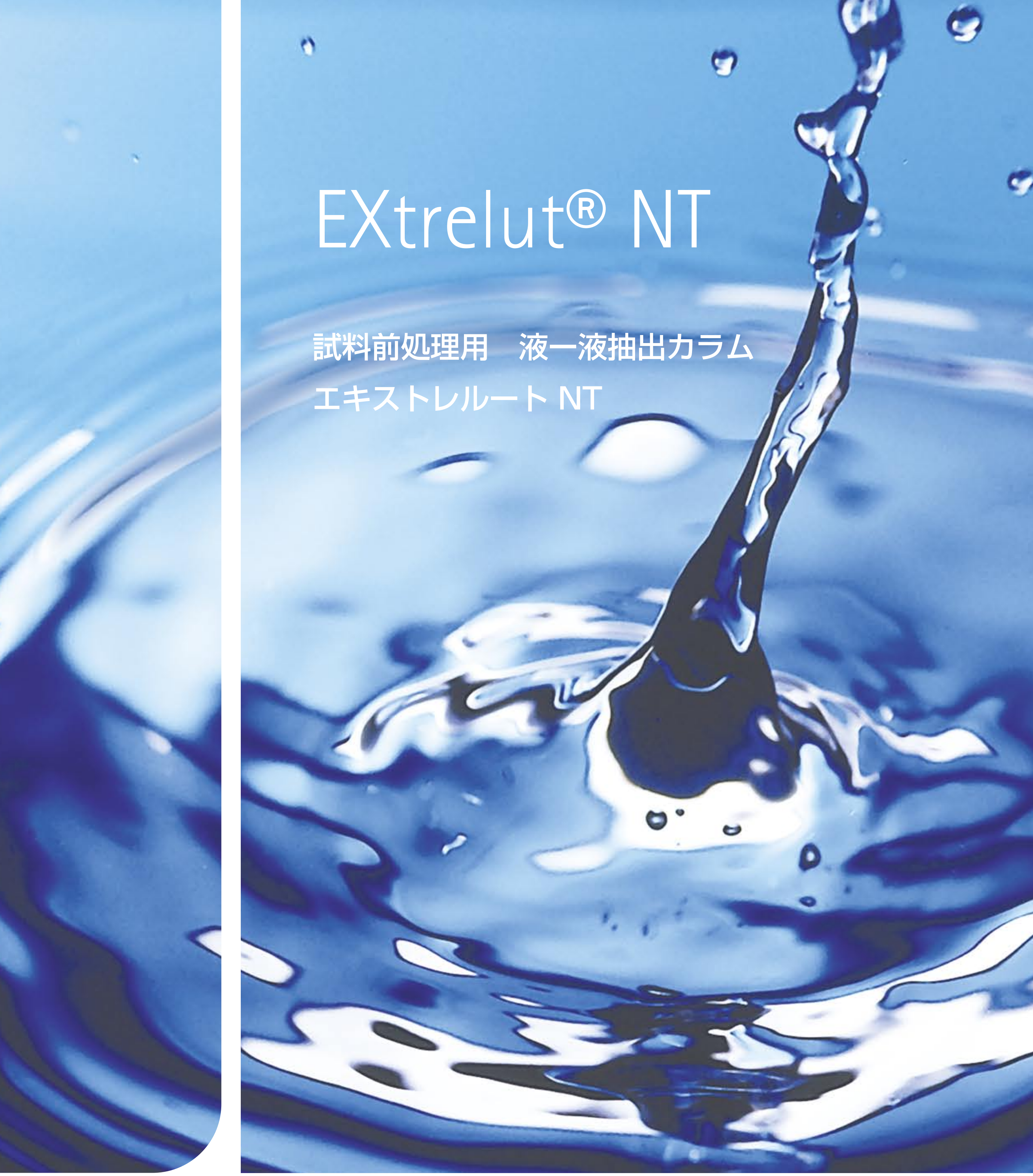

# EXtrelut® NT

## 試料前処理用　液ー液抽出カラム

## エキストレルート NT

MERCK

# EXtrelut® NT

## 試料前処理用　液ー液抽出カラム
## エキストレルート NT

EXtrelut® NT3
EXtrelut® NT3
15 ml
15 ml

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# 試料前処理用 液－液抽出カラム　エキストレルート NT

生体試料中の脂溶性物質の分析には、実際の定性・定量分析に先立って、サンプルの前処理が必要になります。一般に用いられている栓付き試験管もしくは分液ロートを用いた液-液抽出法では、振とうや遠心分離等の煩雑な操作が必要で、また大量の有機溶媒を消費することになります。さらにサンプルによってはエマルジョンが形成し、層分離が不完全であったり、目的物質の回収率が著しく低下することがあります。エキストレルートＮＴはワイドポア (巨大細孔)をもつ珪藻土 (キーゼルグール) を特別に調製し、充填剤として使用した試料前処理用液-液抽出ディスポーサブルカラムです。このカラムを用いることで上記のような問題点は解決され、試料中から簡単で効率のよい液-液抽出を行なうことが可能になりました。

## 抽出の原理

水系試料をエキストレルートNTにアプライしますと、分析対象物質を含んだ試料中の水分が化学的に不活性な担体 (珪藻土) の周りに分配され、薄いフィルムを形成し、固定相のように作用します。
続いて、水とは混合しない有機溶媒 (例えばジエチルエーテル、酢酸エチル、ハロゲン化炭化水素) を流しますと、珪藻土表面にできた水層中に存在する脂溶性物質がその有機溶媒によって抽出され、カラムから溶出されます (図1)。

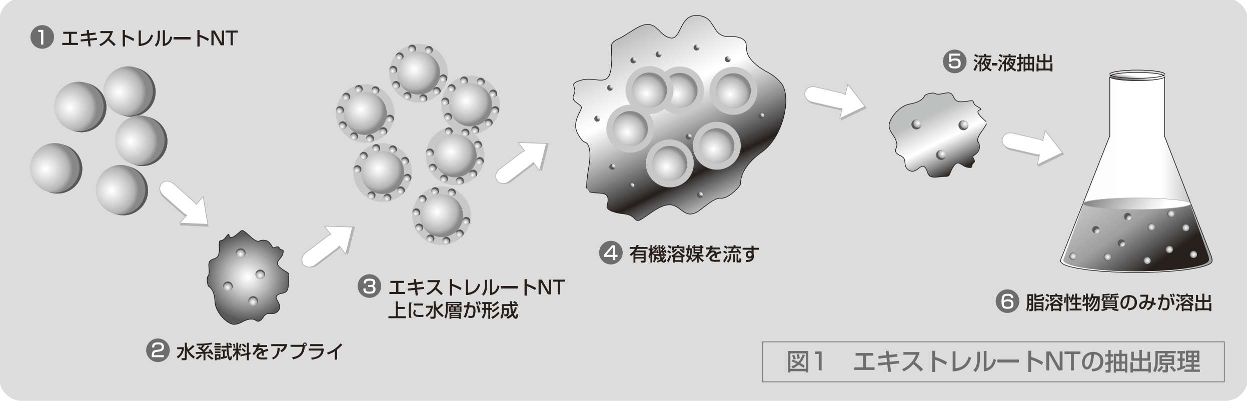
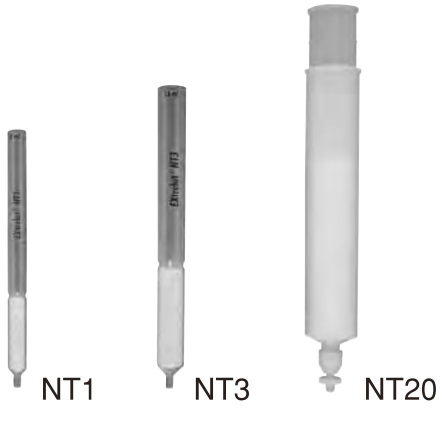

❶ エキストレルートNT
❷ 水系試料をアプライ
❸ エキストレルートNT
上に水層が形成
❹ 有機溶媒を流す
❺ 液-液抽出
❻ 脂溶性物質のみが溶出

図1　エキストレルートNTの抽出原理

## 構　　造

エキストレルートNT1およびNT3はガラスカラムに、エキストレルートNT20は高密度ポリエチレン (HDPE) 製カラムに珪藻土が詰まっております。その基本構造は図2の通りです。


NT1
NT3
NT20

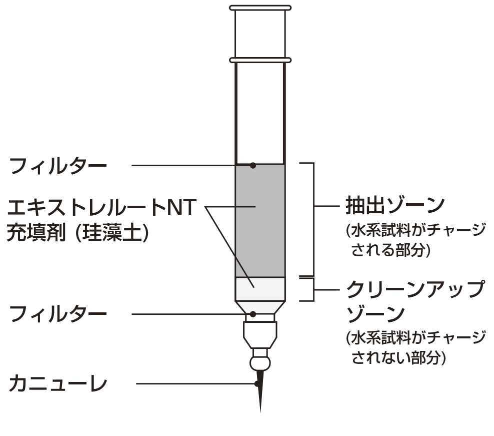

フィルター
エキストレルートNT
充填剤 (珪藻土)
フィルター
カニューレ
抽出ゾーン
(水系試料がチャージ
される部分)
クリーンアップ
ゾーン
(水系試料がチャージ
されない部分)

図2　エキストレルートNT20の構造

## 試料と溶媒

従来の液-液抽出を行なうことができる試料はすべて、エキストレルートNTを用いた前処理が可能です。また、エキストレルートNT はpH1～13と広いpH範囲の試料にお使いいただけます。

例えば、

- 尿
- 全血、血漿、血清
- その他の生体溶液（胃液、髄液、羊水など）
- 動植物、微生物の抽出物
- 農工業用水、排水
- 乳・乳製品
- 飲料（ジュース類）
- 酒類（ビール、ワイン、酒）
- 野菜、果物類
- 医薬品（錠剤、軟膏、シロップ剤、生薬など）

基本的には液-液抽出に用いられる有機溶媒はすべて使用できます。（下記参照）
また、抽出性の良い混合溶媒*としては次のようなものが挙げられます。

- **エーテル類**
  ジエチルエーテル、ジイソプロピルエーテル、t-ブチルメチルエーテル
- **エステル類**
  酢酸エチル、酢酸メチル
- **炭化水素類**
  ヘキサン、シクロヘキサン、ベンゼン
- **ハロゲン化炭化水素類**
  クロロホルム、ジクロロメタン、ジクロロエタン

- クロロホルム／メタノール (90:10～85:15)
- ジエチルエーテル／エタノール (90:10～80:20)
- 酢酸エチル／2-プロパノール (90:10～80:20)
- ジクロロメタン／2-プロパノール (90:10～85:15)

* 混合溶媒を用いる際に低級脂肪族アルコール（メタノール、エタノールなど）のような極性溶媒の比率を高めると、珪藻土に保持された水相の体積が増加し、カラムから水分が脱着してしまう可能性がありますのでご注意下さい。

## 特徴と利点

### 処理時間を大幅に短縮できる

従来の分液ロートなどを用いた液-液抽出では、抽出のための振とうや液相分離のための遠心分離など、煩雑な操作が必要になるので、一度に多数の試料を処理することが困難です。エキストレルートNTはディスポーザブルタイプのカラムで、試料の処理に振とうや遠心分離などの操作が必要ありません。また抽出後の有機溶媒における脱水操作も省くことができます。従いまして、エキストレルートNTを使用することで、多数の試料を簡単に短時間で処理することが可能になります。表1に従来の液-液抽出法とエキストレルートNTを用いた方法での、処理操作ステップ数やサンプルの処理時間の比較を示します。

| | 従来の液-液抽出 | | エキストレルート NT による抽出 | | |
|---|---|---|---|---|---|
| サンプル数 | 2 | 10 | 2 | 10 | 30 |
| 操　　作 | サンプル調製<br>↓<br>振とう抽出 (2-3回)<br>↓<br>二相分離 (放置、遠心分離)<br>↓<br>脱　水<br>↓<br>濃　縮 | | サンプル調製<br>↓<br>カラム内で抽出 (1回)<br>↓<br>濃　縮 | | |
| 処 理 時 間 | 1時間 | 5時間 | 20分 | 1時間15分 | 2時間15分 |
| 1 試料あたりの処理時間 | 1時間 | 30分 | 10分 | 7.5分 | 4.5分 |

表1　従来の液-液抽出法とエキストレルートNT を用いた方法との比較　その1

## エマルジョンを形成しない

生体試料を有機溶媒で抽出する場合、従来の液-液抽出法ではしばしばエマルジョンを形成し、層分離が不完全になり、目的物質の回収率の著しい低下や水溶性の不要成分の混入が生じます。エキストレルートNT を用いると、このようなエマルジョン形成はまったく見られず、以下に示すような、高い回収率や高い抽出効率が得られ、また夾雑物の混入も低く抑えることができます。

