

Temperature-Responsive Aqueous Chromatographic System for Bioseparations

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Functional polymers that respond to small changes in environmental stimuli with large changes in their structure and properties are often called "intelligent" polymers. Research on functional polymers has been widely carried out, which is currently playing important roles in various fields, such as medicine and engineering. We have modified such polymers to material surfaces used for separation systems. Poly (*N*-isopropylacrylamide) (PNIPAAm), a temperature-responsive polymer was utilized as a chromatography column matrix modifier for novel chromatography in which only aqueous media are used as a mobile phase. The ability of the developed temperature-responsive chromatography system to separate solutes without using an organic solvent is advantageous from the point of view of maintaining the structure and activity of bioactive compounds. Recently, we designed and synthesized a new pH- and temperature-responsive copolymer, environmentally-responsive polymers, and grafted it onto aminopropyl silica beads. The products were evaluated as HPLC packing materials. These separation systems are based on a new concept that the property of the stationary phase surface is altered by external stimuli, such as the pH and temperature. This chromatography system utilizing the PNIPAAm copolymer is highly useful for the separation of bioactive substances, such as proteins and peptides, by controlling separation in the aqueous mobile phase with only temperature changes. This analytical system has characteristics for reducing organic waste because of an organic solvent is not used to separate solute. Therefore, this method is an environmentally friendly chromatographic system. In the future, the further applications in medical and pharmaceutical fields are expected.