嘉南藥理學院專題研究計畫成果報告

酒精性飲料中胺基甲酸乙酯之簡易快速氣相層析法

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摘要

市售酒精本研究發展了飲料中胺基甲酸乙酯(ethyl carbamate, EC)之快速氣相層析(使用 CP-wax, 30m X 0.53mm)直接注入分析法。酒精飲料樣品經簡易之前處理包括：(一)直接取樣(不做任何處理)注入法(Method I) 、(二)樣品經濃縮後(濃縮 5-10 倍)之注入法(Method II) 、及(三)樣品中之 EC 經乙酸乙酯(v/v=1/2)萃出濃縮後之注入法 (Method III) 。選用 2-甲基-戊酸(2-methyl-n-pentanoic acid)爲內標準品，分別添加 5 μg 之胺基甲酸乙酯於多種蒸餾酒及非蒸餾酒中，Method I 、Method II 及 Method III 之回收率分別爲 95-119%、96-112%及 96-106%，變異係數 CV%均在 9.5%以下，顯示本研究方法相當精確。以本方法分析市售蒸餾酒 21 件及非蒸餾酒 24 件之胺基甲酸乙酯含量。Method I 、Method II 及 Method III 對上述 45 件樣品中胺基甲酸乙酯之檢出率分別達 22、72 及 77%。其中以 Method III 分析之結果顯示 45 件酒精性飲料中胺基甲酸乙酯之含量分別爲 0～2.74、0～2.28 及 0～2.57 μg/mL。

關鍵字 ： 酒精性飲料、胺基甲酸乙酯、直接注入法、氣相層析法、定量分析。

前言

胺基甲酸乙酯（Ethyl carbamate,EC），又稱 Urethane，自然存在於酒精性飲料及一般醱酵食品中。胺基甲酸乙酯具生物活性，在動物體中會導致腫瘤產生。在 1970 年初，陸續有不少的研究報告指出在各種發酵食品，尤其是酒精性飲料中含有 EC。由於 EC 可能導致癌症，因此在近幾年來有關酒類中 EC 含量之問題頗受重視。在 1985 年之前，各國對於酒類中 EC 含量並無任何規定，但由於加拿大的酒類曾被發現含高量 EC，因此由其健康保護局訂定各種酒類之 EC 含量標準，餐酒（table wine）中 EC 含量不可超過 30 ppb；葡萄酒中 EC 含量不可超過 100 ppb；蒸餾酒中 EC 含量不可超過 150 ppb，而白蘭地等 EC 含量不可超過 400 ppb。同時在 1985 年下令由市場回收含 EC 超過規定量（150ppb）之某些廠牌之酒類。另外也在其他食品如牛乳、麵包、柑橘果汁….中發現 EC 含量。Zimmerli 等學者研究估計，成人每日 EC 之攝食量約為 20ug/Kg body weight。

由於 EC 具有潛在危害性，近年來頗受歐美各國之重視，紛紛致力於研究其在食品中之含量、分析方法、形成原因及降低含量之方法，以減少其對消費者健康之毒害性。

國內傳統之各式酒精性飲料種類相當多，加上近年來酒類之開放進口，國人對於酒精性飲料之消費量非常高，但是對其中可能存在的 EC 含量，卻未能引起政府相關單位及消費大眾之廣泛注意。因此為了維護國人飲食之安全，實有必要建立國內此類食品中（及其他含 EC 之發酵食品）EC 含量之基本衛生資料。然而目前 EC 之分析方法多以溶劑（二氯甲烷或乙醚）萃取法或以二相透析萃取法、萃取後以 GC 分析定量。但由於 EC 為偏親水性物質，萃取率及回收率均偏低，且萃取時的濃度稀釋、濃縮過程造成的分解及管壁殘留、衍生反應的反應率等等，都可能造成回收率精確度偏低，而且這些前處理過程相當耗時耗工，不適合作為例行分析工作之方法。

本人曾以 splittless direct injection 之氣相層析方法，成功的建立了食品中咖啡因、膽固醇及各種防腐劑之簡易快速定量方法。基於此本研究擬採用 splittless direct injection 之方式，探討以 GC 直接分析（或濃縮後再分析）各種酒精性飲料中 EC 含量之可行性。以期建立發酵食品中 EC 之簡易快速定量分析方法，可供作為 EC 之例行分析之標準方法。

材料與方法

一、 材料：

市售各種台灣製及進口之酒精性飲料包括蒸餾酒(distilled spirit) 21件及非蒸餾酒(non-distilled spirit)24件共54件，購自台南與屏東地區之超級市場；胺基甲酸乙酯(ethyl carbamate, EC)、癒創木酚(guaiacol) 、1,3- 二醇(1,3-butanediol)、 1,5-戊二醇(1,5-pentanediol)、 3-甲基-1,5-戊二醇(3-methyl-1,5-pentanediol) 、2-甲基-正戊酸 (2-methyl—pentanoic acid)及1,6-己二醇(1,6-hexanediol) 等標準品(純度均在98以上)爲日本東京化成SCI公司商品製造。