## 高い回収率を維持しつつ、溶媒の節約が行なえる

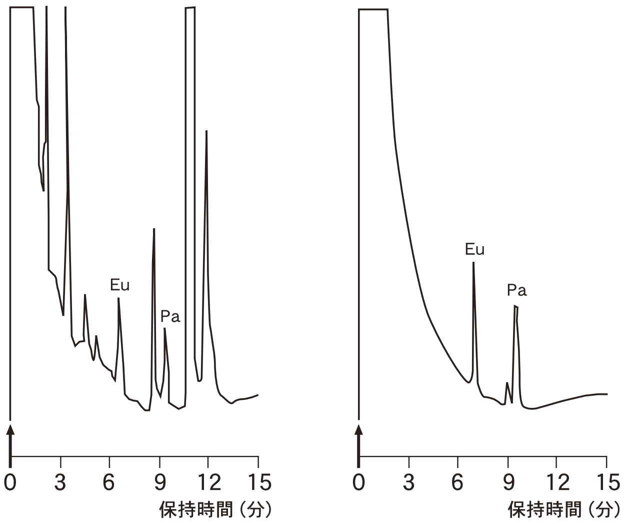
従来の定量的な液-液抽出では通常、有機溶媒による抽出を2回以上行なうため、大量の有機溶媒が使用されます。またエマルジョンの形成や低抽出効率によって、回収率が低くなりがちです。エキストレルートNT を用いると、定量的抽出が1回のカラム操作で行なうことができ、使用溶媒量も少量で済みます。表2に従来の液-液抽出法とエキストレルートNT を用いた方法での回収率と使用溶媒量の比較を示します。

| 目的物質 (抽出溶媒) | 方法 | 試料容量 (ml) | 回収率 (%) |  | 総回収率 (%) | 溶媒使用量 (ml) |
|---|---|---|---|---|---|---|
|  |  |  | 1回目 | 2回目 |  |  |
| バルビタール (エーテル) | 従来法 | 40 | 85 | 13 | 98 | 80 |
|  | エキストレルートNT | 20 | 99 | ー | 99 | 35 |
| モルフィン<br>(ジクロロメタン／2-プロパノール 85：15) | 従来法 | 40 | (合計100) |  | 100 | 80 |
|  | エキストレルートNT | 20 | 99 | 5 | 100 | 55 |
| コデイン<br>(ジクロロメタン／2-プロパノール 85：15) | 従来法 | 40 | (合計100) |  | 100 | 80 |
|  | エキストレルートNT | 20 | 98 | 1 | 99 | 55 |

表2　従来の液-液抽出法とエキストレルートNT を用いた方法との比較　その2

## 夾雑物の混入を抑えることができる

エキストレルートNT ではエマルジョンの形成が見られませんので、それに由来する夾雑物の混入がなく、純度の高い抽出物が得られます。また同時に、相対的な検出感度の向上が見られます。図3に従来の液-液抽出法とエキストレルートNT を用いた方法で処理した後の試料をガスクロマトグラフィーで分析した結果を示します。また表3に両方法で処理された試料における検出感度の比較を示します。



従来法　　エキストレルートNT

図3　従来の液-液抽出法とエキストレルートNT を用いた方法との比較　その3

両方法を用いた血清からの抽出物中の塩基性物質（Eu=オイパベリン、Pa=パパベリン）を、硫酸洗浄により分離後、ガスクロマトグラフィーによって分析。

**分析条件**
サンプル量 ： 5 $\mu$l
カラム ： クロモソルブG AW−DMCS
キャリアガス ： N2 （30ml/min）
昇温 ： 170-275℃ (8℃/min)
検出 ： FID

| 目的物質 (抽出溶媒) | 従来法 (pH9.4) | エキストレルートNT (pH8.9) | 検出試薬 |
|---|---|---|---|
| モルフィン | 0.5 μg | 0.3 μg | 硫酸/ヘキサヨード白金酸 |
| コデイン | 1 μg | 0.6 μg | 硫酸/ヘキサヨード白金酸 |
| フェノバルビタール | 1 μg | 0.5 μg | ジフェニルカルバゾン/硫酸水銀 |

表3　従来の液-液抽出法とエキストレルートNT を用いた方法との比較　その4

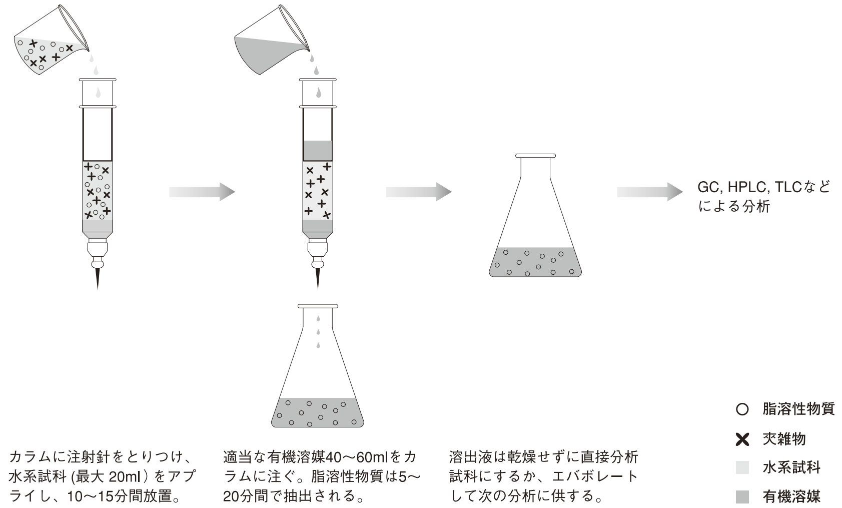
## 広いpH使用範囲

エキストレルートNTは化学的に不活性な充填剤を用いているため、pH1〜13の範囲で安定で、最適の pH条件で抽出できます。またカラム内の pH を順次変化させることにより、1つの試料から酸性・中性・塩基性の条件でそれぞれ抽出可能です（ページ6参照）。

## 操作法

### ❶ 一般的操作法（エキストレルートNT20使用の場合）

図4にエキストレルートNT20を用いる時の一般的操作法を示します。
エキストレルートNT1もしくはNT3を使用される場合の操作も基本的に同じとなりますが、処理可能な試料量等が異なってきます。
詳しくは表4をご参照ください。



カラムに注射針をとりつけ、水系試料 (最大 20ml）をアプライし、10〜15分間放置。

適当な有機溶媒40〜60mlをカラムに注ぐ。脂溶性物質は5〜20分間で抽出される。

溶出液は乾燥せずに直接分析試料にするか、エバポレートして次の分析に供する。

図4　エキストレルートNT カラムの操作法

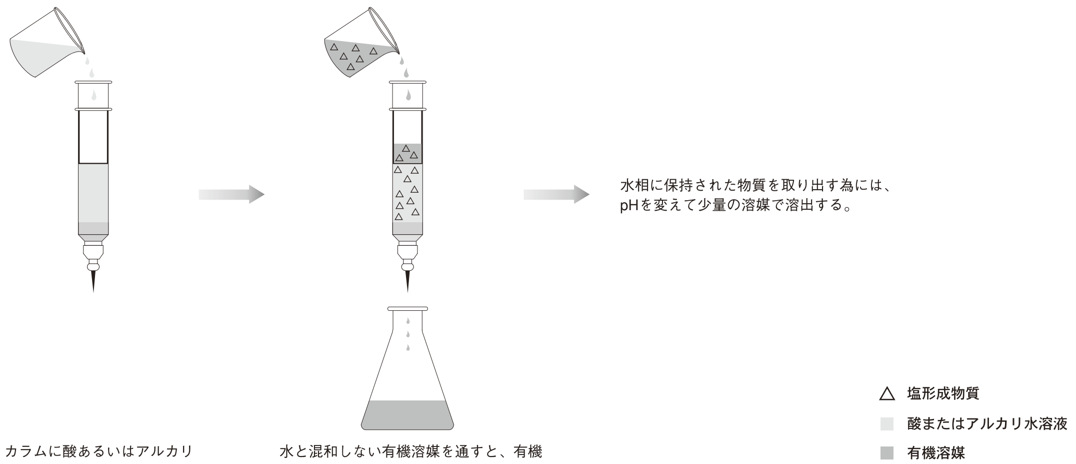
### ● 操作上の注意 ●

1. 抽出時間は試料のタイプ、pHおよび溶出有機溶媒の種類によって異なってきます。
2. NT20の場合、40mlの溶出溶媒を用いると抽出液は25mlとなります(カラムのデッドボリュームは15mlです）。
3. オーバーロードによるカラムからの試料の流出を防ぐために、指定の試料量はお守りください。
4. 試料量が少なすぎる場合は、試料を適量に希釈し、最大処理量に合わせてからアプライしてください。
5. 抽出前の放置時間が短すぎると回収率が悪化することがあります。

| エキストレルートNTの種類 | （推奨される）注射針のサイズ（内径 x 長さ mm） | 処理可能な最大試料量 (ml) | 抽出前の放置時間（分） | 推奨される溶出有機溶媒量 (ml) |
|---|---|---|---|---|
| NT1 | 0.6 x 30 | 1 | 5〜10 | 6 |
| NT3 | 0.6 x 30 | 3 | 5〜10 | 15 |
| NT20 | 0.7 x 30 | 20 | 10〜15 | 40 |

表4　エキストレルートNT の種類と試料量

## ❷ 有機溶媒から塩形成物質を除去する時の操作法



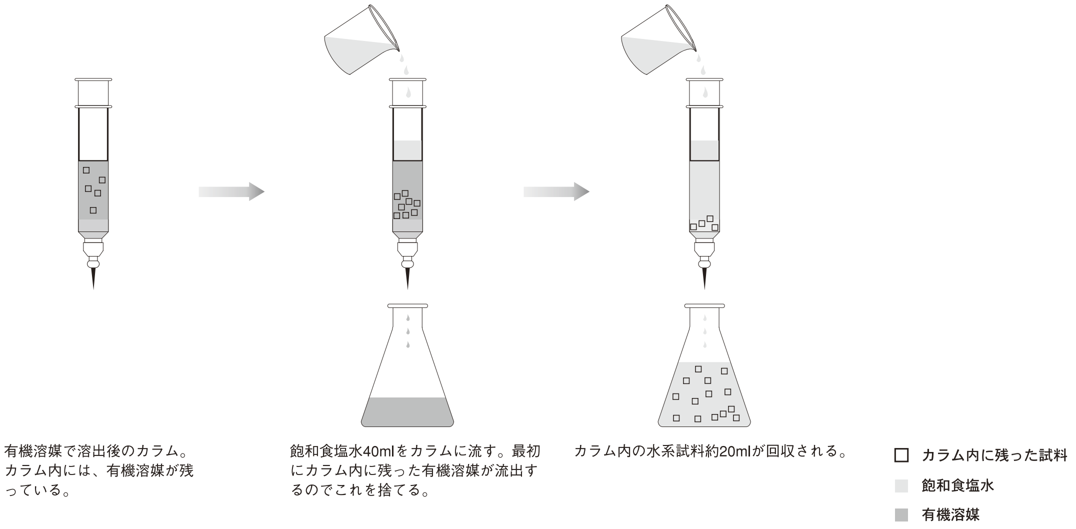
水相に保持された物質を取り出す為には、pHを変えて少量の溶媒で溶出する。

カラムに酸あるいはアルカリ水溶液を流し、固定相として保持させる。

水と混和しない有機溶媒を通すと、有機溶媒中の塩形成物質は、水相に抽出、保持される。溶出した有機溶媒は、塩形成物質を含まない。

図5　塩形成物質の除去法

## ❸ 有機溶媒で抽出後、カラム内の残存水溶性試料を抽出する時の操作法



有機溶媒で溶出後のカラム。カラム内には、有機溶媒が残っている。

飽和食塩水40mlをカラムに流す。最初にカラム内に残った有機溶媒が流出するのでこれを捨てる。

カラム内の水系試料約20mlが回収される。

図6　残存水溶性試料の抽出法

# 具体的使用例 ～NT20を用いて～

## ❶ 尿からの抽出

### 1. 酸性での抽出（酸性物質ならびに中性物質の抽出）

尿20mlを塩酸でpH1.5～2.0に調整し、カラムにアプライします。試料が十分浸透するまで (10～15分間) 放置し、適当な有機溶媒40mlで抽出します。使用有機溶媒としてはジメチルエーテル、クロロホルム、ジクロロメタンなどが適しています。

### 2. 弱塩基性での抽出（塩基性物質の抽出）

尿20mlを塩化アンモニウム／アンモニア バッファー(pH9.5)* 1mlでpH8.5～9.5に調整し、カラムにアプライします。試料が十分浸透するまで (10～15分間) 放置し、適当な有機溶媒40mlで抽出します。
使用有機溶媒としてはクロロホルム、酢酸エチル、ジクロロメタン／イソプロパノール （85：15）などが適しています。

* 塩化アンモニウムの冷飽和水溶液を25%アンモニウム溶液でpH9.5に調製します。

限られた数の薬剤あるいは鎮痛剤のスクリーニングでは、弱塩基性での酸性、中性、塩基性物質の同時抽出が便利です。
図7 および 表5 に各薬剤の抽出におけるpH依存性を示します。

