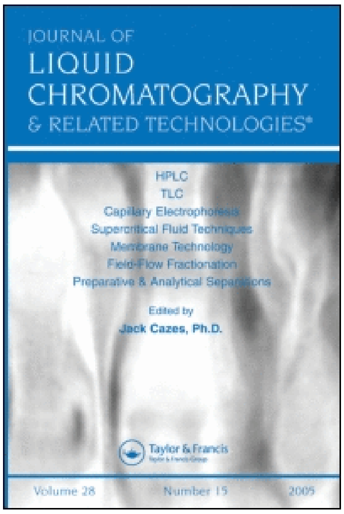

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Introduction

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INTRODUCTION

The technology of countercurrent chromatography evolved from Dr. Yoichiro Ito's observation that two immiscible liquids flowing countercurrently in a helical tube, which is rotating in an acceleration field, become uniformally segmented in the coils of the helix (1). Separation of both soluble and particulate samples was demonstrated. Though tedious and limited to microgram samples, the value of the technique was immediately acknowledged by the commercial development of an instrument called the coil-plant centrifuge by Sanki Engineering, Ltd. (Japan).

In the late 1960's, as a member of the Laboratory of Technical Development at the National Institutes of Health (Bethesda, MD), directed by Dr. Robert Bowman, Dr. Ito began a systematic program to design and evaluate an extensive series of separation devices, often in collaboration with Dr. Bowman and others at NIH. With exception of droplet countercurrent chromatography, coinvented by Drs. Tanimura and Ito (2), and locular countercurrent chromatography (3), the instruments are based on a helical coil which is acted upon by either a gravitational or centrifugally induced acceleration field. Aside from their mechanical features, the devices may be classified on the basis of the cyclic variation in the direction and intensity of this field relative to the coil. The more recently designed chromatographs incorporate an ingenious flow through

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system which permits high speed rotation of the coil without kinking of the flexible influent and effluent lines, thereby avoiding the need for an often troublesome rotating fluid seal.

The process of countercurrent chromatography is essentially liquid-liquid chromatography in which the stationary liquid bed is retained in the column by an acceleration field rather than by a solid supporting matrix. Adsorption effects are thereby eliminated. The technique is particularly advantageous in the preparative (mg to g) range for polar and labile organic compounds and bio-particulate materials such as cells and cell fragments. Virtually any two-phase solvent system, either aqueous or nonaqueous, may be employed and some apparatus is particularly useful for the two-phase aqueous polymer systems developed by Albertsson (4).

The novel contributions of Dr. Ito's research to the development of chromatography include use of the helical coil as a chromatographic column, development of flow-through systems for rotated components not requiring rotating seals, and use of acceleration fields varying cyclically in both intensity and direction as a means for obtaining rapid phase separation while promoting efficient mass transfer. The reader is encouraged to consult recent reviews for detailed discussion of the features of individual countercurrent chromatographs and of the historical development of the methodology (5,6,7).

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