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New platform of bio-based reactions for simple and rapid purification of biopharmaceuticals

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A variety of antibody-based medicines have been approved in recent years. These products have high annual returns due to their high selectivity toward their target antigens, relatively low levels of side effects, and stability in vivo; in addition, these medicines can be produced using standard cell culture procedures. To obtain a high-quality antibody medicine at low cost, it is necessary to select highly productive cells, optimize the culture conditions, and develop an efficient purification method. To evaluate the productivity of a system for biosynthesis of an antibody, especially of the immunoglobulin G (IgG) subtype, Protein A–immobilized chromatography is often employed for selection and optimization of the cell culture. In order to process a large number of samples, it is necessary to perform rapid optimization using high-throughput chromatography. However, for currently available separation media, elution throughput is often limited, resulting in inefficient optimization of purification and productivity. Therefore, there is an urgent demand for new separation media that could facilitate higher throughput and lower cost. In this study, we developed a spongy-like porous polymer (spongy monolith) consisting of poly (ethylene-co-glycidyl methacrylate) with continuous macropores that allowed efficient in situ reaction between the epoxy groups and proteins of interest. Immobilization of Protein A on spongy monolith enabled high-yield collection of immunoglobulin G (IgG) from cell culture supernatant even at high flow rate. In addition, immobilization of pepsin on spongy monolith enabled efficient online digestion at high flow rate. We believe that this new platform will be useful for variety of protein-based reactions with rapid flow rates and low costs. Additionally, the platform can be easily scaled up, and we anticipate that future efforts will contribute to purification of antibody-based medicines including biosimilars at the plant level.

Biography

Takuya Kubo is an Associate Professor of Department of Material Chemistry, Graduate School of Engineering, Kyoto University. He received his PhD from Kyoto Institute of Technology in 2004. He joined the Graduate School of Environmental Studies, Tohoku University as an Assistant Professor (2004–2012) and worked at Department of Chemistry, Portland State University as a Visiting Professor (2010). He joined the Graduate School of Engineering, Kyoto University as an Associate Professor (2012). His research interests include the development of novel materials having molecular recognition ability for selective separation and functional porous materials for novel separation media.

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