# Development of High-Performance Elution of Proteins Adsorbed in Multilayer onto Porous Hollow-Fiber Membrane with NaCl Aqueous Solution

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*Summary*

Both membrane chromatography and perfusion chromatography are based on similar principles that convective flow of a protein solution through the pores of a porous membrane and a porous bead, respectively, can minimize the diffusional mass-transfer path to the ligands immobilized on the pore surface. The membranes and beads have pore diameters ranging from 0.1 to 1 $\mu$ m.

In this study, the recovery of egg-white lysozyme at a high capacity was examined using cation-exchange porous membranes of a hollow-fiber form. Ionizable polymer chains grafted onto a porous hollow-fiber membrane are applicable to protein recovery based on electrostatic interaction. However, increasing the density of the ionizable group, e.g., sulfonic acid group, will enhance the extension of the graft chain from the pore surface toward the pore interior, resulting in the lowering of permeability. Ionic crosslinking of the graft chains by bivalent cations, e.g., $Mg^{2+}$, led to recovery of the permeability to overcome the trade-off between higher protein capacity and lower liquid permeability. The $SO_3H$-group-containing hollow-fiber membrane prepared here exhibited an equilibrium lysozyme capacity of 0.42 g per g of fiber, and an elution percentage of 100%. Since egg white originally contains Mg and Ca at a concentration of 0.005 and 0.015 M, respectively, ionic crosslinking by permeating egg white is applicable to purification of egg-white proteins.

We dealt with lysozyme dissolved in a buffer solution as a model solution of actual egg white. The egg white exhibits a viscosity of about fourfold that of the model solution. Therefore, in processing the egg-white protein using the modified porous hollow-fiber membrane, the operation in the crossflow mode is necessary so as not to reduce the permeability.