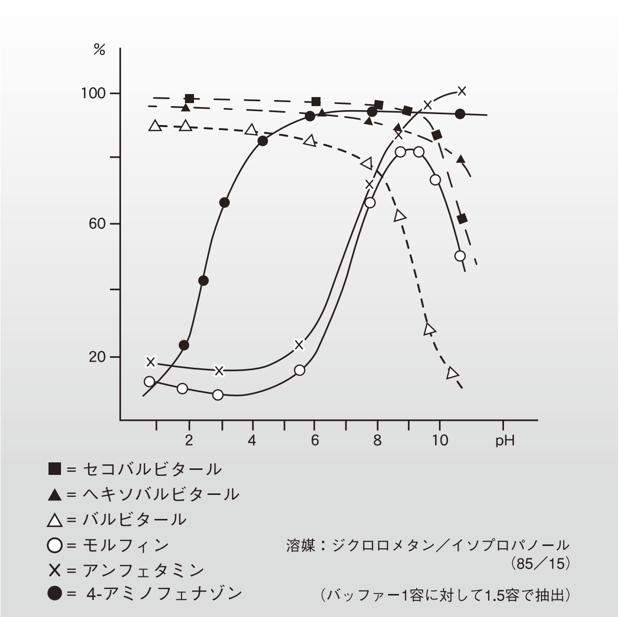


図7　残存水溶液試料の抽出液

| 化合物 | pH 2.0 | | pH 8.5～9.0 | |
|---|---|---|---|---|
| | 1回目の抽出 | 2回目の抽出 | 1回目の抽出 | 2回目の抽出 |
| Morphine | ー | ー | 80ー95 | 5ー20 |
| Quinine | ー20 | 60 | 90ー100 | ー |
| Cocaine | 60ー70 | 20 | 80ー100 | ー |
| Codeine | ー | 20 | 80ー100 | ー |
| Methadone | 80ー90 | ー | 80ー100 | ー |
| Nicotine | ー | ー | 80ー100 | ー |
| Amitryptyline | 80ー90 | ー | 80ー100 | ー |
| Papaverine | 80ー90 | ー | 80ー100 | ー |
| Diphenhydramine | 80ー100 | ー | 80ー100 | ー |
| Phenmetrazine | ー | ー | 80ー100 | ー |
| Mescaline | ー | ー | 80 | 10 |
| Norephedrine | ー | ー | 80 | 20 |
| Ephedrine | 20 | 40 | 60 | 30 |
| Amphetamine | ー | ー | 80ー90 | ー |
| Mephentermine | ー | ー | 80ー100 | ー |
| Oxazepam | 80ー100 | ー | 80ー100 | ー |
| Chlordiazepoxide | 80 | 20 | 80ー100 | ー |
| Nitrazepam | 80ー100 | ー | 80ー100 | ー |
| Diazepam | 80ー100 | ー | 80ー100 | ー |
| Methaqualone | 80ー100 | ー | 80ー100 | ー |
| 4-Aminophenazone | ー | ー | 80ー100 | ー |
| Aminopyrine | 40 | 40 | 80ー100 | ー |
| Salicylic acid | 80ー100 | ー | ー | ー |
| Hexobarbital | 80 | 20 | 80ー90 | ー |
| Amobarbital | 80 | 20 | 70ー80 | 20 |
| Thiopental | 80 ー100 | ー | 80ー90 | ー |
| Phenobarbital | 80 | 20 | 70ー80 | 20 |
| Secobarbital | 80 | 20 | 70ー80 | 20 |
| Pentobarbital | 80 | 20 | 70ー80 | 20 |
| Barbital | 80ー100 | ー | 60ー70 | 20 |
| Chloropromazine | 60ー70 | 20 | 80ー90 | 10 |

表5　pH値に対する抽出率の依存度

## 3. 酸性及び弱塩基性での連続抽出

尿20mlに約0.5gの塩化アンモニウムを加え、25%塩酸でpH2に調整した後、カラムにアプライします。試料が十分浸透するまで (10～15分間) 放置し、ジエチルエーテル等の適当な有機溶媒40mlを流すことで、酸性ならびに中性物質を抽出します。さらにカラムに残存している溶媒を軽く減圧吸引することでそれらの物質を完全に回収します。
次に飽和アンモニアガスをカラム内に通し、カラム内のpHを酸性から塩基性に変化させた後、ジクロロメタン／イソプロパノール （85：15）等の適当な有機溶媒40mlを流し、塩基性物質を抽出します。

## 4. 抱合体からの抽出

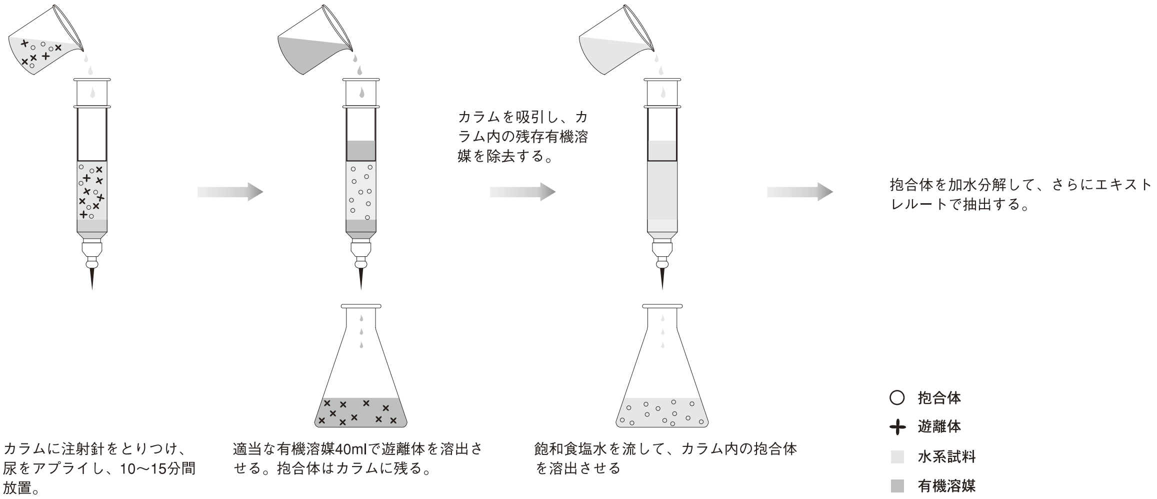
薬物や毒物は生体内で代謝され、代謝物やその抱合体として尿中に排泄されます。例えば、ベンゾジアゼピン、メタカロン、フェニチアジン、モルフィン、コデイン等は、グルクロン酸あるいは硫酸の抱合体として排泄されます。これらの抱合体から薬物を抽出する際にはまず、抱合体のグルクロニダーゼ／アリルスルファターゼによる酵素的加水分解、もしくは、塩酸存在下での加熱加水分解が必要となります。

抱合体の酵素加水分解は、尿20mlに2M酢酸ナトリウム／酢酸バッファー（pH5.5）2mlとグルクロニダーゼ／アリルスルファターゼ*50 μlを混合し、40～45℃で一晩（約16時間）インキュベートして行います。塩酸加水分解は、尿10mlに25%塩酸10mlを加え還流下で15分間加熱することで行い、冷却後徐々に水酸化ナトリウム2～3 g を加えて中和します。

これらの加水分解で調製された試料20mlを塩化アンモニウム／アンモニア バッファー (pH9.5) 1～2mlでpH8.5～9.5に調整し、カラムにアプライします。試料が十分浸透するまで (10～15分間) 放置し、ジクロロメタン／イソプロパノール（85：15）40mlで抽出します。

上記の方法ですと、抱合体中の代謝薬物のみならず遊離型代謝薬物並びに未代謝薬物も合わせて抽出されます。抱合代謝薬物のみを抽出したい場合は図8に示すように、まず抱合体のみを分離し、それを同様な方法で加水分解した後に抽出を行います。

* グルクロニダーゼ／アリルスルファターゼ溶液がございます
（製品番号104114）



カラムに注射針をとりつけ、尿をアプライし、10～15分間放置。

適当な有機溶媒40mlで遊離体を溶出させる。抱合体はカラムに残る。

カラムを吸引し、カラム内の残存有機溶媒を除去する。

飽和食塩水を流して、カラム内の抱合体を溶出させる

抱合体を加水分解して、さらにエキストレルートで抽出する。

図8　抱合代謝薬物の抽出法

## ❷ 血液成分からの抽出

血液成分 (血液、血清、血漿) は、高タンパク質含量によって粘度が高いため、エキストレルートNT カラムにアプライする前に試料の希釈が必要となります。表6に血液からの各薬物の抽出効率に及ぼす希釈率の影響を示します。

また溶出に使用される溶媒には試料の凝固を起こさない溶媒が適しており、ヘプタン、ジエチルエーテル、ジイソプロピルエーテル、酢酸メチル、酢酸エチル、ジクロロメタン等が用いられます。

| 目的物質（薬物）* | 希釈割合（試料+水） | pH | 回収率（%） | 溶出溶媒（希釈血液20mlに対する溶媒量） |
|---|---|---|---|---|
| モルフィン | 1＋2 | 9 | 65 | 酢酸エチル (50ml) |
|  | 1＋4 |  | 78 |  |
|  | 1＋9 |  | 92 |  |
| パパベリン | 1＋2 | 8～11 | 94 | 酢酸エチル (50ml) |
|  | 1＋4 |  | 97 |  |
|  | 1＋9 |  | 93 |  |
| レボプロマジン | 1＋2 | 9 | 57 | 酢酸エチル (50ml) |
|  | 1＋4 |  | 65 |  |
|  | 1＋9 |  | 56 |  |
| ニトラゼパム | 1＋1 | 9.5 | 79 | エーテル (50ml) |
| オキサゼパム | 1＋1 |  | 86 |  |
| クロルジアゼポシド | 1＋1 |  | 81 |  |
| バルビタール | 1＋4 | 3 | 95 | エーテル (50ml) |
| フェノバルビタール | 1＋4 | 3 | 90 |  |
| フェノバルビタール | 1＋4 | 3 | 88 | クロロホルム (50ml) |

* 薬物濃度は全血に対し600ng～200μg/ml

表6　エキストレルートNT による新鮮な全血の抽出

### 1. 血清からの抽出

酸性物質の抽出には0.1M塩酸溶液を、塩基性物質の抽出には0.1M水酸化ナトリウム溶液を、試料と同量加え、希釈します。アルコール含有溶媒で抽出を行う場合は試料と同量の飽和食塩水で希釈します。希釈された試料20mlをカラムにアプライし、適当な溶媒40～60mlで抽出します。使用有機溶媒としてはジエチルエーテル、酢酸エチル、ジイソプロピルエーテル／酢酸メチル（70：30）、ジクロロメタンなどが適しています。

### 2. 血液、もしくは血漿からの抽出

血液 (全血) は最低でも2倍に、通常は5倍に水で希釈します (この際、溶血が起きます)。凝固した血液は希釈前にホモジネートしておきます。酸性物質の抽出は希釈試料4mlに水15mlと1M塩酸溶液1mlを、塩基性物質の抽出には希釈試料4mlに0.025%アンモニア溶液16mlを加えた後、10～15分放置してからカラムにアプライします。粘度が高い時はカラムの出口側から軽く減圧吸引します。
試料が浸透するまで (10分間) 放置し、適当な有機溶媒40～60mlで抽出します。
使用有機溶媒としてはジエチルエーテル、酢酸エチル、ジイソプロピルエーテル／酢酸メチル（70：30）などが適しています。

## ❸ 組織や排泄物からの抽出

試料を硫酸アンモニウム、酒石酸、およびエタノールと混合し、ホモジネートします。これをろ過して、ろ液を乾固した後、水で溶解します。この試料溶液20mlを用いて、❶で示したような方法で抽出を行います。

# エキストレルートNTを用いた実際の分析例

## ーヒト血清中の抗てんかん薬の分析ー

血清500 μlをりん酸バッファー*500 μlで希釈

↓

エキストレルートNT1にアプライし、8分間放置

↓

ジクロロメタン／2-プロパノール（9：1）
1mlを添加し、10分間放置

↓

ジクロロメタン／2-プロパノール（9：1）
6mlを添加し、抽出

↓

抽出物を窒素ガスにより乾固

↓

乾固物をメタノール1mlで溶解

↓

10 μlをHPLCで分析

↓

### HPLC conditions :

Column : LiChroCart® 250-4
LiChrospher® RP-select B (5 μm)

Mobile phase : A－Water / Acetonitrile (1 : 1)
B－Water

Gradient :

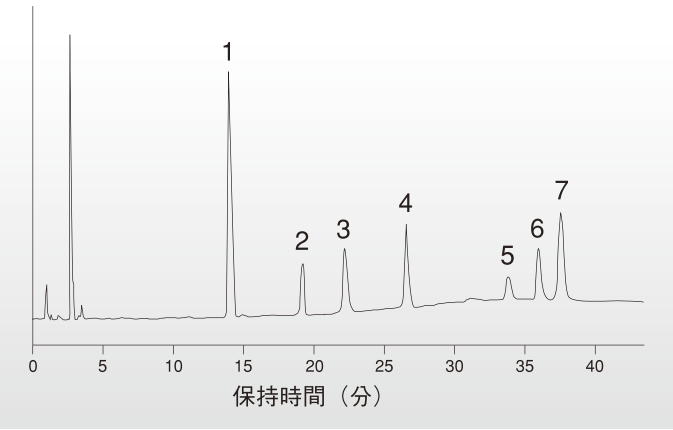
| Time | %A | %B |
|---|---|---|
| 0 min | 10% | 90% |
| 30 min | 60% | 40% |
| 44 min | 60% | 40% |
| 44.1 min | 100% | 0% |
| 50 min | 100% | 0% |
| 51 min | 10% | 90% |
| 75 min | 10% | 90% |

Flow : 1 mL / min

Temperature : 30℃

Detection : UV205nm

* りん酸2水素ナトリウム17.6g、りん酸水素2ナトリウム2水和物4.5g、アジ化ナトリウム1.5gを水1L中で溶解（pH6.0～6.1）



### サンプルならびに回収率

| | |
|---|---|
| 1. Ethosuximide | 84±7% |
| 2. Primidone | 100±2% |
| 3. α-methyl- α-propylsuccinimide | internal standard |
| 4. Phenobarbital | 96±2% |
| 5. Hexobarbital | 99±2% |
| 6. Carbamazepine | 97±1% |
| 7. Phenytoin | 100±1% |

