

Size-selective purification of hepatitis B virus-like particle in flow-through chromatography: Types of ion exchange adsorbent and grafted polymer architecture

*Hon Wei Ng¹ Micky Fu Xiang Lee¹ Gek Kee Chua² Bee Koon Gan^{3,4}
Wen Siang Tan^{3,4} Chien Wei Ooi¹ Siah Ying Tang¹ Eng Seng Chan^{1,5} Beng Ti Tey^{1,5}*

¹Chemical Engineering Discipline, School of Engineering, Monash University Malaysia, Selangor, Malaysia

²Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Pahang, Malaysia

³Department of Microbiology, Faculty of Biotechnology and Biomolecular Sciences, Universiti Putra Malaysia, Selangor, Malaysia

⁴Institute of Bioscience, Universiti Putra Malaysia, Selangor, Malaysia

⁵Advanced Engineering Platform, Monash University Malaysia, Selangor, Malaysia

ABSTRACT

Hepatitis B virus-like particles expressed in *Escherichia coli* were purified using anion exchange adsorbents grafted with polymer poly(oligo(ethylene glycol) methacrylate) in flow-through chromatography mode. The virus-like particles were selectively excluded, while the relatively smaller sized host cell proteins were absorbed. The exclusion of virus-like particles was governed by the accessibility of binding sites (the size of adsorbents and the charge of grafted dextran chains) as well as the architecture (branch-chain length) of the grafted polymer. The branch-chain length of grafted polymer was altered by changing the type of monomers used. The larger adsorbent (90 μm) had an approximately twofold increase in the flow-through recovery, as compared to the smaller adsorbent (30 μm). Generally, polymer-grafted adsorbents improved the exclusion of the virus-like particles. Overall, the middle branch-chain length polymer grafted on larger adsorbent showed optimal performance at 92% flow-through recovery with a purification factor of 1.53. A comparative study between the adsorbent with dextran grafts and the polymer-grafted adsorbent showed that a better exclusion of virus-like particles was achieved with the adsorbent grafted with inert polymer. The grafted polymer was also shown to reduce strong interaction between binding sites and virus-like particles, which preserved the particles' structure.

KEYWORDS: adsorbents; anion exchange chromatography; flow-through chromatography; hepatitis B virus-like particles; size-selective adsorption