Characterization of partitioning behaviors of immunoglobulin G in polymer-salt aqueous two-phase systems

ABSTRACT

The partitioning behavior of immunoglobulin G (IgG) in the aqueous two-phase system (ATPS) composed of poly(ethylene glycol) (PEG) and phosphate was studied. The parameters of ATPS exhibiting the pronounced effects on the partitioning behavior of IgG include phase composition, PEG molecular weight, and the addition of sodium chloride (NaCl). The accumulation of IgG at the interface of the ATPS increased drastically as the tie-line length (TLL) was increased. This trend was correlated with a linear relationship relating the natural logarithm of interfacial partition coefficient (ln G) to the difference of PEG concentration between the top phase and the bottom phase (Δ[PEG]), and a good fit was obtained. An attempt was made to correlate the natural logarithm of partition coefficient (ln K) to the presence of NaCl with the proposed linear relationship, $\ln K = \alpha'' \ln [Cl^-] + \beta''$. The proposed relationship, which serves as a better description of the underlying mechanics of the protein partitioning behavior in the polymer-salt ATPS, provides a good fit ($r^2 > 0.95$) for the data of IgG partitioning. An optimum recovery of 99.97% was achieved in an ATPS (pH 7.5) composed of 14.0% (w/w) PEG 1450, 12.5% (w/w) phosphate and 5.0% (w/w) NaCl.

Keyword: Aqueous two-phase system; Bioseparation; Immunoglobulin G; Protein recovery; Purification; Statistical mechanics