二、 方法：

(一)標準品及內標準溶液之配製：

分別精稱0.4g之胺基甲酸乙酯及2-甲基-正戊酸(2-methyl-n-pentanoic acid)於100mL定量瓶中，以甲醇稀釋定量至標線。

(二) 胺基甲酸乙酯對2-甲基-正戊酸之相對表現因子(relative response factor，RRF)之測定：

將0.4% (w/v)之胺基甲酸乙酯與0.4% (w/v)之2-甲基-正戊酸（內標準品）甲醇溶液依不同比例混合(ethyl carbamate /2-methyl-pentanoic acid=2/1、1/1及1/2)，依氣相層析分析，

以兩者在氣相層析儀之波峰面積，計算胺基甲酸乙酯對2-甲基-正戊酸之相對表現因子。亦即：

$RRF = (A_S/W_S) \div (A_{IS}/W_{IS})$……(1)

A_S = ethyl carbamate 之GC波峰面積； A_{IS} = 2-methyl-pentanoic acid 之GC波峰面積； W_S = ethyl carbamate 之重量(ug)； W_{IS} = 2-methyl-pentanoic acid 之重量(ug)。

(三) 胺基甲酸乙酯之定量分析：

*酒精飲料樣品經簡易之前處理包括：

(1)直接取樣(不做任何處理)注入法(Method I) 、

(2)樣品經濃縮後(濃縮 5-10 倍)之注入法(Method II) 、及

(3)樣品中之 EC 經乙酸乙酯(v/v=1/2)萃出濃縮後之注入法 (Method III) 。

即直接取0.1 μL注入GC中分析。胺基甲酸乙酯之含量可依公式(2)計算求得：

Ethyl carbamate (ug/mL) = $(A_S/A_{IS})\times(W_{IS}/RRF)\times 1/V$ ……(2)

V = 檢體之體積(mL)。

Method Ⅰ:直接注入法

取酒類樣品 1 mL

⇓

放入 7 mL vial 中

⇓

加入 200 μg/50 μL 之內標準溶液

(IS = 2-Methyl-n-Pentannoic Acid)

⇓

取 0.1 μL 注入氣相層析儀

分析 EC 含量

Method Ⅱ:濃縮後注入法

取酒類樣品 25 mL

⇓

放入 250 mL 濃縮瓶中

⇓

加入 400 μg/100 μL 之內標準溶液

(IS = 2-Methyl-n-Pentannoic Acid)

⇓

減壓濃縮至約 2-5 mL

⇓

取 0.1 μL 注入氣相層析儀

分析 EC 含量

Method Ⅲ:溶劑萃取法

取酒類樣品 25mL

⇓

放入 100 mL 量筒中

⇓

加入 200 μg/50 μL 之內標準溶液

(IS = 2-Methyl-n-Pentannoic Acid)

⇓

以 50 mL 之乙酸乙酯萃取 2-3 次

⇓

乙酸乙酯萃取液減壓濃縮至約 0.2-0.5 mL

⇓

取 0.1 μL 注入氣相層析儀

分析 EC 含量

(四)最低檢出量試驗：

以胺基甲酸乙酯標準溶液(200 μg /mL)，分別以純水稀釋至 2.5、1.0、0.5、0.25及0.1 μg/mL，各取1 mL上述溶液，添加50 μg 之內標準溶液(2-methyl-pentanoic acid)，混合均勻後，直接以GC分析之，估計胺基甲酸乙酯之最低檢出量，每一濃度均做三重覆。

(五)添加回收試驗：

分別添加5 μg之胺基甲酸乙酯於1 mL, 25 mL及25mL之蒸餾酒及非蒸餾酒中，再分別添加200, 400及200 μg之內標準溶液，經混合均勻後，分別以Method I, Method II 及Method III分析之，每一添加量均做三重覆，同時作空白試驗，計算胺基甲酸乙酯之回收率。

(六)氣相層析儀條件：

GC儀器：Hitachi G-3000； FID 檢測器：H_2 ，flow rate=30 mL/min，air flow rate=300 mL/min； 檢測器溫度=280°C；注入口溫度=240°C； 攜帶氣體：He ，flow rate = 4 mL/min； 分離管柱：CP-Wax (30 m×0.53 mm，1 μm) ，(Chrompack, Netherlands)；烘箱溫度：起始溫100 ^{o}C，2鐘後，以每分鐘3 ^{o}C之速率升溫至135 ^{o}C，再以每分鐘5 ^{o}C之速率升溫至155 ^{o}C，再以每分鐘50 ^{o}C之速率升溫至300 ^{o}C； 注入量： 0.1 μL； 注入型式： direct injection mode。

