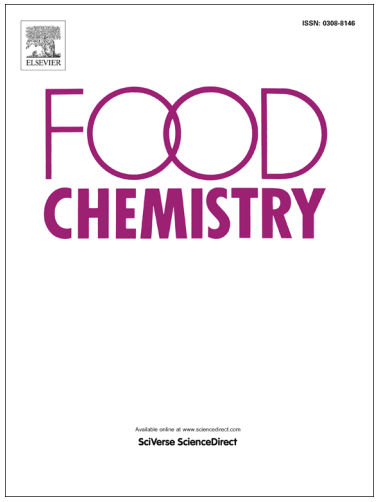

Efficient extraction of heavy metals from collagens by sulfonated polystyrene nanospheres

Yaotian Peng, Yi Shen, Moyan Ge, Ziyan Pan, Weiming Chen, Bin Gong

PII: S0308-8146(18)31680-7
DOI: https://doi.org/10.1016/j.foodchem.2018.09.111
Reference: FOCH 23598

To appear in: *Food Chemistry*

Received Date: 26 April 2018
Revised Date: 26 August 2018
Accepted Date: 18 September 2018

Please cite this article as: Peng, Y., Shen, Y., Ge, M., Pan, Z., Chen, W., Gong, B., Efficient extraction of heavy metals from collagens by sulfonated polystyrene nanospheres, *Food Chemistry* (2018), doi: https://doi.org/10.1016/j.foodchem.2018.09.111

Efficient extraction of heavy metals from collagens by sulfonated polystyrene nanospheres

Yaotian Peng,[a, b] Yi Shen[a,*] Moyan Ge,[a] Ziyan Pan,[a, b] Weiming Chen,[a] and Bin Gong,[a]

[a] School of Food Science and Technology, [b] School of Materials Science and Engineering, South China University of Technology, Guangzhou, 510640, China. E-mails 201530291627@mail.scut.edu.cn (Y. P.); 872447556@qq.com (M. G.); 201530291603@mail.scut.edu.cn (Z. P.), 201563381128@mail.scut.edu.cn (W. C), 201520120227@mail.scut.edu.cn (B. G) and feyshen@scut.edu.cn (Y. S.) Tel./fax: +862087113843;

Abstract

This work reports the feasibility of utilizing sulfonated polystyrene nanospheres (SPS NSs) to extract heavy metals from collagen solutions. We have endeavored to present a detailed study on the adsorption characteristics and mechanism of heavy metals including Pb^{2+}, Mn^{2+}, Cr^{3+} and Cd^{2+}. The adsorption isotherms were fitted by the Langmuir and Freundlich models while the adsorption kinetics data were described by the pseudo-first-order, pseudo-second-order and intraparticle diffusion equations. The adsorption isotherms were better fitted by the Langmuir model, leading to theoretical maximum capacities of 50.7, 15.0, 8.7 and 39.0 mg g^{-1} for the adsorption of Pb^{2+}, Mn^{2+}, Cr^{3+} and Cd^{2+}, respectively. Isothermal titration calorimetry (ITC) measurements were conducted to detect the heat exchange of the adsorption processes. As a proof of concept, SPS NSs were practically applied in sequestrating heavy metals from Talapia-fish-scale derived collagen. The effects of pH of the collagen solutions in the removal of metals were investigated. By a single treatment, the concentrations of the metal ions were decreased to the regulatory standards whilst the concentration of collagen proteins was well maintained.

Keywords: *Heavy metals; collagens; competitive adsorption; isothermal titration calorimetry; adsorption isotherms; protein purification*