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| Cartap | Colorimetric and fluorometric determination of cartap by use of ion association with calcon. | Yakugaku Zasshi, 1983, 103 (6), 650-654. |
| Catechol estrogens | Assay of enzymic O-methylation of catechol estrogens by HPLC with coulometric detection. | J. Chromatogr. Biomed. Appl., 1993, 128 (J. Chromatogr., 617), 221-225. |
| Catechol, Guaiacol estrogens | Determination of catechol and guaiacol estrogens in urine by capillary GC-MS. | Biomed. Chromatogr., 1993, 7 (3), 172-176. |
| Catecholamines | Improves radioenzymic assay for the determination of catecholamines in plasma. | Clin. Chim. Acta, 1983, 132 (1), 111-116. |
| Cerebrovascular disorders agents (AJ 3941) | Determination of AJ 3941, a possible agent for the treatment of cerebrovascular disorders, in plasma and brain by means of HPLC with fluosescence detection. | J. Chromatogr. Biomed. Appl., 1992, 116 (J. Chromatogr., 578), 152-156. |
| Chlorambucil | Studies on the pharmacokinetics of chlorambucil and prednimustine in patiens using a new HPLC assay. | Canc. Chem. Pharm., 1989, 23, 208. |
| Chloramphenicol | HPLC screening and confirmation methods for chloramphenicol residues in meat with off-line cartridge sample clean-up and on-line diode array UV-visible detection. | J. Chromatogr., 1986, 352, 445-453. |
| Chloramphenicol | Determination of chloramphenicol in tissues-problems with in vitro metabolism | Analyst, 1988, 113 (12), 1875-1876. |
| Chloramphenicol | Development and validation of a GC-MS procedure for the identificationand quantification of residues of chloramphenicol. | Anal. Chim. Acta, 1990, 237 (1), 61-69. |
| Chlordane compounds and metabolite residues | Chlordane compounds and metabolite residues in termite control workers' blood. | Bull. Environ. Contam. Toxicol., 1995, 54 (6), 855-862. |
| Chlorhexidine | Selected-ion-monitoring assay for chlorhexidine in medical waste water. | Biomed. Mass Spectrom., 1984, 11 (5), 203-206. |
| Chlorophenoxyacetic acids | Simultaneous extraction and methylation of chlorophenoxyacetic acids from aqueous solution using supercritical carbon dioxide as a phase-transfer solvent. | Anal. Chem., 1994, 66 (24), 4459-4465. |
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| Chloropropane diols | Determination of the chloropropanols, 3-chloro-1,2-propandiol and 2-chloro-1,3-propandiol, in hydrolysed vegetable proteins and seasonings by GC-ion trap tandem MS. | Rapid. Commun. Mass Spectrom. 1997, 11(13), 1417-1424. |
| 3-Chloropropane-2-diol | Analysis of residual 3-chloro-2-propanediol in seasonings after derivatization with phenylboronic acid. | Shokuhin Eiseigaku Zasshi, 1995, 36 (3), 360-364. |
| 3-Chloropropane-2-diol | Determination of 3-chloropropane-2-diol in hydrolysed vegetable proteins by capillary GC with electrolytic conductivity detection. | J. Chromatogr., 1993, 638 (1), 71-74. |
| Chloropropanols | Determination of chloropropanols in protein hydrolysates. | J. Chromatogr., 1992, 589 (1-2), 109-119. |
| Chloroquine | A rapid HPLC procedure for the simultaneous determination of chloroquine, monodeethylchloro-quine, diazepam, and nordiazepam in blood. | J. Anal. Toxicol., 1989, 13 (2), 89-93. |
| Chlorpheniramine | Highly sensitive determination of chlorpheniramine as fluorescence derivative by HPLC. | J. Chromatogr. Biomed. Appl., 1987, 64 (J. Chromatogr., 420), 63-72. |
| Cholesterol | TLC of radioactively labelled cholesterol and precursors from biological material: a simple and sensitive method for investigating action on the sterol pathway. | Fresenius' Z. Anal. Chem., 1987, 327 (5-6), 558-560 |
| Cimetidine | Rapid method for determination of cimetidine in biological fluids by HPLC using EXtrelut NT extraction. | J. Chromatogr. Biomed. Appl., 1983, 24 (J. Chromatogr., 273), 223-227. |
| Cisplatin | Analysis of mutagenic activity in human urine after concentration on different resins and HPLC. | Toxicol. Lett., 1989, 45 (2-3), 241-149. |
| Citaloprams | Simultaneous determination of citalopram, monodemethylcitalopram and didemethylcitalopram in plasma HPLC after column extraction. | J. Chromatogr. Biomed. Appl., 1990, 92, (J. Chromatogr., 527), 226-232. |
| Citrinin | HPLC determination of citrinin in cereals using an acid-buffered silica gel column. | J. Chromatogr., 1989, 462, 406-410. |
| Clenbuterol | Determination of clenbuterol in urine of calves by HPLC with in-series ultra-violet and electrochemical detection. | J. Pharm. Biomed. Anal., 1991, 9 (6), 485-492. |
| Clenbuterol, Salbutamol | Determination of clenbuterol and salbutamol in urine by capillary GC with capillary columns of 100 µm. | J. Chromatogr. A, 1993, 655 (1), 73-76. |
| Clomipramine | Improved clean-up procedure for the HPLC assay of clomipramine and its demethylated metabolite in human plasma. | J. Chromatogr. Biomed. Appl., 1995, 669 (2), 416-417. |
| Cloridine | Procedure for the GC determination of Clonidine in human plasma. | J. Chromatogr., 1980, 187, 161-169. |
| Cocaine, Benzoyl-ecgonine, local anaestetic agents | LC analysis of cocaine, benzoylecgonine, local anaesthetic agents and some of their metabolites in biological fluids. | J. Liq. Chromatogr., 1993, 16 (13), 2797-2811. |
| Cocaine, Ecgonine derivatives | Quantitation of cocaine, benzoylecgonine and ecgonine methyl ester by GC-CI-MS-selected ion monitoring after EXtrelut NT extraction. | Forensic Sci. Int., 1984, 26 (3), 181-192. |
| Codeine, Morphine | Procedure for GC determination of Morphine and Codeine in urine. | Forensic Sci., 1976, 7, 131-140. |
| Corticosteroids | Chemiluminescence HPLC of corticosteroids using lucigenin as post-column reagent. | Biomed. Chromatogr., 1990, 4 (3), 119-122. |
| Cortisol | Procedure for radioimmunological determination of urinary free cortisol. | Clin. Chim. Acta, 1980, 101, 125-134. |
| Cortisol | Procedure for routinely practicable determination of free cortisol in urine by combination of automatic HPLC and RIA. | Clin. Chim. Acta, 1980, 106, 63-73. |

| Compound | Title | Joumal |
|---|---|---|
| Cortisol | Pre-chromatographic derivatization of samples for (HP)TLC. | J. High Resolut. Chromatogr. Chromatogr. Commun., 1982, 5, 534-538. |
| Cotinine | Simultaneous determination of cotinine and trans-3'-hydroxycotinine in human serum by HPLC. | J. Chromatogr. Biomed. Appl., 1992, 115 (J. Chromatogr., 577), 358-361. |
| Cotinine | Urinary cotinine and exposure to parental smoking in a population of children with asthma. | Clin. Chem., 1999, 45(4), 505-509. |
| Cotinine, Nicotine | Hair analysis for nicotine and cotinine: evaluation of extraction procedures, hair treatments, and development of reference material. | Forensic Sci. Int., 1997, 84(1-3), 243-252. |
| Coumatetralyl | Screening for coumatetralyl in soft drinks by solid matrix extraction and HPLC with DAD. | J. Chromatogr., 1991, 553, 305. |
| p-Cresidine | Determination of p-cresidine [2-methoxy-5-methyl-aniline] in FD & C Red No. 40 by the diazotization and coupling procedure follwed by reversed-phase HPLC. | J. Chromatogr., 1987, 405, 283-294. |
| Cresols | GC determination of cresols in the biological fluids of a non-fatal case of cresol intoxication. | Forensic Sci Int., 1990, 47 (1), 21-29. |
| Cyclosporin A | Preparation, extraction and HPLC of cyclosporin A from plasma that contains interfering compounds. | Ann. Clin. Biochem., 1985, 22 (4), 402-407. |
| D&C Yellow No. 10 | LC determination of 2-(2-quinolyl) H-indene-3[2H]-dione and other organic-soluble matter in D&C Yellow No. 10. | J. Assoc. Off. Anal. Chem., 1985, 68 (3), 477-479. |
| Debrisoquine | LC method for the determination of debrisoquine and its 4-hydroxy-metabolite in human urine. | J. Chromatogr. Biomed. Appl., 1986, 51 (J. Chromatogr., 378), 509-513. |
| Demeton-S-methyl sulphoxide | Fast determination of demeton-S-methyl sulphoxide (Metasystox R) in blood plasma. | J. Anal. Toxicol., 1989, 13 (6), 330-332. |
| Deoxynivalenol | Oxidative transformation of deoxynivalenol (vomitoxin) for quantitative and chemical confirmatory purposes. | J. Agric. Food Chem., 1984, 32 (1), 72-75. |
| Deoxynivalenol | Analysis of trace levels of deoxynivalenol in cow's milk by high pressure LC. | J. Liq. Chromatogr., 1994, 17 (3), 673-683. |
| Dextromoramide | Determination of dextromoramide in plasma and whole blood using HPLC with ultra-violet absorbance detection. | J. Chromatogr. Biomed. Appl., 1992, 111 (J. Chromatogr., 573), 87-92. |
| Dextromoramide, Propoxyphenes | Simultaneous determination of dextromoramide, propoxyphene and norproxyphene in necropsic whole blood by LC. | J. Chromatogr. Biomed. Appl., 1993, 126 (J. Chromatogr., 615), 357-364. |
| Diacetoxyscirpenol | Simultaneous determination of diacetoxyscirpenol and T-2 toxin in fungal cultures and grain samples by capillary GC. | Food Addit. Contam., 1987, 4 (3), 277-284. |
| Dicyclomine hydro-chloride | Stability-indicating capillary GLC assay of dicyclomine hydrochloride in some pharmaceutical formulations. | J. Chromatogr., 1989, 475, 381-389. |
| Diethylene glycol | Determination of diethylene glycol in wine by use of an EXtrelut NT column. | Shokuhin Eiseigaku Zasshi, 1986, 27 (3), 283-287. |
| Diethylene glycol | Rapid determination of diethylene glycol in wine by GC using alumina column clean-up. | Shokuhin Eiseigaku Zasshi, 1986, 27 (2), 187-189. |
| Diethylene glycol | Determination of diethylene glycol in wine by high-performance liquid chromatography using anthracene-9-carbonyl chloride as a derivatizing reagent. | J. Chromatogr., 1988, 445 (2), 403-408. |
| Difenzoquat | Determination of difenzoquat in cereals by GC-MS. | Shokuhin Eiseigaku Zasshi, 1998, 39, 431-435. |
| Digoxin, Digoxigenin, Dihydrodigoxigenin | Determination of digoxin, digoxigenin and dihydrodigoxigenin in urine by extraction, derivatization HPLC. | J. Chromatogr. Biomed. Appl., 1986, 55 (J. Chromatogr., 382), 349-354. |
| Dihydroergotamine | Determination of sub-nanogram amounts of dihydroergotamine in plasma and urine using LC and fluorimetric detection with offline and online solid-phase drug enrichment. | J. Chromatogr. Biomed. Appl., 1987, 61 (J. Chromatogr., 417), 319-329. |
| Dihydroxyvitamin $D_3$, Vitamin $D_3$ | Development of a double-antibody radio-immunoassay for quantitation of 1alpha,25-dihydroxyvitamin D3. | Clin. Chim. Acta, 1990, 189 (2), 97-110. |
| Dihydroxyvitamin $D_3$, Vitamin $D_3$ | Rapid, selective separation of 1alpha,25-dihydroxy-vitamin D3 from serum with EXtrelut NT columns. | Clin. Chem., 1987, 33 (1), 187. |
| Dihydroxyvitamin $D_3$ | Sensitive and simplified radio-immunoassay for 1,25-dihydroxyvitamin D3. | Clin. Chim. Acta, 15. 1984, 142 (3), 325-338. |
| Dimethoate, Formothion | Determination of dimethoate in blood and hemo-perfusion cartridge following ingestion of formothion - case study. | Forensic Sci. Int., 1990, 48 (1), 79-88. |
| Disulfoton | Determination of disulfoton and its metabolites in the body fluids of a Di-Syston intoxication case. | Forensic Sci. Int., 1990, 48 (2), 145-154. |
| Diuretics | Detection of diuretics in horse urine by GC - MS. | J. Anal. Toxicol., 1992, 16 (3), 194-198. |
| Drugs | Procedure for GC determination of underivatized drugs in blood. | Clin. Chem., 1979, 25 (12), 2020-2025. |
| Drugs | Application of HPLC equipment with rapid-scan detection to the identification of drugs in toxicological analysis. | J. Liq. Chromatogr., 1994, 17 (19), 4131-4144. |
| Drugs | Identification of drugs of abuse by HPTLC. | J. Anal. Toxicol., 1980, 4, 141-144. |
| Drugs | Impact of biological matrix and isolation methods on detectability and interlaboratory variations of TLC Rf-values in systematic toxicological analysis. | J. Anal. Toxicol., 1984, 8 (4), 149-154. |
| Drugs | Rapid procedure for the isolation of drugs in biological samples: usefulness of enzymic digestion and the EXtrelut NT column. | Aichi Ika Daigaku Igakkai Zasshi, 15 (4), 1987, 617-625. |
| Dymron | Determination of dymron in agricultural products by HPLC. | Shokuhin Eiseigaku Zasshi, 1999, 40(3), 233-240. |
| Eicosapentaenoic acid | Fluorescence HPLCof eicosapentaenoic acid in serum and vital blood of fishes and in body fluid of plankton after labelling with 9-anthryldiazomethane. | Bunseki Kagaku, 1984, 33 (7), E271-E278. |
| Embutramide, Pentobarbitone | Determination of embutramide and pentobarbitone in meat and bone-meal by GC-MS. | Analyst, 1998, 123(12), 2513-2516. |
| Epomediol | Capillary GC determination of epomediol in human plasma and urine using a rapid solid-phase extraction. | Biomed. Chromatogr., 1989, 3 (5), 199-202. |
| Eproxindine hydrochloride | Determination of eproxindine hydrochloride in human plasma by capillary GC. | J. Chromatogr. Biomed. Appl., 1988, 71 (J. Chromatogr., 427), 157-161. |
| Estrogens | LC determination of the estrogens daidzein, formononetin, coumestrol, and equol in bovine blood plasma and urine. | J. Assoc. Off. Anal. Chem., 1988, 71 (5), 938-941. |

