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### CCC 2004-Tokyo, the Third International Conference on Countercurrent Chromatography

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## CCC 2004–Tokyo, the Third International Conference on Countercurrent Chromatography

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**Abstract:** The scientific content and the attendance at the second international conference on countercurrent chromatography, CCC 2004, held in Tokyo, Japan, August 28–31, are presented. The major events, scientific, as well as social, are described. CCC 2004 marked the 40th anniversary of Dr Ito's research activity in the field. The next CCC symposium will be held in the USA in 2006.

**Keywords:** Countercurrent chromatography, Symposium report

This special issue of the *Journal of Liquid Chromatography & Related Technologies* is dedicated to the memory of Fang-Te Edward Chou, the founder of the Pharma-Tech CCC Company, which heavily supported the venues of all symposia of the CCC series and could not participate to this one. He passed away on October 6th, 2004. He had been an ardent international ambassador for the technology and his contribution is greatly responsible for where the CCC technology is today. All articles in this special issue are dedicated to his memory. Thanks, Ed, we miss you.

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## INTRODUCTION

Countercurrent chromatography is a variation of liquid chromatography in which the stationary phase is a support-free liquid.<sup>[1]</sup> Biphasic liquid systems are used. The column content is made up with the liquid mobile phase and the liquid stationary phase and nothing else. The challenge is to maintain the liquid stationary phase when the liquid mobile phase is flowing through. Centrifugal forces are used. Since the solute has access to the whole volume of the liquid stationary phase, which can be as high as 90% of the column volume, the technique is mainly preparative. The presentation of new, modern large scale CCC devices based on both the hydrodynamic (two axes of rotation and coiled tubes) or hydrostatic schemes (a single axis of rotation and channels), was the principal feature of the Tokyo symposium.

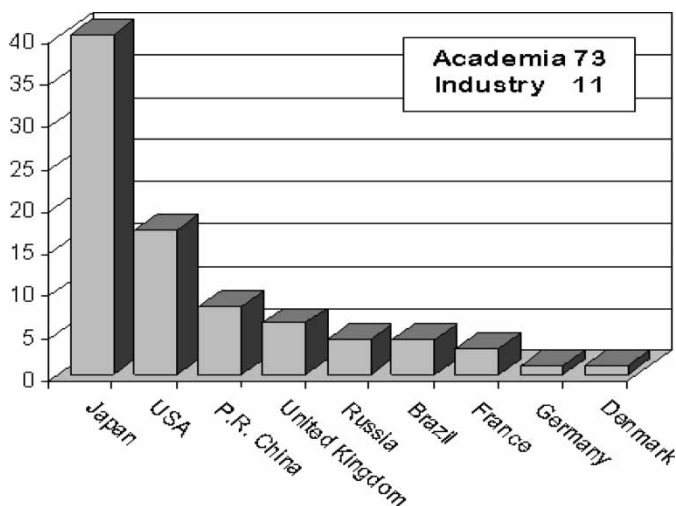
CCC 2004 is part of a symposium series dedicated to the technique. CCC 2000 was the first venue of the series, held in London in September 2000 and chaired by Ian Sutherland.<sup>[2]</sup> Edward Chou contributed generously to the symposium budget. He helped, again, for the second symposium held in Beijing in 2002 and chaired by TianYou Zhang.<sup>[3]</sup> In Beijing, the CCC International Committee agreed on the candidacy of Dr. Hisao Oka to organize the next international CCC symposium in 2004 in Tokyo. Japan is the native homeland of Yoichiro Ito, the founder of the technique. It was selected as the appropriate place to hold CCC2004, as the conference marks the 40th anniversary of Dr Ito's research activities in CCC that started in 1964<sup>[4]</sup> with the first landmark article published in Nature in 1966.<sup>[5]</sup>

CCC 2004 was successfully organized by a local committee chaired by Pr. H. Oka and co-chaired by Pr. H. Nakazawa and Dr. Y. Shibusawa. The major facts and figures of this event are reported in this article. This special issue gathers works that were presented in Tokyo, and is fully dedicated to the memory of Fang-Te Edward Chou who generously sponsored this venue but was not able to participate personally.

## CCC 2004

### Attendance

Eighty four scientists attended the symposium. The London and Beijing attendances were, respectively, 100 and 65 people. The low attendance in Beijing was clearly attributed to the flight problem due to the post 9/11 event in the USA. Figure 1 shows that 17 US scientists participated in CCC 2004 (only 3 US attendants in China in 2002). Naturally, the organizing country sent the most delegates. However, the international diversity of the attendance already observed in London and Beijing is preserved. An important point is the increased number of people coming from industry



**Figure 1.** The international diversity of the CCC 2004 attendance in Tokyo.

(11 people, a 120% increase compared to the 5 industrial attendants in Beijing). It shows that the future of CCC is in industry. Once the industrial world realizes the tremendous potential of the technique in chemical and biochemical separations and purifications, the instrument companies will invest and develop reliable devices and insure the CCC becomes established.

