

Application News

No. G278

Gas Chromatography

Triple Capillary Column System

High-resolution capillary columns are very effective for most GC analyses. However, when the sample consists of complex mixture of components, adequate separation of all the components may not be possible with a single capillary column, requiring that the column and/or analytical conditions be changed depending on the target components.

This Application News introduces a triple capillary system in which 3 columns having different selectivity characteristics are connected to a single injection unit, thereby permitting complete and efficient separation and identification of the sample components.

■ Triple Capillary Column System

The triple capillary column system consists of a GC-2010 Plus equipped with a single injection unit and 3 detectors. The injected sample is introduced into each of the columns that branch from the bottom of the injection unit, so that the sample undergoes separation analysis on all three columns, and three chromatograms are produced.

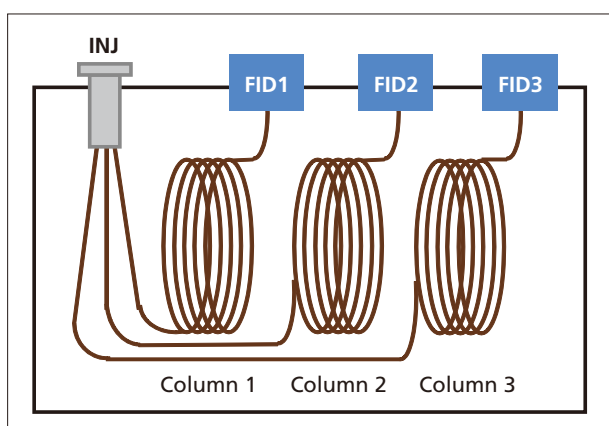


Fig. 1 Configuration of Triple Capillary Column System

Replacing the standard capillary adapter at the bottom of the injection unit with a 3-way adapter allows connection of 3 capillary columns.



Fig. 2 Capillary 3-Way Adapter

■ 12-Component Organic Solvent Analysis Using a Triple Capillary Column System

Here we introduce an example of analysis in which a triple capillary column system was used for analysis of a mixture of 12 organic solvents using 3 types of capillary columns. The columns consisted of a non-polar (Column 1), medium polarity (Column 2) and strongly polar (Column 3) capillary column. The obtained chromatograms are shown in Fig. 3.

Sample components that are overlapped or incompletely separated with one column are separated using another liquid phase column. Thus, by analyzing the separation results obtained using a combination of multiple columns, identification of all 12 components becomes possible.