| Compound | Title | Joumal |
|---|---|---|
| Ethopabate,<br>Niicarbazin,<br>Lasalocid sodium,<br>Decoquinate | Simultaneous determination of ethopabate, nicarbazin, lasalocid sodium and decoquinate in mixed feeds by HPLC. | Shiryo Kenkyu Hokoku (Tokyo Hishiryo Kensasho), 1991, 16, 128-140. |
| Ethyl carbamate | Determination of ethyl carbamate in sake by alkylation and GC with a flame ionization detector. | Shokuhin Eiseigaku Zasshi, 1987, 28 (5), 330-335. |
| Ethyl carbamate | Simple analytical method for ethyl carbamate in alcoholic beverages. | Shokuhin Eiseigaku Zasshi, 1987, 28 (6), 492-497. |
| Ethyl carbamate | Measurement of ethyl carbamate in blood by capillary GC-MS using selected-ion monitoring. | Biomed. Environ. Mass Spectrom., 1990, 19 (1), 27-31. |
| Ethyl carbamate | Determination of ethyl carbamate in soy sauces. | Food Chem., 1993, 48 (3), 313-316. |
| Ethylamphetamine, stereoselective metabolism | Analysis of time-lapse changes of D- and L-enantiomers of racemic ethylamphetamine and stereoselective metabolism in rat urine by HPLC determination. | J. Anal. Toxicol., 1995, 19 (4), 225-228. |
| Ethylene thiourea | An improved method for residue analysis of ethylene thiourea in vegetables by HPLC. | J. Pestic. Sci., 1986, 11 (1), 81-84. |
| Ethylene thiourea,<br>Propylene thiourea | Determination of ethylene thiourea and propylene thiourea in tomato products and in fruit purees. | Food Chem., 1993, 47 (3), 299-302. |
| Fatty acids | HPLC determination of fatty acids in phospholipid fraction of human platelets and plasma after administration of eicosapentaenoic acid. | Bunseki Kagaku, 1984, 33 (7), E219-E226. |
| Fatty acids, unsatu-rated | Procedure for TLC determination of radioactive labelled unsaturated compounds. | J. Chromatogr., 1979, 169, 213-222. |
| Fenitrothion | A rapid and sensitive method for detecting fenitrothion in biological fluids using the phosphorus-sulfur selective detector : a fenitrothion intoxication case. | Hiroshima J. Med. Sci., 1986, 35 (2), 87-92. |
| Flunarizine | Simple method for determination of flunarizine in serum by GC. | J. Chromatogr. Biomed. Appl., 1987, 65 (J. Chromatogr., 421), 372-376. |
| Fluoxetine,<br>Norfluoxetine | Issues in methodology and applications for therapeutic drug monitoring of fluoxetine and norfluoxetine enantiomers. | Ther. Drug. Monit., 1998, 20(1), 20-24. |
| Food additives (t-Butylquinol) | Determination of food additives by HPLC. IV. Determination of t-butylquinol in oily foods and dried fish. | Shokuhin Eiseigaku Zasshi, 1984, 25 (2), 209-213. |
| Fungicides | Application of solid-phase partition cartridges in the determination of fungicide residues in vegetable samples. | J. Chromatogr., 1993, 643 (1-2), 363-368. |
| Fungicides | Rapid analysis of fungicides in agricultural products and processed foods by applying an accelerated solvent extraction system. | Shokuhin Eiseigaku Zasshi, 1997, 38(5), 358-362 |
| Furazolidone | Determination furazolidone in swine plasma, muscle, liver, kidney, fat and urine based on HPLC separation after solid-phase extraction on EXtrelut NT. | J. Chromatogr., 1986, 362 (1), 141-145. |
| General aspects | Determination of a new angiotensin converting enzyme inhibitor and its active metabolite in plasma and urine by GC-MS. | J. Chromatogr., 1987, 419, 122-133. |
| Ginsenosides | Procedure for LC determination of ginsenosides from ginseng drug preparations or plant material. | Planta Med., 1980, 39, 348-357. |
| Glyburide | Determination of glyburide in human plasma by LC with fluorescence detection. | J. Liq. Chromatogr., 1989, 12 (10), 1741-1758. |
| Glyceryl trinitrate | Simultaneous determination of glyceryl trinitrate and its two dinitrate metabolites in plasma and tissues by capillary GC | J. Chromatogr. Biomed. Appl., 1990, 99 (J. Chromatogr., 534), 196-201. |
| Granisetron | A rapid assay of granisetron in biological fluids from cancer patients. | Biol. Pharm. Bull.,1998, 21(5): 535-537. |
| Griseofulvin | Determination of griseofulvin in rat plasma by HPLC and HPTLC. | J. Chromatogr., 1979, 163, 322-326. |
| Growth-promoting compounds | Procedure for the GC-MS confirmation of some exogenous growth-promoting compounds in the urine of cattles. | J. Chromatogr., 1983, 279, 533-542. |
| Haloacetic acids | Measurement of haloacetic acids and their decomposition in wine by capillary GC. | Food Addit. Contam., 1991, 8 (1), 119-124. |
| Haloperidol,<br>Hydroxyhaloperidol | HPLC analysis of haloperidol and hydroxyhaloperidol in plasma after solid-phase extraction. | J. Chromatogr. Biomed. Appl., 1990, 97 (J. Chromatogr., 532), 193-202. |
| Heterocyclic amines (HAA) | Determination of heterocyclic amines (HAA) in commercially available meat products and fish by HPLC-ESI-MS-MS. | Chromatographia, 1998, 48(3-4), 258-262. |
| Heterocyclic aromatic amines | Quantitative estimation of heterocyclic aromatic amines by ion-exchange chromatography and electrochemical detection. | J. Chromatogr. A, 1995, 697 (1-2), 377-382. |
| Heterocyclic aromatic amines | Evaluation of different clean-up procedures for the analysis of heterocyclic aromatic amines in a lyophilized meat extract. | J. Chromatogr. A, 1999, 836(2), 223-233. |
| Heterocyclic aromatic amines | Determination of heterocyclic aromatic amines in fried beefsteak, meat extract and fish by capillary zone electrophoresis. | Chromatographia, 1998, 48(9-10), 700-706. |
| Homopolymeric peptides | Fluorimetric determination of homopolymeric peptides with 5-dimethylaminonaphthalene-sulphinic acid after N-chlorination. | Chem. Pharm. Bull., 1989, 37 (10), 2841-2842. |
| Hydrocortisone | Clean up and re-use of kieselguhr (Extrelut) for liquid-liquid extraction of urinary cortisol. | J. Chromatogr. Biomed. Appl., 1997, 692(1), 238-240. |
| 3-Hydroxybutyric acid | Determination of incubator-reject eggs in egg products by means of the 3-hydroxybutyric acid content. I. Improved enzymic and GCassays. | J. Agric. Food Chem., 1986, 34 (4), 663-666. |
| Hydroxycortico-steroids | Determination of 17-hydroxycorticosteroids in urine by fluorescence HPLC using Dns-hyydrazine as a pre-column labelling reagent. | J. Chromatogr., 1982, 232 (1), 1-11. |
| 4-Hydroxymandelic acid enantiomers | Determination of p-hydroxymandelic acid enantiomers in urine by HPLC with electrochemical detection. | J. Pharm. Biomed. Anal., 1997, 15(9-10): 1509-1514. |
| p-Hydroxymethadone | Synthesis, characterization and quantitation of para-hydroxymethadone, a metabolite of methadone in the rat. | Drug Metab. Dispos., 1986, 14 (4), 477-481. |
| 4-Hydroxy-2-(4-methyl-phenyl) benzo-thiazole | Enzyme immunoassay for 4-hydroxy-2-(4-methylphenyl)benzothiazole. | J. Pharm. Biomed. Anal., 1993, 11 (6), 469-476. |
| 4-Hydroxynonenal | Quantitative determination of the lipid peroxidation product 4-hydroxynonenal by HPLC. | Anal. Biochem., 1985, 150 (2), 369-378. |
| 5-(4-Hydroxyphenyl)-5-phenylhydantoin | HPLC method for direct separation of 5-(4-hydroxyphenyl)-5-phenylhydantoin enantiomers using a chiral tris(4-methylbenzoate) column. | J. Chromatogr. Biomed. Appl., 1991, 106 (J. Chromatogr., 568), 157-163. |

| Compound | Title | Joumal |
|---|---|---|
| Hydroxysteroids | Fluorescence HPLC determination of 3 alpha-hydroxysteroids in urine of 21-hydroxylase deficiency. | Biomed. Chromatogr., 1986, 1 (1), 1-6. |
| 4-Hydroxytertatolol stereoisomers | Determination of 4-hydroxytertatolol stereoisomers in rat and human urine by HPLC. | J. Liq. Chromatogr., 1995, 18 (14), 2801-2812. |
| Hyoscyamine, Hyoscyne | Comparison between TLC-densitometry and HPLC for the determination of hyoscyamine and hyoscyne in leaves, fruit and seeds of Datura (Datura spp.). | J. Chromatogr., 1985, 329, 415-421. |
| Imipramine, Desipramine | Simultaneous determination of imipramine, desipramine and their deuterium labelled analogues in biological fluids by capillary GC-MS. | J. Chromatogr. Biomed. Appl., 1988, 70 (J. Chromatogr., 426), 93-101. |
| Ipronidazole, Ronidazole, Dimetridazole | LC multi-component methods for determination of residues of ipronidazole, ronidazole, and dimetridazole and some relevant metbolites in eggs, plasma, and faeces and its use in depletion studies in laying hens. | J. Assoc. Off. Anal. Chem., 1991, 74(1), 46-55. |
| Isosorbide dinitrate | Determination of isosorbide dinitrate and its mononitrate metabolites in human plasma using EXtrelut NT purification and capillary-column GLC. | J. Chromatogr. Biomed. Appl., 1984, 31 (J. Chromatogr., 306), 165-172. |
| Isosorbide nitrates | Clean-up of plasma extracts by GPC during analysis of isosorbide nitrates by capillary GC. | J. Chromatogr., 1991, 553 (1), 21-27. |
| Ketobemidone | Determination of ketobemidone in plasma by HPLC with electrochemical detection. | J. Chromatogr. Biomed. Appl., 1986, 48 (J. Chromatogr., 375), 207-211. |
| Lauric acid, Ethyl laurate | Simultaneous quantitation of lauric acid and ethyl laurate in Sabal serrulata by capillary GC and derivatization with trimethyl sulphoniumhydroxide. | J. Chromatogr. A, 1996, 719 (2), 479-482. |
| Laxatives | Qualitative and quantitative analysis of some synthetic, chemically acting laxatives in urine by GC-MS. | J. Chromatogr., 1981, 222 (3), 389-398. |
| Levamisole | Rapid EXtrelut NT column method for determination of levamisole in milk using HPLC. | J. Chromatogr. Biomed. Appl., 1985, 38 (J. Chromatogr., 337), 151-155. |
| Lidocaine | Toxicoligical analysis of lidocaine in biological materials by using HPLC: Benzocaine, procaine, tetracaine, bupivacaine. | Forensic Sci. Int., 1991, 49 (1), 65-73. |
| Local anaesthetics | Simultaneous determination of local anaesthetics including ester-type anaesthetics in human plasma and urine by GC-MS with solid-phase extraction. | J. Chromatogr. Biomed. Appl., 1999, 726(1-2), 185-194. |
| Lornoxicam and 5'-hydroxy-lornoxicam | Determination of the novel non-steroidal anti-inflammatory drug lornoxicam and its main metabolite in plasma and synovial fluid. | J. Chromatogr. Biomed. Appl., 1998, 707(1-2), 151-159. |
| Lysergide (LSD) and its N-demethyl metabolite | Determination of LSD and N-demethyl-LSD in urine by LC coupled to ESI-MS. | J. Chromatogr. Biomed. Appl., 1997, 692(2), 329-335. |
| Malathion | GC determination of malathion. | Eisei Kagaku, 1983, 29 (6), 423-426. |
| Methamphetamine | Separation of methamphetamine and amphetamine in blood and urine on an EXtrelut NT column. | Nippon Hoigaku Zasshi, 1983, 37 (1), 63-66. |
| Methamphetamine | Extraction of methamphetamine in human urine using EXtrelut NT column. | Kagaku Keisatsu Kenkyusho Hokoku, Hokagaku Hen. 37 (3), 1984, 224-226. |
| Methandienone | Detection of methandienone (methandrostenolone) and metabolites in horse urine by GC-MS. | J. Chromatogr. Biomed. Appl., 1992, 115 (J. Chromatogr., 577), 195-203. |
| Methomyl | Sensitive determination of methomyl in blood using GC-MS as its oxime tert-butyldimethylsilyl derivative. | J. Chromatogr. Biomed. Appl., 1998, 713(2), 323-330. |
| 3-Methoxy-4-hydroxyphenylglycol | Determination of unconjugated 3-methoxy-4-hydroxyphenylglycol by LC for monitoring inhibition of monoamine oxidase activity in plasma. | Clin. Chem., 1987, 33 (11), 2078-2080. |
| 3-Methoxy-4-sulfonyloxyphenyle-thanediol | Direct determination of 3-methoxy-4-sulphonyloxyphenylethanediol (MHPG sulphate) in urine using GLC. | J. Chromatogr. Biomed. Appl., 1984, 30 (J. Chromatogr., 305), 438-441. |
| Methy lamphetamine | Simple extractive derivatization of methylamphetamine and its metabolites in biological materials with Extrelut columns for their GC-MS determination. | J. Anal. Toxicol., 1997, 21(1), 54-58. |
| Methyl amphetamine, Amphetamine | Estimation of optically active methylamphetamine and amphetamine using alpha-methoxy-alpha-trifluoromethylphenylacetyl chloride. | Nippon Hoigaku Zasshi, 1991, 45 (1), 1-5. |
| Methyl carbamate, Ethyl carbamate | Method for the determination of methyl carbamate and ethyl carbamate in wines. | Food Addit. Contam., 1992, 9 (2), 149-160. |
| N-Methyl carbamate pesticides | Determination of N-methylcarbamate pesticides in foods using an accelerated solvent extraction with a mini-column clean up. | Analyst, 1998, 123(4), 711-714. |
| Methylcitric acid | Methylcitric acid (2-hydroxybutane -2,3-tricarboxylic acid) determination in amniotic fluid by electron-impact mass fragmentography. | J. Clin. Chem. Clin. Biochem., 1988, 26 (5), 345-348. |
| Methylmalonic acid | Capillary GC-MS - stable isotope dilution analysis of methylmalonic acid in plasma: a candidate reference method for the diagnosis and the follow-up of methylmalonic acidaemias. | Chromatographia, 1993, 36, 212-214. |
| Methylparaben | Quantitative Gc and TLC determination of methylparaben (methyl hydroxybenzoate) in pharmaceutical dosage forms. | J. Chromatogr., 1984, 294, 431-435. |
| Methylprednisolone | Rapid method for the measurement of methylprednisolone and its hemisuccinate in plasma and urine following "pulse therapy" by HPLC. | J. Chromatogr. Biomed. Appl., 1985, 43 (J. Chromatogr., 342), 251-260. |
| Methylpyrazines | Simple and accurate determination of methylpyrazines in biofluids using HPLC. | J. Chromatogr., 1991, 567, 415. |
| Metoclopramide | Procedure for LC determination of metoclopramide in human serum. | Fresenius' Z. Anal. Chem., 1980, 301, 109-110. |
| Mexiletine | Investigation of blood level of mexiletine. | Byoin Yakugaku, 1987, 13 (3), 132-136. |
| Mexiletine | Sensitive determination method for mexiletine derivatized with dansyl chloride in rat plasma utilizing a HPLC peroxyoxalate chemiluminescence detection system. | J. Pharm. Biomed. Anal., 1997, 15(9-10): 1509-1514. |
| Microbial metabolites | Pre-column switching in HPLC quantitation of small amounts of microbial metabolites as an alternative method to off-line extraction. | Chromatographia, 1984, 19, 246-250. |
| Moclobemide (monoamine oxidase inhibitor) | Determination of the new monoamine oxidase inhibitor moclobemide and three of its metabolites in biological fluids by HPLC. | J. Chromatogr. Biomed. Appl., 1987, 64 (J. Chromatogr., 420), 110-120. |
| Mononitroso piperazine | Determination of N-mononitrosopiperazine and N,N-dinitrosopiperazine in human urine, gastric juice and blood. | J. Chromatogr., 1983, 278 (1), 71-80. |
| Morphine | Combined liquid-solid chromatography and radioimmunoassay for determination of morphine in human fluids. | J. Pharmacol. Methods, 1984, 11 (4), 227-237. |

