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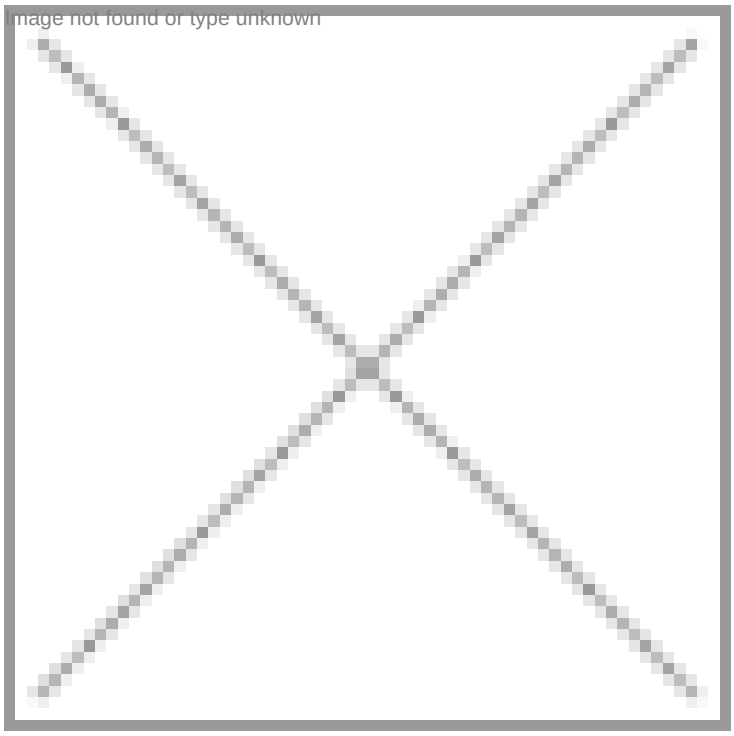

LC, the Widely Accepted Chemical Analysis Technique

—Madhu Nayak, business development manager, Life Sciences, GE Healthcare

Chromatography is a family of separation techniques in which a mixture dissolved in 'mobile phase' is passed over a 'stationary phase' which separates the analyte to be measured from other molecules in the mixture. In liquid chromatography the mobile phase is a liquid and the fixed phase is in a column or a plane.
Chromatography began to take its modern form following the work of Martin and Synge in the 1940's and 1950's. Up to the mid-1970's most chemical separations were carried out using a variety of techniques including open-column chromatography, paper chromatography and thin layer chromatography, these were not easily quantifiable and also lacked resolution. High performance liquid chromatography (HPLC) was introduced in the mid-1970's and rapidly improved with particle chemistry performance and the conveniences of online detectors. In the early 1980's two Swedish manufacturers launched biocompatible LC systems that overcame the difficulties of working with biological material.
In 1981, Pharmacia Biotech launches the fast protein liquid chromatography (FPLC) system, a completely new concept for chromatographic protein separations on a laboratory scale. Today, the HPLC and FPLC techniques are widely used in biotechnological, biomedical and biochemical research as well as in the pharmaceutical industry. Newer applications extend into energy, food, cosmetics and environmental industry.

New developments
The design and development of newer chromatographic matrices and sub-2 micron particles are a significant challenge. Using ultra performance liquid chromatography (UPLC), it is now possible to take full advantage of chromatographic principles to run separations using shorter columns packed with 1.7 to 1.8 micron particles for increased speed, superior resolution and sensitivity. UPLC combined with mass spectrometric detection (UPLC-MS) is used widely in the bioanalysis of

small molecule drug candidates in plasma. UPLC-MS has shown to increase sample throughput by reducing run times over three-fold without compromising on sensitivity or resolution. Some vendors, the leaders being Waters, Agilent and Shimadzu, report more than 10-fold faster separations for some samples. UPLC or HPLC is projected to be the fastest growing segment of LC. Over the next five years UPLC or HPLC is expected to produce a compounded annual growth rate of nearly 10 times than that of conventional LC.

Chromatography matrices

The enlarged family of LC, besides normal and reverse phase, includes gel permeation, gel filtration, desalting, ionexchange, affinity, hydrophobic interaction, chromatofocusing, chiral, etc. each making use of a particular physicochemical property of molecules to bring about separation. Newer stationary matrices allow applications for tagged, high-throughput, refolding proteins and antibodies with or without a system for the purification. Polymer based matrices score over silica- based matrix on its wider operating range of pH particularly for peptide separations.

The world's first gel filtration medium, Sephadex was first invented in Uppsala, Sweden in 1957 and in 1960 it was launched by Pharmacia as a commercial medium for chromatography. Now GE Healthcare has the world's largest installed capacity for the production of chromatography media, with an annual capacity of 4,50,000 liters and/or kilograms.

Future

Disposable solutions enable lean production schemes by eliminating waste activities in daily routine. This plug and play concept is especially apt for multi-product production facilities. In this concept, comes the newly launched AKTAready, a LC system designed for process scale-up and production for phase I–III drug development and full-scale production to good laboratory practices (GLP) and good manufacturing practice (GMP) standards.

The spread of the technology to new segments of users is the primary driver for the liquid chromatography market, its market revenues is estimated to cross $2 billion by 2012. LC has played a significant role in the life sciences revolution, particularly in protein purification, peptide fractionation and sequencing, amino acid analysis and DNA sequencing. Very small chip-based systems may in the future change how chemical analysis in biology, medical research and healthcare evolve over the next 10-15 years.