中国化学工程学报 2005 13 (1) 18-23 ISSN: 1004-0416 CN: 44-1063/R

SEPARATION SCIENCE & ENGINEERING

空间质量作用模型预测小分子离子交换平衡

陈宏伟[a]，王晓杰[a]，张志国[b]

[a] Department of Biochemical Engineering, School of Chemical Science and Engineering, University of Petroleum China (Beijing), Beijing 102249, China [b] Institute of Molecular Radiobiology, GSF, Ingolstaedtr. 1,D-85764 Neuherberg, Germany

[c] State Key Laboratory of Biochemical Engineering, Institute of Process Engineering, Chinese Academy of Sciences Beijing 100080, China

收稿日期 修回日期 网络版发布日期 接受日期

摘要 The steric mass-action (SMA) model has been widely reported in the literature for ion-exchange and metal-affinity interaction adsorption equilibrium of biomacromolecules. In this paper, the usefulness of SMA model is analyzed for describing micromolecule ion-exchange equilibrium onto cation exchangers, CM Sephadex C-25 and Streamline SP. Batch adsorption experiments with ephedrine hydrochloride as a model adsorbate are carried out to determine the model parameters, that is, steric factor, characteristic charge and equilibrium constant. The result shows that the SMA model parameters of micromolecule cannot be obtained using the nonlinear least-square fitting method as protein's due to the remarkable difference between the molecular mass and dimension of micromolecule and protein. It is considered that the small size of the adsorbates dealt with in this study justifies the neglect of steric hindrances arising from adsorbate bulkiness. Thus, the three-parameter SMA model is reduced to two-parameter one (i.e., steric factor is equal to zero) for describing micromolecule ion-exchange equilibrium. It is found that the equilibrium constant for CM Sephadex C-25 increases with increasing ionic strength, while the equilibrium constant for Streamline SP shows an opposite trend. This is probably due to the remarkable difference between the physicalpro perties of the two adsorbents. Then, the relationship between the equilibrium constant and ionic strength is described by an expression. The computer simulations show that, the theoretical model with the correlation is promising in the prediction of micromolecule adsorption decrease with increasing ionic strength in a wide range of salt concentration.

关键词 微分子，离子交换平衡模型，空间质量作用，SMA模式，色谱法，SMA模型

分类号

DOI:

Suitability of Steric Mass-action Model for Ion-exchange Equilibrium of Micromolecule

CHEN Weidong, WANG Tandong[a], SE Zhiguo[c]

[a] Department of Biochemical Engineering, School of Chemical Science and Engineering, University of Petroleum China (Beijing), Beijing 102249, China [b] Institute of Molecular Radiobiology, GSF, Ingolstaedtr. 1,D-85764 Neuherberg, Germany

[c] State Key Laboratory of Biochemical Engineering, Institute of Process Engineering, Chinese Academy of Sciences Beijing 100080, China

Received Revised Online Accepted

Abstract The steric mass-action (SMA) model has been widely reported in the literature for ion-exchange and metal-affinity interaction adsorption equilibrium of biomacromolecules. In this paper, the usefulness of SMA model is analyzed for describing micromolecule ion-exchange equilibrium onto cation exchangers, CM Sephadex C-25 and Streamline SP. Batch adsorption experiments with ephedrine hydrochloride as a model adsorbate are carried out to determine the model parameters, that is, steric factor, characteristic charge and equilibrium constant. The result shows that the SMA model parameters of micromolecule cannot be obtained using the nonlinear least-square fitting method as protein's due to the remarkable difference between the molecular mass and dimension of micromolecule and protein. It is considered that the small size of the adsorbates dealt with in this study justifies the neglect of steric hindrances arising from adsorbate bulkiness. Thus, the three-parameter SMA model is reduced to two-parameter one (i.e., steric factor is equal to zero) for describing micromolecule ion-exchange equilibrium. It is found that the equilibrium constant for CM Sephadex C-25 increases with increasing ionic strength, while the equilibrium constant for Streamline SP shows an opposite trend. This is probably due to the remarkable difference between the physicalpro perties of the two adsorbents. Then, the relationship between the equilibrium constant and ionic strength is described by an expression. The computer simulations show that, the theoretical model with the correlation is promising in the prediction of micromolecule adsorption decrease with increasing ionic strength in a wide range of salt concentration.

Key words micromolecule ion-exchange equilibrium steric mass-action model chromatography

通讯作者：
陈宏伟 wdchen@bjpeu.edu.cn
作者个人主页：陈宏伟[a]，王晓杰[a]，张志国[c]

扩展功能
本文信息
Supporting info
PDF(217.9KB)
DOI(10.5.2.1)(0KB)
关闭文献
服务与反馈
把本文推荐给朋友
加入收藏夹
加入引用管理器
问题反馈
Email Alert
文章反馈
浏览反馈信息
相关信息
本刊中 包含“微分子”的 相关文章
本文作者相关文章
陈宏伟
王晓杰
张志国
张志国
王晓杰