| Compound | Title | Joumal |
|---|---|---|
| Morphine | Concentrations of free and conjugated morphine in blood in twenty cases of heroin-related deaths. | J. Chromatogr. Biomed. Appl., 1987, 66 (J. Chromatogr., 422), 267-273. |
| Morphine | Determination of morphine in plasma by GC using a macrobore column and thermoionic detection after EXtrelut NT column extraction: application to follow-up morphine treatment in cancer patients. | J. Chromatogr. Biomed. Appl., 1989, 81 (J. Chromatogr., 489), 411-418. |
| Morphine | Morphine determination by GC-MS in human vitreous humour and comparison with radio-immunoassay. | J. Anal. Toxicol., 1992, 16 (6), 372-374. |
| Morphine | Comparative study of different extractive procedures to quantify morphine in urine by HPLC - UV. | J. Liq. Chromatogr., 1992, 15 (9), 1533-1541. |
| Morphine | Comparison of solid-phase extraction and supercritical fluid extraction for the analysis of morphine in whole blood. | J. Anal. Toxicol., 1999, 23(3), 216-218. |
| Morphine, Amphetamine | Analysis of morphine and amphetamine in meconium with immunoassay and HPLC-diode-array detection. | J. Anal. Toxicol., 1994, 18 (5), 294-295. |
| Mucoregulatory drug (CO 1408) | HPLC determination of the mucoregulatory drug CO 1408 (-)-2-[6(S)-hydroxy-4(R)-(1-hydroxy-methylethyl)cyclohexenyl]ethanol in rat plasma and urine. | J. Chromatogr., 1990, 507, 227-234. |
| Nadolol diastereomers | Determination of nadolol diastereomers in dog plasma using chiral derivatization and reversed-phase HPLC with fluorescence detection. | J. Chromatogr. Biomed. Appl., 1994, 661 (2), 281-289. |
| Nandrolone, Trenbolone | Determination of 19-nortestosterone and trenbolone in animal tissues by HPLC with immunoaffinity clean up. | Food. Addit. Contam., 1998, 15(3), 293-301. |
| Naphthalene | Naphthalene in biological fluids. | Res. Pract. Forensic Med., 1988, 31, 151-156. |
| Nicergoline metabolite | Determination of 10-alpha-methoxy-9,10-dihydrolysegol, a nicergoline metabolite, in human urine by HPLC. | Biomed. Chromatogr., 1992, 6 (1), 91. |
| Nicotine | Improved method for routine determination of nicotine and its main metabolites in biological fluids. | J. Chromatogr., 1982, 232 (2), 295-303. |
| Nicotine | Microanalysis of nicotine in urine and plasma. | Eisei Kagaku, 1982, 28 (1), 13-17. |
| Nicotine | Determination of nicotine and four metabolites in the serum of smokers by HPLC with ultra-violet detection. | J. Chromatogr. Biomed. Appl., 1993, 132 (J. Chromatogr., 621), 257-261. |
| Nicotine | Determination of nicotine and two major metabolites in serum by solid-phase extraction and HPLC and HPLC - particle beam - MS. | J. Chromatogr. Biomed. Appl., 1993, 123 (J. Chromatogr., 612), 209-213. |
| Nicotine | Rapid solid-phase extraction method for automated GC-MS determination of nicotine in plasma. | J. Chromatogr. Biomed. Appl., 1998, 707(1-2), 312-316. |
| Nicotine, Cotinine | Simultaneous determination of nicotine and cotinine in urine by GLC. | Eisei Kagaku, 1986, 32 (4), 276-280. |
| Nimesulide and its metabolites | MS characterization and HPLC determination of the main urinary metabolites of nimesulide in man. | J. Pharm. Biomed. Anal., 1998, 18(1-2), 201-211. |
| Nimustine hydrochloride | Rapid and simple method for the determination of nimustine hydrochloride in human blood and brain by HPLC. | J. Chromatogr., 1990, 526 (2), 507-514. |
| Nitenpyram and its metabolites | Determination of the neonicotinoid pesticide nitenpyram and its metabolites in agricultural products. | Shokuhin Eiseigaku Zasshi, 1998, 39(2), 127-134. |
| Nitrazepam | HPLC determination of nitrazepam and its metabolites in human urine. | J. Chromatogr. Biomed. Appl., 1984, 35 (J. Chromatogr., 310), 213-218. |
| Nitroglycerin and its dinitrate metabolites | Determination of the two dinitrate mebabolites of nitroglycerin in human plasma by capillary GC with electron-capture detection. | J. Chromatogr. Biomed. Appl., 1987, 57 (J. Chromatogr., 413), 101-108. |
| Nitrophenols | HPLC of nitrophenols determination of products of on-column nitration of phenol. | J. High Resolut. Chromatogr. Chromatogr. Commun., 1987, 10 (11), 624-625 |
| Nitrosamines | Investigation on occurende of volatile nitrosamines in marinaded herrings prepared with and without addition of nitrate. | Z. Lebensm. Unters. Forschung, 1983, 177 (4), 261-263. |
| N-Nitrosamines, volatile and non-volatile | Quantitative assay of volatile and non-volatile N-nitrosamines by GC with an electrolytic detector. I. Method development and assay of N-nitrosodiethanolamine (NDELA) in creams and lotions. | J. Soc. Cosmet. Chem., 1988, 39 (6), 329-346. |
| Nitrosamines, volatile | Rapid solid-phase extraction method for the detection of volatile nitrosamines in food. | J. Agric. Food. Chem., 1997, 45(12), 4706-4713. |
| N-Nitrosodimethyl-amine | Procedure for GC determination of carcinogenic N-nitrosodimethylamine as a conta-mination in drugs containing aminophenazone. | Arzneim. Forschg., 1977, 29, 867-869. |
| Nitrosomethylurea | HPLC determination of N-nitrosomethylurea in biological fluids by reaction with 4-nitrothiophenol. | Food-Chem. Toxicol., 1986, 24 (3), 247-250. |
| N-Nitrosopiperazine | Determination of N-nitrosopiperazine and N,N'-di-nitrosopiperazine in human urine, gastric juice and blood. | J. Chromatogr. Biomed. Appl., 1983, 29 (J. Chromatogr., 278), 71-80. |
| Nitrosourea | Qualitative and quantitative analysis of a new sulphur-containing nitrosourea in blood by HPLC. | J. Chromatogr. Biomed. Appl., 1987, 63 (J. Chromatogr., 419), 381-387. |
| Norethisterone and six metabolites | Simultaneous determination of norethisterone and six metabolites in human plasma by capillary GC with mass-selective detection. | J. Chromatogr. Biomed. Appl., 1995, 674 (2), 155-165. |
| Norflurazon and oxadixyl residues | Simultaneous extraction of norflurazon and oxadixyl residues from food crops with supercritical carbon dioxide. | Chromatographia, 1996, 42 (3-4), 147-150. |
| Noscapine | New sensitive method to determine noscapine in serum by reversed-phase LC. | J. Chromatogr. Biomed. Appl., 1985, 38 (J. Chromatogr., 337), 429-433. |
| Ochratoxin A | Radio-immunoassay of ochratoxin A in barley. | Appl. Environ. Microbiol., 1985, 50 (2), 529-531. |
| Oestrogens | Determination of free oestrogens in serum using HPLC and electrochemical detection. | Analysis, 1990, 18 (5), 319-322. |
| Opiates | Procedure for GC determination of opiates in biological samples. | J. Chromatogr., 1981, 206, 109-116. |
| Organic acids | GC-MS and GC-FT-IR analysis of organic acids: preliminary data. | Biomed. Environ. Mass Spectrom., 1988, 16 (1-2), 285-288. |
| Organo-chlorine /organo-phosphorous pesticides | Multicolumn solid-phase extraction clean up of organophosphorus and organochlorine pesticide residues in vegetable oils and butterfat. | J. Assoc. Off. Anal. Chem. Int., 1995, 78 (2), 431-437. |

