Method for Purification of Organic Water-Soluble Polymers and Monomers from Hydrophobic Contaminants

INVENTION BACKGROUND

There are several sources of hydrophobic contaminants in water-soluble polymers. The primary source is the monomer and compounds used in polymerization reactions. The secondary contamination may come from the polymer production processes and storage. Water-soluble polymers are commonly purified by methods such as dialysis and various variants of ultrafiltration. However, contaminants must be water-soluble in order to be removable from a polymer solution in this way. As a result, purified grades of polymers typically contain substantial amounts of hydrophobic contaminants. Simply, removal of hydrophobic contaminants represents a problem.

INVENTION SUMMARY

This invention was created based on a long-term research of inventors on the behavior of hydrophobic molecules in solutions of water-soluble polymers and monomers, especially their adhesion to polymers and mesoscale solubilization in aqueous solutions and mixtures. The release of hydrophobes from polymer chains reached by polymer ionization via pH adjustment is followed by their mesoscale solubilization in the form of nano- and submicron sized particles and droplets. These are stable over time, mechanically strong, and stable in shape. Given these properties, the size of the mesoscale objects and average sizes of polymer chains, the mesoscale structures comprising hydrophobic contaminants can be separated from polymers by filtration, based on a proper choice of filter pore sizes and pressures. An example realized on ionized poly(methacrylic acid) is shown in the figure comprising SPME GCMS elugrams and light scattering data on PMA solution before (red) and after filtration (green). In the case of monomer purification, the advantage is that hydrophobes do not adhere to monomers and hence the ionization step is not necessary.

STAGE OF PROTECTION

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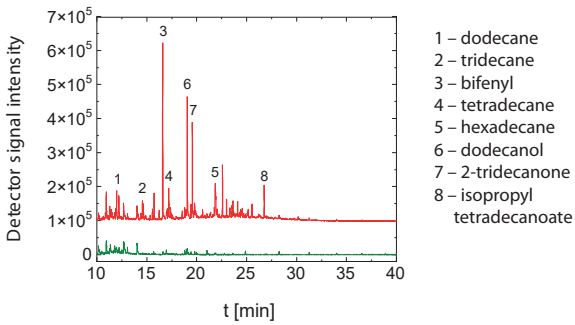
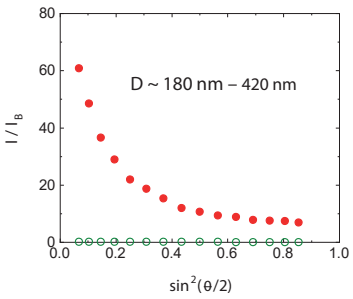
AREA OF APPLICATION

Purification of water-soluble polymers (neutral polymers, polyanions, polycations, pH-sensitive weak polyacids and polybases) and ionic and non-ionic monomers. For applications where purity is a must.

COMPETITIVE ADVANTAGE

- suitable for polymer contamination levels from 0.0005% to 0.1% of hydrophobic contaminants
- capable of reducing hydrophobic contaminants level below 0.0001%
- reprecipitation as an alternative method provides only a "rough purification" or a pre-purification
- reprecipitation, unlike our method, requires usage of expensive ultrapure organic solvents
- preparative chromatography as another alternative method is incomparably more expensive in terms of operational cost, equipment cost, and personnel cost





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