PolyVivo AK009 (mPEG-P(DL)La, 2000 – 2200 Da) (lot# 70207STR-C, ~25 mg/ml) (red) in DI water against water blank.

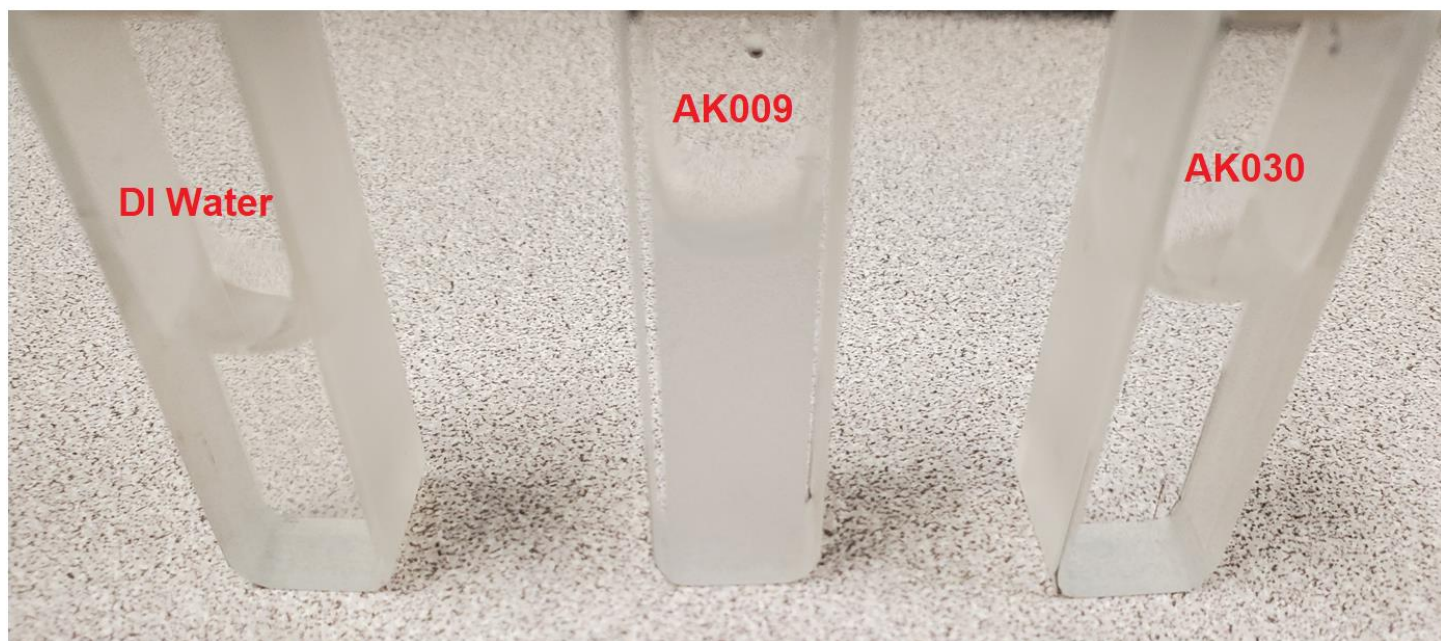


Figure 2. Visual image of filtered solutions in cuvettes.

Conclusion

AK009 solution passed through the 0.45 μm filter more successfully retaining more of its nanoparticulate ‘milky’ appearance which contributed to a non-specific light scattering across the entire spectrum while AK030 was largely removed in particulate form.

When detecting drug molecules using UV-Vis the natural UV-Vis absorbance of the polymer solution itself should be compensated for at higher frequency wavelengths (<300-400nm) or an alternate method such as High-Pressure Liquid Chromatography (HPLC) should be used to separate the solution first.