| Compound | Title | Joumal |
|---|---|---|
| Organo-chlorine /organo- phosphorous pesticides | Behaviour of 23 persistent organochlorine compounds during sulphuric acid cleanup on a solid-matrix column. | J. Chromatogr., 1990, 513, 33-337. |
| Organochlorine compounds | Multicolumn solid-phase extraction clean up of organophosphorus and organochlorine pesticide residues in vegetable oils and butterfat. | J. Assoc. Off. Anal. Chem. 1995, 78 (2), 431-437. |
| Organochlorine compounds | Sandwich-type extraction column with online sulfuric acid treatment for the determination of organochlorine compounds in vegetable oil or oilseeds by GC with electron-capture detection. | J. Chromatogr., 1993, 642 (1-2), 253-262. |
| Organochlorine pesticides | Solid-matrix partition for separation of organochlorine pesticide residues from fatty materials. | J. Chromatogr., 1991, 552 (1-2), 241-247. |
| Organochlorine pesticides | Single-step separation of organochlorine pesticide residues from fatty materials by combined use of solid-matrix partition and C18 cartridges. | J. Chromatogr. A., 1997, 765(1), 61-68. |
| Organophosphate pesticides | On-column partition cleanup of fatty extracts for organophosphate pesticide residue determination. | J. Assoc. Off. Anal. Chem., 1987, 70 (1), 106-108. |
| Organophosphate pesticides | Single-step multi-cartridge cleanup for organophosphate pesticide residue determination in vege-table oil extracts by GC. | Analyst, 1990, 115 (9), 1167-1169. |
| Organophosphorous pesticides | Single-step solid-matrix cleanup of vegetable extracts for organophosphorus pesticide residue determination. | J. Chromatogr., 1988, 456 (1), 149-153. |
| Organophosphorous pesticides | Screening of organophosphorus pesticides using LC-APCI-MS. | J. Chromatogr., 1992, 595, 193-202. |
| Organophosphorus pesticides | Multiresidue method for determination of organophosphorus pesticides in vegetables. | Food Addit. Contam., 1998, 15(5), 510-517. |
| Organophosphorus pesticides | Determination of organophosphorus pesticides in foods using an accelerated solvent extraction system. | Analyst, 1997, 122(3), 217-22. |
| Ornidazole | Simple LC method for the determination of ornidazole and metronidazole in human serum. | J. Chromatogr. Biomed. Appl., 1987, 64 (J. Chromatogr., 420), 228-230. |
| Ornidazole | Determination of ornidazole and its main metabolites in biological fluids. | J. Chromatogr. Biomed. Appl., 1990, 99 (J. Chromatogr., 534), 233-240. |
| Oxcarbazepine | Stereoselective bioanalysis of oxcarbazepine and the enantiomers of its metabolites by HPLC. | J. Liq. Chromatogr., 1995, 18 (8), 1533-1541. |
| Oxidative hair dye compounds | Practical GC-MS analysis of oxidation dye components in hair fibre as a forensic investigative procedure. | J. Forensic. Sci., 1999, 44(2), 292-296. |
| Oxine-copper | Determination of oxine-copper in organe by GC. | J. Chromatogr., 1989, 474 (2), 381-387. |
| Oxpentifylline and its metabolite | Determination of 3,7-dimethyl -(5-oxohexyl)xanthine (oxpentifylline) and its 1-(5-hydrohexyl)-3,7-dimethylxanthine metabolite in the plasma of patients with multiple diseases using HPLC. | J. Chromatogr. Biomed. Appl., 1984, 30 (J. Chromatogr., 305), 419-427. |
| Oxprenolol | Determination of oxprenolol in plasma by column LC. | J. Chromatogr. Biomed. Appl., 1988, 70 (J. Chromatogr., 426), 229-233. |
| Oxprenolol | Identification and quantitative determination of oxprenolol in blood. | J. Planar Chromatogr., 1989, 2 (2), 153-155. |
| Oxybuprocaine | Oxybuprocaine and five metabolites simultaneously determined in urine by GC and GC-MS after extraction with EXtrelut NT. | Clin. Chem., 1987, 33 (5), 697-700. |
| Patulin | LC determination of patulin in french apple ciders. | J. Assoc. Off. Anal. Chem., 1996, 79 (5), 1107-1110. |
| PCDD, PCDF, PCB, PAH | PCDD (polychlorinated dibenzo-p-dioxins), PCDF (polychlorinated dibenzofurans), PCB (polychlorinated biphenyls), PAH (polyaromatic hydrocarbons), cadmium and lead in roadside soil: Relationship between road distance and concentration. | Chemosphere, 1992, 24 (8), 1077-1083. |
| Pentachloronitro-benzene | LC study of degradation and metabolism of pentachloronitrobenzene by four soil micromycetes. | Chemosphere, 1996, 33 (4), 683-692. |
| Pesticides | Simplified extraction and cleanup for multi-residue determination of pesticides in lanolin. | J. Assoc. Off. Anal. Chem., 1989, 72 (6), 991-993. |
| Pesticides | Multiresidue analysis of various kinds of pesticides in cereals by SFE, GC and HPLC. | Shokuhin Eiseigaku Zasshi, 1999, 40(1), 68-74. |
| Pesticides | Studies on simultaneous determination of fifteen pesticides in cereals by SFE and HPLC. | Shokuhin Eiseigaku Zasshi, 1998, 39(3), 184-191. |
| PHB esters, Sorbic acid | Simultaneous determination of sorbic acid, dehydroacetic acid, benzoic acid and p-hydroxy-benzoic acid esters by pretreatment with EXtrelut NT column. | Fukushima-ken Eisei Kogai Kenkyusho Nenpo, 1985(3), 100-105. |
| Phenobarbital | Phenobarbital in hair and drug monitoring. | Forensic Sci. Int., 1995, 70 (1-3), 191-202. |
| Phenols | Schotten-Baumann benzoylation of phenols on an EXtrelut NT column. | J. Chromatogr., 1987, 398, 320-322. |
| Phenols | Application of liquid-liquid partition chromatography to a student exercise in organic chemistry. IV. Nitra-tion of phenol in an EXtrelut NT column. | Kagaku to Kyoiku, 1987, 35 (3), 251-253. |
| Phenols, p-Nitrophenols | On-column organic reactions. III. Catalysis by phenol in the nitration of p-nitrophenol with aqueous nitric acid on an EXtrelut NT column. | Chem. Pharm. Bull., 1988, 36 (7), 2661-2664. |
| Phenytoin | Sensitive method for the determination of phenytoin in plasma, and phenytoin and 5-(4-hydroxyphenyl)-5-phenylhydantoin in urine by HPLC. | J. Pharm. Biomed. Anal., 1992, 10 (10-12), 1001-1006. |
| Phenytoin, Hydroxyphenytoin | HPLC determination of phenytoin and hydroxyphenytoin in human urine. | J. Chromatogr. Biomed. Appl., 1983, 26 (J. Chromatogr., 275), 97-105. |
| Phospholipids | Trace analysis of phospholipids by enzymic reactions on a silica-gel plate. | Nippon Kagaku Kaishi, 1990 (8), 896-897. |
| Phospholipids | Flow-injection analysis for determination of choline-containing phospholipids by luminol chemiluminescence. | Yakugaku Zasshi, 1992, 112 (1), 50-55. |
| Piperazine | GC method for determination of a piperazine derivative (Trelibet) and its metabolites in human plasma and urine. | J. Chromatogr. Biomed. Appl., 1986, 51 (J. Chromatogr., 378), 155-162. |
| Piperazine (anti-hypertensive drug) | Determination of the antihypertensive drug 1-[2-ethoxy-2-(3'-pyridyl)ethyl]-4-(2'-methoxy-phenyl) piperazine (IP/66) in rat and human plasma by HPLC and isotpe dilution MS. | J. Chromatogr., 1989, 487 (2), 331-340. |

| Compound | Title | Joumal |
|---|---|---|
| Piroxicam | HPTLC assay for the routine determination of piroxicam in plasma, urine and tissue. | J. Chromatogr. Biomed. Appl., 1983, 27 (J. Chromatogr., 276), 243-248. |
| Pirprofen | Determination of the (+)- and (-)-enantiomers of pirprofen in human plasma by HPLC. | J. Chromatogr. Biomed. Appl., 1987, 58 (J. Chromatogr., 414), 131-137. |
| Pirprofen | HPLC determination of pirprofen and five of its metabolites in human plasma without hydrolysis and in human urine before and after chemical hydrolysis. | J. Chromatogr. Biomed. Appl., 1989, 87 (J. Chromatogr., 495), 195-203. |
| Polycyclic aromatic hydrocarbons, Heterocyclic aromatoc amines | Solid-phase extraction for the selective isolation of polycyclic aromatic hydrocarbons, aza-arenes and heterocyclic aromatic amines in charcoal-grilled meat. | J. Chromatogr. A, 1996, 731 (1-2), 85-94. |
| Polyethylene glycol 400 | HPLC determination of polyethylene glycol 400 in urine: Oligomeric profile in healthy and coeliac disease subjects. | Clin. Chem., 1994, 40 (8), 1571-1574. |
| Polyphenols | Polyphenolic content in five Tuscany cultivars of Olea europaea L. | J. Agric. Food. Chem., 1999, 47(3), 964-967. |
| Polysorbates | Determination of polysorbates in foods by colorimetry with confirmation by IR spectrophotometry, TLC and GC. | J. Assoc. Off. Anal. Chem., 1989, 72 (1), 27-29. |
| Prazepam | Quantitative analysis of prazepam and its metabolites by electron capture GC and selected ion monitoring. Application to dia-placetal passage and fetal hepatic metabolism in early human pregnancy. | J. Chromatogr., 1978, 146 (2), 227-239. |
| Pregnenolone | Quantitation of pregnenolone and 17-hydroxypreg-nonolone in human serum by automatic HPLC and subsequent radioimmunoassay. | J. Chromatogr., 1981, 224, 229-237. |
| Preservatives in food | Separation of flavoring agents and preservatives from food by EXtrelut NT. | Nara-ken Eisei Kenkyusho Nenpo, 1980, 15, 86-88. |
| Procainamide | Simultaneous determination of procainamide and N-acetylprocainamide in serum by GC with nitrogen-selective detection. | J. Chromatogr. Biomed. Appl., 1987, 59 (J. Chromatogr., 415), 143-147. |
| Progesterone | Procedure for GC determination of progesterone in rat plasma. | J. Chromatogr., 1979, 177, 237-244. |
| Propylene glycol | Rapid analysis of propylene glycol in fatty foods. | Eisei Kagaku, 34 (2), 1988, 175-178. |
| Prostaglandin E1 | Determination of prostaglandin E1 and its main plasma metabolites 15-ketoprostaglandin E0 and prostaglandin E0 by GC - negative-ion-CI triple-stage. | Biol. Mass Spectrom., 1994, 23 (3), 165-170. |
| Prothiophos | A case of death from prothiophos poisoning. | Forensic Sci. Int., 1988, 38 (1-2), 13-19. |
| Proxyphylline | HPLC determination of (R)- and (S)-proxyphylline in human plasma. | J. Chromatogr. Biomed. Appl., 1989, 83 (J. Chromatogr., 491), 355-366. |
| Psilocin | Quantitation of psilocin in human plasma by HPLC and electrochemical detection: comparison of liquid-liquid extraction with automated on-line solid-phase extraction. | J. Chromatogr. Biomed. Appl., 1998, 709(2), 255-263. |
| Pyrethrins | Determination of pyrethroid pesticide residues in fatty materials by solid-matrix dispersion partition, followed by mini-column size-exclusion chromatography. | J. Chromatogr., 1999, 833(1), 19-34. |
| Pyrethrins | Clean-up of aqueous acetone vegetable extracts by solid-matrix partition for pyrethroid residue determination by GC – electron capture detection. | J. Chromatogr., 1997, 765(1), 39-49. |
| Pyrrolidinone | Determination of pyrrolidinone in plasma by HPLC. | J. Chromatogr. Biomed. Appl., 1985, 45 (J. Chromatogr., 344), 125-136. |
| Pyrrolizidine alkaloids | Determination of pyrrolizidine alkaloids in honey from selected sites by solid-phase extraction and HPLC-MS. | Food. Addit. Contam., 1997,. 14(5), 419-428. |
| Quinoline | 2-amino-3,4-dimethylimidazo-4,5-F-quinoline is not detectable in commercial instant und roasted coffees. | J. Agric. Food Chem., 1991, 39 (12), 2231-2236. |
| Resorcinol | Determination of free resorcinol in human serum and urine by HPLC with amperometric detection. | Ann. Chim., 1986, 76 , 419-426. |
| Retention index values | Impact of biological matrix, drug concentration and method of isolation on detectability and variability of retention index values in GC. | J. Anal. Toxicol., 1985, 9 (2), 49-54. |
| Retinoic acid | Determination of the new aromatic retinoic acid Ro 13-7410 in plasma by two-dimensional GC - negative ion - CIMS with selected-ion monitoring. | Biomed. Environ. Mass Spectrom., 1989, 18 (7), 453-463. |
| Retinol | Disposable cartridge extraction of retinol and alpha-tocopherol from feedstuffs. | J. Assoc. Off. Anal. Chem., 1985, 68 (6), 1121-1125. |
| Retinol, alpha-Tocopherol | Disposable cartridge extraction of retinol and alpha-tocopherol from fatty samples. | J. Assoc. Off. Anal. Chem., 1988, 71 (1), 12-15. |
| Revenast hydrochloride | Determination of revenast hydrochloride in human plasma by GC with nitrogen-selective detection. | J. Chromatogr. Biomed. Appl., 1987, 63 (J. Chromatogr., 419), 351-356. |
| Rifabutin | Specific HPLC assay for determination of rifabutin plasma concentration following Extrelut column extraction. | J. Chromatogr. Biomed. Appl., 1999, 728(2), 233-239. |
| Risperidone, 9-Hydroxyrisperidone | Determination of risperidone and 9-hydroxyrisperi-done in human plasma by HPLC with electrochemical detection. | J. Chromatogr. Biomed. Appl., 1993, 125 (J. Chromatogr., 614), 333-339. |
| Rocuronium and its 17-desacetyl metabolite | Quantification of the neuromuscular blocking agent rocuronium and its putative metabolite 17-desacetylrocuronium in heparinized plasma by capillary GC using a nitrogen sensitive detector. | J. Chromatogr. Biomed. Appl., 1997, 702(1-2), 111-117. |
| Saccharin | Determination of food preservatives and saccharin by HPLC. | J. Chromatogr., 1979, 173 (2), 343-348. |
| Sesquiterpene lactones | Sesquiterpene lactones from Arnica chamissonis Less. VI. Identification and quantitative determination by HPLC and GC. | J. Chromatogr., 1987, 410 (2), 329-342. |
| Sherry-like wine (Vernaccia di Oristano) | Volatile composition of Vernaccia di Oristano sherry-like wine as affected by biological ageing. | J. Sci. Food Agric., 1996, 70 (1), 44-50. |
| Silybin | LC assay of silybin (silymarin I) in human plasma and urine. | J. Liq. Chromatogr., 1991, 14 (7), 1285-1296. |
| Steroid hormones | Improved extraction method for plasma steroid hormones. | Clin. Chim. Acta, 1979, 93 (3), 429-431. |
| Steroid hormones | Simultaneous determination of fifteen steroid hormones from a single serum sample by HPLC and radio-immunoassay. | J. Chromatogr. Biomed. Appl., 1984, 35 (J. Chromatogr., 310), 386-389. |
| Steroids | Rapid and efficient extraction of steroids from microliter quantities of plasma using EXtrelut NT mini-columns. | Clin. Chim. Acta, 1980, 108 (3), 479-482. |
| Steroids | Testosterone radioimmunoassay: rapid extraction technique for steroids based on kieselguhr mini-columns. | Steroids, 1980, 36 (2), 149-159. |

