

## 相分離混相流を利用したキャピラリークロマトグラフィーにおける理論段相当高さからの考察

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Consideration of capillary chromatography based on phase separation multi-phase flow from height equivalent to a theoretical plate (Faculty of Science and Engineering, Doshisha University) ○MATSUSHITA, Chihiro; SUGAWA, Yuki; OGAWA, Kazuhiro; TUKAGOSHI, Kazuhiko

Two-phase separation mixed solutions undergo phase separation due to changes in temperature and/or pressure in a batch vessel, providing the upper and lower phases. On the other hand, when they are delivered into a microspace, phase separation occurs, where multi-phase flows such as a droplet, a slug, and an annular flow can be observed. This is called phase separation multi-phase flow. Especially, annular flow of the mixed solution is called TRDF (tube radial distribution flow) based on the distribution of solvent molecules to tube diameter direction.

We have proposed and developed a capillary chromatography using TRDF (tube radial distribution chromatography; TRDC). In TRDC, in the annular flow generated under laminar flow conditions, the inner phase serves as the mobile phase, and the outer phase serves as the pseudo-stationary phase. In this study, (1-naphthol + 2,6-naphthalenedisulfonic acid) mixed solution as a model sample was mainly analyzed on TRDC using fused silica capillary and water/acetonitrile/ethyl acetate mixed solution. The height equivalent to a theoretical plate was calculated from the chromatogram obtained by changing the analytical conditions such as capillary inner diameter, capillary inner wall characteristics, flow velocity, and we discussed the separation mechanism in TRDC based on the calculated results.

**Keywords :** TRDC; phase separation multi-phase flow; height equivalent to a theoretical plate

二相分離混合溶液は、回分式容器内で温度・圧力の変化で相分離し、上相下相に分かれる。一方、そのような混合溶液を微小空間に送液し相分離させると、液滴流、スラグ流、環状流などの混相流が見られる。これを相分離混相流という。特に環状流は、相分離を通して溶媒分子が管径方向に分配することに基づく流れであることから管径方向分配流(TRDF)と呼ぶ。

我々は TRDF を利用したキャピラリークロマトグラフィー(管径方向分配クロマトグラフィー ; TRDC)を提案し、開発してきた。TRDC では、層流条件下に生じる環状流において、内側相が移動相、外側相が疑似固定相としてそれぞれはたらく。今回、フューズドシリカキャピラリーと水/アセトニトリル/酢酸エチル混合溶液を用いた TRDC で、主にモデル試料として(1-ナフトール+2,6-ナフタレンジルスルホン酸)混合液を分析した。キャピラリー内径、キャピラリー内壁処理、流速等の分析条件を変化させ、得られたクロマトグラムから理論段相当高さを算出し、TRDC の分離メカニズムを考察した。