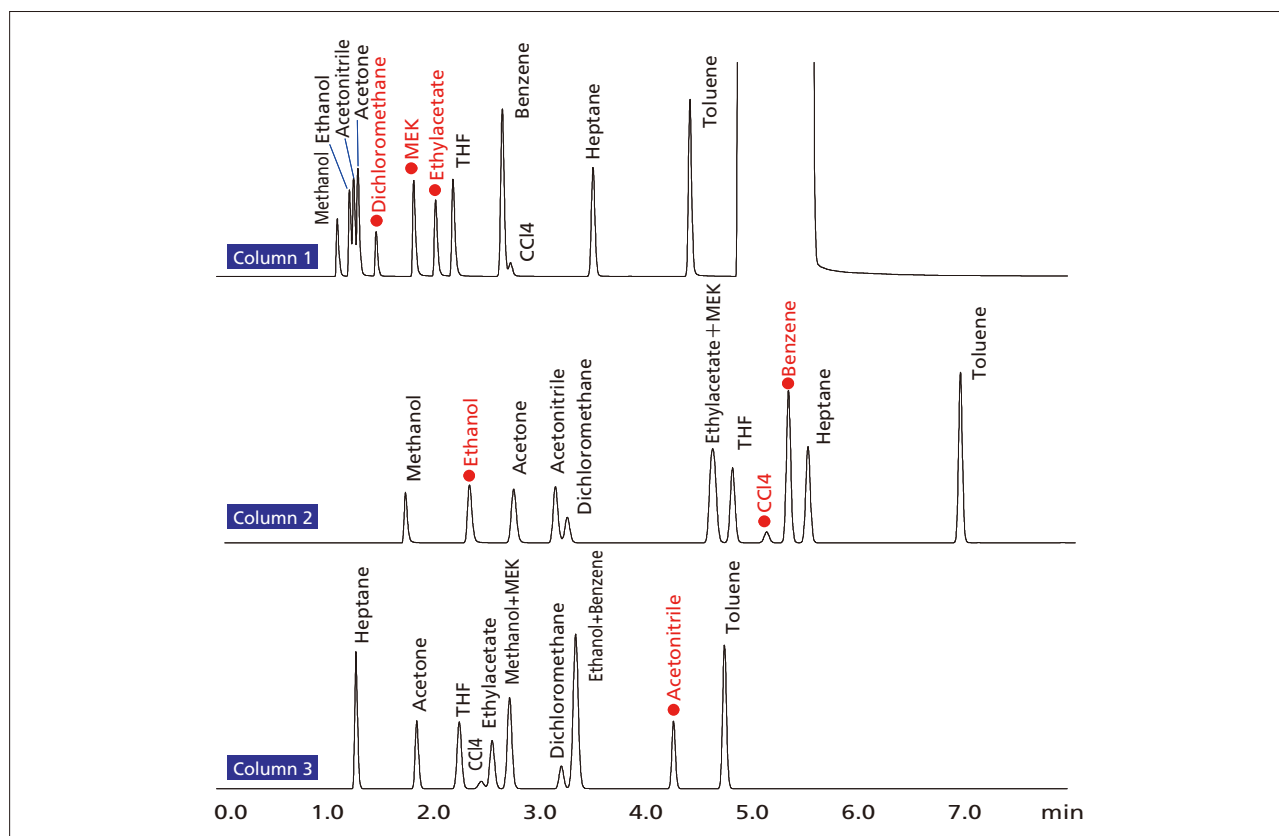


Fig. 3 Chromatograms

■ Repeatability and Linearity

Table 1 shows the results of repeatability of retention time and area value in each of the columns, and Table 2 shows the analytical conditions.

Table 1 Repeatability of Retention Time (RT) and Peak Area

		1	2	3	4	5	Avg	C.V.(%)
Dichloromethane	RT	1.547	1.546	1.546	1.545	1.545	1.546	0.054
Ethanol	(min)	2.299	2.298	2.297	2.297	2.296	2.297	0.051
Acetonitrile		4.301	4.300	4.299	4.298	4.297	4.299	0.037
Dichloromethane	Area	138176	138205	138058	137661	137890	137998	0.16
Ethanol	(μV·s)	287216	285855	285528	285193	285088	285776	0.30
Acetonitrile		331622	331003	330584	330075	330080	330673	0.20

* Dichloromethane (Column 1), Ethanol (Column 2), Acetonitrile (Column 3)
* 1000 ppm

In addition, excellent linearity was obtained in the concentration range of 100 – 1000 ppm with a coefficient of correlation greater than R=0.9999.

Table 2 Analytical Conditions

Model	: GC-2010 Plus AF/AOC FID-2010 Plus × 2 Capillary 3-Way Adapter	
Column Temp.	: 40 °C (3min)-20 °C/min-200 °C	
Det. Temp.	: 250 °C	
Inj. Temp.	: 250 °C	
Inj. Mode	: Split 1:20	
Carrier Gas	: He 67.1 cm/sec (Constant Linear Velocity Mode) 33.2 kPa at 40 °C	
Inj. Volume	: 1.0 μL	
Column 1	: Rtx-1	0.53 mm I.D. × 30 m df=1.0 μm
Column 2	: Rtx-624	0.53 mm I.D. × 30 m df=3.0 μm
Column 3	: Rtx-WAX	0.53 mm I.D. × 30 m df=1.0 μm

■ Notes and Cautions Regarding Triple Capillary Column System

1. Please order the INJ 3-way unit (221-75230-41) which includes all the necessary parts of the Triple Capillary Column System. [INJ 3-way unit composition: Capillary 3-way adapter (221-72540-91) × 1, Multiple column hanger (P/N: 221-72849) × 1, INJ unit (221-16325-01) × 3]
2. Depending on the column cage size, it may not be possible to mount 3 columns in the oven.
3. If the 3 columns selected are of different sizes (internal diameter, length), the flowrate of the carrier gas in the column and the split ratio will differ, making it difficult to optimize the carrier gas flowrate. As this can result in sensitivity variation, it is recommended to select columns of the same size.
4. With the GC-2010 Plus, the column information necessary to calculate the AFC flowrate can be set for only 1 column. Please select the column having the lowest maximum temperature. The various parameters including column flowrate and linear velocity, etc. are calculated according to the selected column.
5. The Triple Capillary Column system uses a glass insert for split injection (221-41444-01). One glass insert for split injection is provided as standard with the GC-2010 Plus.
6. For a dual capillary column system that connects two columns, a capillary 2-way adapter (221-56222-91) and an INJ 2-way branching unit (221-75231-41) [capillary 2-way adapter × 1, column hanger for multiple columns × 1, INJ nuts × 2] are also available.
7. Either GCsolution or Labsolutions is necessary for simultaneous detection by 3 detectors.

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