| Compound | Title | Joumal |
|---|---|---|
| Steroids | A reverse phase HPLC-UV spectrometry method for the analysis of several intrinsic adrenal delta 4-steroid concen-tration. | Nippon Naibunpi Gakkai Zasshi, 62 (12), 1986, 1326-1335. |
| Steroids | Semi-automated application of steroids on to TLC sheets. | Anal. Biochem., 1995, 231 (2), 447-449. |
| Steroids | Improved detection of steroids on $NH_2$ layers. | Chromatographia, 1995, 41 (3-4), 175-177. |
| Steroids | The use of supercritical-fluid extraction for the determination of steroids in animal tissues. | Analyst, 1998, 123(12), 2671-2676. |
| Steroids, adrenal | Simultaneous quantitative measurement of fourteen adrenal steroids by capillary column GC-MS and its clinical appli-cation. | J. Chromatogr., 1986, 374 (1), 5-16. |
| Sterols | New, rapid method for the separation of labelled sterols synthesized by cell cultures by means of EXtrelut NT. | Fresenius'Z. Anal. Chem., 1985, 322 (5), 512-513. |
| Strychnine | A new HPLC method for the quantitation of strychnine in urine and tissue extracts. | J. Clin. Chem. Clin. Biochem., 1982, 20 (4), 203-206. |
| Sulphasalazine | LC method for the simultaneous determination of sulphasalazine and its metabolites in biological fluids. | Chromatographia, 1987, 24, 720-724. |
| Sulphonamides | LC with amperometric detection of some sulphonamides and their N-4-acetyl-metabolites in serum und urine. | J. Pharm. Biomed. Anal., 1991, 9, 925-928. |
| Sulthiame | Analysis of sulthiame in serum by narrow-bore HPLC. Comparison of direct sample injection with pre-column switching and EXtrelut NT extraction. | J. Chromatogr., 1991, 553 (1), 7-13. |
| Synephrine enantiomers | Determination of synephrine enantiomers in food and conjugated synephrine in urine by HPLC. | Anal. Biochem., 1996, 235 (2), 191-194. |
| Temazepam | Development of a supercritical fluid extraction method for the determination of temazepam in whole blood. | J. Anal. Toxicol., 1997, 21(4), 297-300. |
| Tenoxicam | Determination of tenoxicam, and the isolation, identification and determination of Ro 17-6661, its major metabolite, in human urine. | J. Chromatogr., 1984, 317, 483-492. |
| Terpenes | Analysis of terpenes from Ginkgo Biloba L. extracts by RP-HPLC. | Chromatographia, 1990, 29, 251. |
| Tertatolol | Determination of tertatolol enantiomers in biological fluids by HPLC. | J. Chromatogr. Biomed. Appl., 1991, 110 (J. Chromatogr., 572), 203-210. |
| Testosterone | Measurement of plasma testosterone by GC – negative ion - CIMS using pentafluoropropionic derivatives. | J. Chromatogr. Biomed. Appl., 1995, 663 (2), 187-192. |
| Testosterone | Determination of testosterone in human hair by GC - selectedion monitoring - MS. | Analyst, 1998, 123(12), 2661-2663. |
| Testosterone, Androstadienone | Simultaneous determination of testosterone and androstadienone (sex attractant) in human plasma by GC-MS with high-resolution selected-ion monitoring. | J. Chromatogr. Biomed. Appl., 1991, 103 (J. Chromatogr., 565), 35-44. |
| Tetraorganolead compounds | Metabolism of tetraorganolead compounds by rat-liver microsomal monooxygenase. I. Analytical methods for quantitative determination of dealkyla-tion products. | Xenobiotica, 1983, 13 (10), 577-581. |
| Theophylline, Theobromine , Caffeine | Highly sensitive and rapid determination of theophylline, theobromine and caffeine in human plasma and urine by gradient capillary HPLC - frit - FABMS. | J. Chromatogr. Biomed. Appl., 1995, 667 (2), 241-246. |
| Thiabendazole | Capillary GC determination of thiabendazole in citrus and apple juices. | J. Assoc. Off. Anal. Chem., 1994, 77(5), 1293-1296. |
| Thiamphenicol | Procedure for LC determination of thiamphenicol in bovine serum and milk. | J. Liq. Chromatogr., 1994, 17 (12), 2625-2632. |
| Thiopental | Toxicological study on intravenous thiopental anesthesia-interrelation between rate of injection and distribution of thiopental. | Forensic Sci. Int., 1987, 33 (3), 169-175. |
| Ticlopidine | Quantitative HPLC, GC, and GC-MS analysis of ticlopidine in baboon plasma after solid-phase extraction. | J. Pharm. Sci., 1991, 80 (11), 1092-1095. |
| Timelotem dihydrogen maleate | Determination of timelotem dihydrogen maleate and its main metabolite N-desmethyltimelotem in plasma by capillary GC. | J. Chromatogr. Biomed. Appl., 1987, 63 (J. Chromatogr., 419), 357-362. |
| Tiropramide | Identification of metabolites of tiropramide in human urine. | Biomed. Environ. Mass Spectrom., 1988, 15 (4), 205-209. |
| Toluene-2,4-diamine | GC determination of 2,4-toluenediamine (toluene-2,4-diamine) in urine. | Ann. Chim., 1992, 82 (3-4), 179-183. |
| Trace aroma and flavour components | Solid-phase extraction and determinationof trace aroma and flavour components in cider by GC-MS. | Chromatographia, 1996, 42 (1-2), 101-105. |
| Trace organic impurities | Isolation, characterization and determination of trace organic impurities in FD and C Red No. 40 [C.I. Food Red 17]. | J. Chromatogr., 1989, 467, 167-176. |
| Tranquilizers | GC and GC/MS analysis of tranquilizers in meat. | Fresenius' Z. Anal. Chem., 1982, 311, 398-399 |
| Triclosan | Selected-ion-monitoring assay for triclosan in medical waste water. | Biomed. Environ. Mass Spectrom., 1988, 16, 255-257. |
| Triethylene thiophosphoramide | HPLC of the anti-tumour agent triethylene thiophosphoramide and its metabolite triethylene phosporamide with sodium sulphide, taurine and phthalaldehyde as pre-column fluorescent derivatization reagents. | J. Chromatogr., 1988, 458, 295-301. |
| Triethylene thio-phosphoramide | Spectrofluorimetric determination of triethyelene thiophosphoramide in blood. | Anal. Chim. Acta, 1987, 201, 77-82. |
| Vitamin $D_3$ | A sensitive and simplified radioimmunoassay for 1alpha,25-dihydroxyvitamin $D_3$. | Clin. Chim. Acta, 1984, 142 (3), 325-338. |
| Vitamin $D_3$ | Rapid method for measuring physiological concen-trations of 25-hydroxyvitamin D levels in blood serum. | Clin. Chim. Acta, 1985, 153 (2), 85-92. |
| Yutac | HPLC method for quantitative determination of Yutac, a new antiarrhythmic agent, in dog plasma. | J. Chromatogr. Biomed. Appl., 1985, 39 (J. Chromatogr., 338), 428-432. |
| Zindoxifene | Chromatographic analysis of the new antiestrogen zindoxifene and its metabolites in biological material. | J. Chromatogr., 1987, 414, 235-241. |

# エキストレルルート NT 製品ラインアップ

## プレパックカラム

| 製品名 | サンプル容量 (mL) | カラム材質 | カラム数（一箱中） | 注文番号 |
|---|---|---|---|---|
| エキストレルルート NT1 | 0.1-1 | ガラス | 100 | 1.15094.0001 |
| エキストレルルート NT3 | 1-3 | ガラス | 50 | 1.15095.0001 |
| エキストレルルート NT20 | <20 | プラスチック | 25 | 1.15096.0001 |

## 詰め替え用充填剤

| 製品名 | 包装単位 | 注文番号 |
|---|---|---|
| エキストレルルート NT20 用<br>詰め替えパック | 50 パック | 1.15093.0001 |
| エキストレルルート NT 充填剤<br>( 詰め替え用 ) | 1kg | 1.15092.0001 |

## アクセサリー

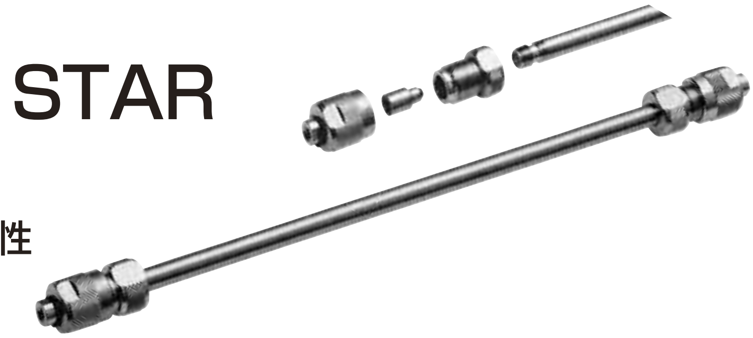
| 製品名 | サイズ | 包装単位 | 注文番号 |
|---|---|---|---|
| エキストレルルート NT1/NT3 用<br>カニューレ | 0.6 × 30 mm | 100 本 | 1.15373.0001 |
| エキストレルルート NT1/NT3 用<br>コレクションチューブ | 15 ml タイプ | 30 本 | 1.15622.0001 |
| 交換フィルター NT1 用 | 直径 10 mm | 100 枚 | 1.14236.0001 |
| 交換フィルター NT3 用 | 直径 15 mm | 100 枚 | 1.14237.0001 |
| 交換フィルター NT20 用 | 直径 24 mm | 50 枚 | 1.14567.0001 |

EXtrelut® NT3
EXtrelut® NT3
15 ml
15 ml

### 高分解能 HPLC カラム

# ピューロスフェア STAR

Purospher® STAR



## ● 高カラム効率　● 優れた選択性
## ● 再現性　● 高い耐久性

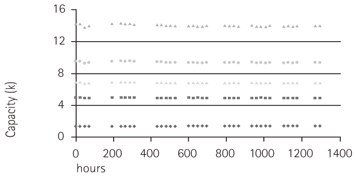
ピューロスフェア STAR はメルクが現在提供している最新の HPLC 担体です。メルク製品ラインアップの中で最も高い理論段数を実現しつつ、広範囲の pH で利用可能です。担体にはきわめて純度の高い球状シリカゲルを使用しています。総金属不純物含量は 5ppm 以下に抑えられており、酸性・塩基性、キレート化合物を問わず非常に美しいクロマトグラムが得られます。

**● ピューロスフェア STAR の主なスペック**

金属含有量：Na, Ca, Mg, Al：1ppm 以下、Fe：3ppm 以下
細孔径：120Å　比表面積：$330m^2/g$
使用可能 pH 範囲：1.5 - 10.5(RP-8e・RP-18e)
2.0 - 7.5(Si・$NH_2$)

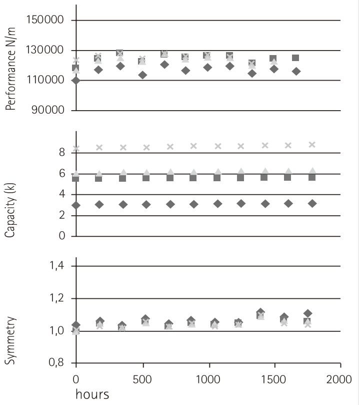
## pH 安定性

### Stability test at pH 10.5



| | |
|---|---|
| Column: | LiChroCART® 150-4.6,<br>Purospher® STAR<br>RP-18e, 5 μm |
| Eluent: | Acetonitrile/Water<br>(0.1% NH3 [25%]; 60:40) |
| Flow rate: | 1.0 ml/min |
| Detection: | UV 254 nm |
| Temperature: | RT |
| Inj. Volume: | 10 μl |
| Sample: | 1. Thiourea ◆<br>2. Benzene ■<br>3. Toluene ▲<br>4. Propylbenzene ●<br>5. Butylbenzene ▲ |

### Stability test at pH 1.5



| | |
|---|---|
| Column: | LiChroCART® 150-4.6,<br>Purospher® STAR<br>RP-18e, 5 μm |
| Eluent: | Acetonitrile/Water<br>(0.01% TFA; 50:50) |
| Flow rate: | 1.0 ml/min |
| Detection: | UV 254 nm |
| Temperature: | RT |
| Inj. Volume: | 10 μl |
| Sample: | Ketoprofen ◆<br>Fenoprofen ■<br>Flurbiprofen ▲<br>Ibuprofen × |

## ● 製品ラインアップ

| カラム内径 (mm) / カラム長 (mm) | 0.5 | 1 | 2 | 3 | 4 | 4.6 | 10 | 21.2 | 25 |
|---|---|---|---|---|---|---|---|---|---|
| 30 | | | RP-18e<br>(3 μm) | | RP-18e<br>(3 μm) | | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) |
| 50 | | | | | | | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) |
| 55 | | | RP-18e<br>( 3 μm) | | RP-18e<br>(3 μm) | | | | |
| 75 | | | | | RP-18e<br>(3 μm) | | | | |
| 100 | | | | | | | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) |
| 125 | | | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) | | | | |
| 150 | RP-18e<br>( 3 μm) | RP-18e<br>(3/5 μm) | | | | RP-8e/18e/<br>$NH_2$/Si<br>(5 μm) | | | |
| 250 | | | RP-8e/18e<br>(5 μm) | RP-8e/18e<br>(5 μm) | RP-8e/18e/<br>$NH_2$/Si<br>(5 μm) | RP-8e/18e/<br>$NH_2$/Si<br>(5 μm) | RP-8e/18e<br>(5 μm) | | |

■汎用分析カラム　■セミ分取カラム　■ハイスループットカラム　■セミミクロカラム

**メルク株式会社**

**パフォーマンス・ライフサイエンス化学品事業部**

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