It is interesting to detail the origins of the academic attendants. Thirty-two came from colleges or departments of pharmacy, 18 came from engineering and/or analytical chemical institutions, 14 came from biochemistry, and 9 came from phytochemistry and plant study groups.

### Scientific Content

During the four days of the symposium (August 28–31, 2004), eleven sessions of plenary lectures and talks were organized on the subjects listed in Table 1. Nine posters were also displayed during the symposium. All the articles included in this special issue were presented in Tokyo.

### Scientific and Social Events

CCC 2004 had presentations that proved that the knowledge and understanding of the liquid exchanges in both hydrodynamic and hydrostatic CCC devices is steadily improving. Dr. Ito opened the symposium with a lecture on the history of the technique that he invented. Next, he demonstrated his

**Table 1.** Subjects and Chairmen of the CCC 2004 Sessions

Session	Subject	Chairmen
1	Instruments	E. Kitazume
2	Two-phase solvent systems	T.Y. Zhang
3	Methodology	R. Margraff
4	Theory	A. Berthod; W.D. Conway
5	Optimizing CCC conditions	Y. Ma
6	Natural products	G. Leitao; X. Cao
7	Industrial scale-up of CCC	T. Maryutina; P. Wood
8	Related technologies	T. Sookkumnerd; T. Okada
9	Bioactive compounds	J.T. Hsu; G.F. Pauli
10	Hyphenated CCC	G. Harris
11	pH-zone refining CCC and other applications	I.A. Sutherland

great involvement by presenting new separation methods, such as precipitation chromatography and the spiral disk CCC. Berthod presented the elution-extrusion CCC, a new way to use the liquid nature of the stationary phase to speed-up separations. Harris used this method to study antifungal compounds. The Chicago CCC group of Pauli gave some excellent talks on simplifying CCC separation approaches, estimating solvent properties, and separating natural mixtures. The British school from Brunel University presented fundamental studies on hydrodynamic liquid motion and retention, and scaled-up preparative systems.

Several talks dealt with the separation of biologics (e.g., proteins, DNA, cells) and/or natural products (e.g., plant extracts, catechins, terpenes) using a variety of solvent systems, including the polar/polar and aqueous two-phase systems (ATPS). Theoretical models were presented to predict liquid-liquid equilibria, distribution coefficients, and dielectric constants. Several talks demonstrated that coupling CCC with mass spectrometers is possible.

Very important talks were given on scaling up the technique. Three European groups are independently working on large scale devices. Sutherland presented a reliable 4.6-liter hydrodynamic instrument developed in England. He also described the 25-litre hydrostatic instrument developed by Foucault, Legrand, Marchal, and Couillard in France. This offered a new way of alternating ascending and descending modes that would produce a real moving bed for continuous separation of a binary mixture. Margraff described a new 25-liter hydrostatic device designed for the kilogram scale production and also developed in France.

Dr. Oka led groups to tour the research laboratories at the Hoshi University, Department of Pharmaceutical Science, where the symposium took place.

**Table 2.** The CCC International Committee

Name	Country	Institution
Alain Berthod	France	CNRS, Université de Lyon 1
Xueli Cao	China	Beijing Technol. Business University
Walter Conway	USA	Conway Centrichrom Inc., NY
Alain Foucault	France	GEPEA, St Nazaire
Guy Harris	USA	Merck Research, Rahway, NJ
Kurt Hostettmann	Switzerland	Université de Lausanne
Yoichiro Ito	USA	National Institute of Health, MD
Eiichi Kitazume	Japan	Iwate University, Iwate
Gilda G. Leitao	Brazil	Universidade Federal de Rio de Janeiro
Garye Lye	UK	University College, London
Tatiana Maryutina	Russia	Russian Academy of Sciences, Moscow
Hiroyuki Nakazawa	Japan	Hoshi University, Tokyo
Hisao Oka	Japan	Aichi Prefectural Institute of Health
Guido Pauli	USA	University of Illinois at Chicago, IL
Kazufusa Shinomiya	Japan	Nihon University, Chiba
Ian Sutherland	UK	Brunel Institute of Bioengineering
Peter Winterhalter	Germany	Institute of Food Chemistry, Braunschweig
Tianyou Zhang	China	Beijing Institute of New Technologies

## FUTURE SYMPOSIUM VENUES

The attendance and venue of CCC 2004 has confirmed that the CCC technique is mature enough for a useful and viable symposium to be held every two years. In a tradition established by Ian Sutherland in London, the international CCC committee met to decide the location of the next CCC symposium (Table 2). There were two proposals to organize CCC 2006: Rio de Janeiro (Brazil) presented by Dr. Leitao and Philadelphia (USA) presented by Pr. Pauli with the support of Dr. Ito. It was finally agreed that CCC 2006 will be organized by a US committee in the last week of July 2006, so that it can be associated with the 47<sup>th</sup> ASP symposium (American Society of Pharmacognosy) held in Baltimore in the same week. The committee also agreed that CCC 2008 will be held in Brazil (Rio de Janeiro) and CCC 2010 in Europe.

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