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Klaus K. Unger, Nobuo Tanaka, and Egidijus Machtejevas

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Preface

One of the most prominent drivers in the field of separation science and technology is the search for novel and efficient materials as adsorbents to improve the mass transfer kinetics and to allow fast separations. While the major attention was directed to provide particle packed columns with smaller and smaller particles the idea to develop continuous beds based on silica monoliths was pioneered by Professor N. Soga and K. Nakanishi from Kyoto University, Japan, utilizing the template approach. It was a milestone in the development of silica monoliths when both researchers (NS and KN) had the splendid idea to introduce them as continuous beds in High Performance Liquid Chromatography (HPLC). In close collaboration with Professor K. Nakanishi, Dr Minakuchi and one of our co-editors (NT) performed the synthesis of such columns for HPLC. However, there was a serious limitation to apply monolithic silicas in 4 and 4.6 mm I.D. column format as the shrinkage of silica calling for a leak-tight and pressure stable cladding. This problem was finally solved by researchers (Dr K. Cabrera and Dr D. Lubda) from Merck KGaA, Darmstadt, Germany.

When my research group (KKU) became access to research samples from Merck, Darmstadt, at the mid of 1990s we were fascinated by the potential of silica monoliths as continuous beds in HPLC due to their flexibility in adjusting and controlling the morphology, pore structure and surface chemistry and thus enabling to optimize the chromatographic performance parameters. The second-generation monolithic silica columns just appearing seem to provide much higher performance than the first-generation columns commercialized in 2000.

The focus of Professor Tanaka’s group was the preparation and improvement of monolithic fused silica capillaries to generate high efficiency columns and to compare them with particle packed fused silica columns.

Professor Tanaka and Dr E. Machtejevas both could demonstrate the potential of such columns in various life science applications such as proteomics and peptidomics using multidimensional HPLC/MS.

After almost twenty years of extensive research and development in the field the three authors (KKU, NT and EM) became convinced that it is time to review the work under the various aspects of separation science.

The authors are jointly indebted to the division of performance and life science chemicals of Merck KGaA, Darmstadt, Germany, for the generous support and