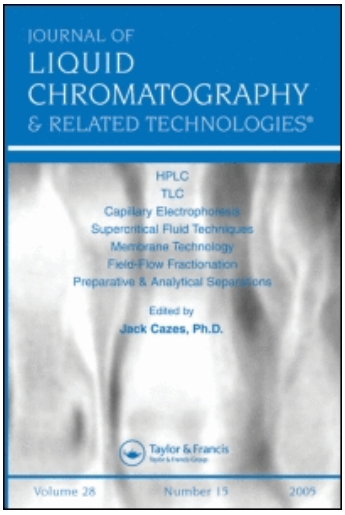

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Introduction

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INTRODUCTION

This is the fourth special issue dealing exclusively with countercurrent chromatography (CCC) and all the four issues are published in the Journal of Liquid Chromatography. The purpose of publishing special issues is to consolidate all papers on a subject so that readers will have an opportunity to read all the papers in one place and this in turn will provide help in measuring progress in the present state of the art in this field.

When the first issue was published six years ago, CCC was just emerging. It soon caught the attention of many chromatographers because of its novel technique which is based on the liquid-liquid partition principle. Therefore, it is different from the other forms of chromatography which contain a solid support for the stationary phase. In any two phase system selected for CCC, one liquid phase serves as a stationary phase and the second phase is used as a mobile phase. There is no limitation on the size of the molecules for separation. In other words, separations can be achieved from small, medium to very large molecules such as biopolymers. Even cells, organelles and particles can be separated by CCC.

Prior to the publication of the first special issue, only two commercial instruments were available. They were the droplet countercurrent chromatograph (DCCC) and the rotation locular countercurrent chromagraph (RLCC). Several papers, especially in the field of natural products and biopolymers, were published with the use of either the commercial instruments or the prototypes, thus demonstrating the usefulness of the CCC method. However, many chromatographers were skeptical of this technique because of the cumbersome nature of the partition systems (especially droplet formation which is critical in DCCC and the limitation on the solvents for droplet formation). Additionally, the separation times were very, very long (from several hours to a couple of days).

After the first issue, new developments in instrument technology took place and high speed countercurrent chromatographs were constructed. Several prototypes were built and many reports appeared demonstrating the usefulness (or application) of these new instruments. These prototypes, some of which are now commercially available, increased the efficiency of the separation and reduced the separation time from several hours to a few minutes. Today most CCC separations can be achieved in about an hour. In a majority of the cases the separations can be accomplished within 30 minutes. These advances made the CCC

separations comparable to those of HPLC and therefore made the CCC truly complimentary to HPLC. As advances continue to progress, investigators explored coupling the CCC with powerful detection systems such as the Fourier-transform infrared spectrophotometer (FT-IR) and the mass spectrometer (MS). Additionally, detectors that are used for HPLC are found to be equally applicable to CCC. This is because the eluent (or the effluent) from the CCC column is monitored in the same way as that coming from the HPLC column.

Although great strides have taken place, CCC technology is still in the stage of infancy, especially with respect to the automation part of the chromatographic operation. Because of ease of operation due to automation, liquid and gas chromatographic operations are being performed by several scientific disciplines without knowledge of the theory behind chromatography. Contrary to this, the chromatographer working on CCC has to make virtually all the chromatographic operations manually. Perhaps, that is the reason this technology has not become popular eventhough many realize the potential for CCC. To use CCC as a tool for separations on a routine basis, automated technology needs to be implemented, so that any user (novice) can use it routinely (must be equipped with automatic injector, and built in pumps, solvent reservoir, detection systems and strip chart recorder with integrating capabilities). Only with such automation can CCC find wide markets. This can be achieved by companies who want to market CCC on a large (mass) scale. Until such time it will remain as a custom-made instrument which will have only a limited market. We hope to see progress in the commercialization of CCC in the next few years.

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