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Born 1974; **Qualification:** MSc (Chemistry), Okayama University (2004); Doctor of Science/D.Sc (Chemistry), Okayama University (2007), JSPS Postdoctoral Research Fellow, Nagoya University (2010-2012). **Positions:** Head of Analytical Chemistry Laboratory, Faculty of Science, Brawijaya University (2012-present), Head of Research Center for Advanced System and Material Technology (ASMAT), Brawijaya University (2013-present).

My Research Interest: Flow-based System for Analytical and Bioanalytical Chemistry

The main objective of my scientific efforts is to create novel technologies and methods for advanced chemical analysis. Therefore, my research is focused on (a) detection reaction by developing highly sensitive and selective analytical reagents, (b) separation chemistry by developing solid phase extraction (SPE) using a biomass (i.e chitosan), and also organic polymer-based monoliths which are aimed for eliminating matrix complexity in analytical samples as well as for chromatographic separation, (c) automation system by developing flow-based analytical system such as flow injection analysis (FIA), sequential injection analysis (SIA), and automated-pretreatment system (APS), and (d) instrumental analysis by developing hyphenated system for example HPLC-ICP/MS system, APS-ICP/AES, capillary flow focusing nebulizer (CFFN) as a new interface for coupling HPLC or FIA with spectroscopic detection system.

In the field of flow analysis a set of new and modified calibration methods have been proposed with the use of dedicated flow systems [1-7]. For example, I have been successfully developing laboratory-assembled Automated Pretreatment System (APS) by combining the benefits of FIA and SIA system [8-14]. Then, the developed SPEs is utilized as on-line collection/preconcentration device, which is installed into the Automated Pretreatment System. By coupling with spectroscopic detection, it offered highly performance, fully automated and powerful analytical tool for the separation, the collection/concentration and the determination of trace- and ultratrace-elements in environmental samples in a short time. In comparison to the commercially available flow-based system (FIA and SIA), the Automated Pretreatment System is more robust and versatile, which is characterized by the use of discrete volumes, variable-flow conditions throughout the analytical cycle, ease-to-use, and simple operation. More importantly, the novel SPEs developed in combination with the newly automated pretreatment system established, satisfied the requirement for the improvement of selectivity, sensitivity, precision, accuracy, rapidity, and reproducibility in advance analytical chemistry.

I am also involved in development of new analytical procedures for separation and accurate detection of biomolecules through the development of organic polymer-based monoliths coupled with chromatographic system. The addition of monolith columns as stationary phase on HPLC system has been proven to improve the performance of the system, since monolith possesses a number of advantages over conventional packed-column. Uniformity of bed with no end frits, higher permeability and the ability to design to desired length are the main advantages of monolithic stationary phase. These monoliths, installed into HPLC as well as HPLC-CFFN-ICP/MS system, are applied to separation and quantification of single strand DNA, double strand DNA, methylated DNA, single nucleotide polymorphism (SNP), oligonucleotide, protein, phosphopeptide by employing methacrylate-based monolithic columns installed into HPLC as well as HPLC-CFFN-ICP/MS system. By using this current system, the study on bio-elementomic/ metallomics will be much improved [15-20].

For example, we have so far prepared a reverse phase monoliths of poly(lauryl methacrylate-co-ethylene dimethacrylate) (poly(LMA-co-EDMA)) inside microbore column [16,19]. This monolith allows rapid separation of ten common proteins such as aprotinin, ribonuclease A, insulin, cytochrome c, trypsin, transferrin, conalbumin, myoglobin, β-amylase, and ovalbumin on the time scale of seconds using a linear CH_3CN gradient elution. We also successfully prepared anion exchange monoliths inside 1.0 mm i.d column for the separation of DNA samples [20]. The separation of DNA samples becomes very important recently, since DNA analysis has been widely applied to the diagnosis of various diseases. In this work, epoxy-containing monolithic matrix was synthesized by *in situ* copolymerization of glycidyl methacrylate (GMA) with ethylene dimethacrylate (EDMA) in the presence of a ternary porogenic mixture of 1-propanol, 1,4-butanediol, and water inside a silicosteel tubing. The applicability of this monolith is demonstrated

through the separations of 20 bp DNA ladder, 100 bp DNA ladder, and pBR322 Hae III digest. To the best of our knowledge, capillary electrophoresis (CE) was mainly used for these separations. However, it is still a challenge to separate 123 bp and 124 bp fragments in pBR322 Hae III digest using CE and RP-HPLC. This problem have been successfully solved by our monolith by providing a good potential for precise chromatographic separations of a variety of sized DNA fragments mentioned above. Furthermore, oligodeoxythymidylic acids (dT_{10} – dT_{30}) could be separated efficiently within 12 min at pH 8. No need for ion pairing reagent and organic solvent are another great advantage of our anion- exchange mode HPLC.

Recently, we prepared weak anion exchange monolith inside a silicosteel tubing with the inner diameter 0.5 mm i.d, which is smaller than those used by our previous work [20], in which a 1.02 mm i.d column was used. The difference in column diameter was greatly affects the physical properties of the prepared monolith, such as porosity, permeability, and homogeneity. Small diameter monolith column was expected to possess several advantages over large one, including high sensitivity especially for biological samples in small quantities, low sample and low reagent consumption, make it more efficient and also environmentally friendly. While large diameter monolith columns are less homogeneous, not only because of the unequal heating across the tube diameter but also because of the growing gravitational settling effect during the exothermic polymerization process. Interestingly, this work is capable to perform separation of DNA fragments using a simple linear gradient elution. A linear gradient elution method is easy as DNA fragments are eluted during a linear increase of salt concentration. This method does not require a complicated setup, as often happened in step gradient elution mode. The monolithic column fabricated in this work has promising potential for separation of other DNA samples, such as DNA methylation and single nucleotide polymorphism (SNP). Both DNA methylation and SNP are a biomarker for early detection of certain types of diseases [21].

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