結果與討論

一、氣相層析條件之探討：

最近有關胺基甲酸乙酯之傳統前處理之分析定量方法，均是以有毒之有機溶劑如(二氯甲烷乙醚)多次的連續萃取，再經濃縮後以GC分析定量之，此傳統之前處理步驟。其中李等[19]是以1 mL醬油，調pH至2.0後，以

10倍體積之乙醚連續萃取三次，乙醚層經濃縮至1 mL後，再以GC分析定量之（採split mode 注入方式）。此法每分析一個樣品耗時約30~40min，果糖酸之回收率約在90%左右。而本研究室先前[20]以5 mL醬油，調pH至2.0再以NaCl飽和後，以6倍以上乙酸乙酯萃取，加入內標準品（heptanoic acid）後，再稍經減壓濃縮去除部分乙酸乙酯，即以GC分析定量之（採splitless direct injection mode 注入方式）。此法每分析一個樣品需時約20min，果糖酸之回收率在92~98%左右。以上兩種分析果糖酸之方法，已是相當簡便快速，缺點是果糖酸仍是親水性極高化合物，需以大量之有機溶劑萃取才可達到90%以上之回收率。Sheu et. al., 1996, 發展出二相透析萃取法，此法相當費時，且回收率亦不高。

氣相層析具有高解析度及高靈敏度等優點，仍為現代最重要分析技術之一。本研究室從事多年GC分析發現，可於注入口(injector) 之insert 玻璃管內塞上玻璃棉或接上一小段（約1~2m）保護管柱（guard column），可有效防止非揮發性之有機物等進入分離管柱，以降低污染物之干擾，減少波峰之拖尾現象（tailing），提高GC層析圖之解析度[22-24]。本研究室亦發現市面販售之GC分離管柱（megapore column） 之耐水性相當高[24]。即使直接注入水溶液之樣品於GC中，GC管柱之分離效果與滯留時間之再現性仍與原先之新管柱一樣。且滯留在insert玻璃管內之鹽分及雜質不需經常的清洗，約可在分析100個以上之樣品後才需清除，而insert之清除亦很簡便，只需將insert玻璃管取出，用鹽酸浸泡10分鐘後，將玻璃棉取出，用水沖洗乾淨，乾燥後換上新的玻璃棉即可放回injector內使用。

基於上述之理由，本研究擬將酒精性飲料，(一)不經任何前處理，加入適當適量之內標準水溶液後，直接注入氣相層析儀中(Methood I)，(二)樣品經濃縮後注入GC(Method II)(三)樣品以乙酸乙酯脆出濃縮後注入GC(Method III)配合適當的分離管柱及氣相層析條件，以期建立簡便、快速又精確之酒精性飲料中胺基甲酸乙酯之定量分析方法。

本研究之結果顯示，在分離管柱之選擇方面，在分析極性之胺基甲酸乙酯(EC)乃採用極性之管柱如CP-Wax為宜。樣品採用直接注入方式進行分析，管柱分析之昇溫程序為起始溫度為100^{o}C經2 min後，每分鐘昇溫8^{o}C至220^{o}C，再以每分鐘50 ^{o}C之速率升溫至250 ^{o}C。檢測器之溫度為290^{o}C，注入口溫度為250^{o}C。依上述條件直接注入酒精性飲料而得EC之GC滯留時間為12.73min，如圖一至圖四所示，分析一個樣品需約20 min。

在內標準品的選擇方面，於酒精性飲料等樣品中逐一加入少量之guaiacol , 1,3-butanidiol, 2-methyl-n-pentanoic acid, 1,5-pentanediol 、

3-methyl-1,5-pentanediol及1,6-hexanediol 六種水溶性之標準品，然後依上述GC條件分析之，由分析之結果顯示，1,5-pentanediol、3-methyl-1,5-pentanediol及1,6-hexanediol之滯留時間分別爲11.41, 14.32, 14.68, 17.24, 18.57及19.08min，如表一所示。經與空白樣品之GC圖比對，以2-methyl-n-pentanoic acid 最適宜，波峰完全不會與樣品中之波峰重疊，因此選定爲本研究中EC分析定量之內標準品。

依上述之 GC 分析條件，Method I , Method II 及 Methood III 三種分析市售酒類樣品，分析一個樣品僅需 20 分鐘左右，如圖一～圖五所示。

三、 胺基甲酸乙酯對內標準品之相對表現因子：

本研究選擇水溶性之 2-methyl-n-pentanoic acid 作爲直接定量酒類等水溶液樣品中 EC 之內標準，要有準確之定量，必需先定出 EC 對 2-methyl-n-pentanoic acid (內標準)之相對表現因子(RRF)，則樣品中 EC 之含量可依公式(2)計算之。由 EC 對內標準品之 GC 波峰面積比(Y 軸)對其濃度比(X 軸)作圖，其線性迴歸係數 R^2=0.99 以上。並計算求得 EC 對內標準品之相對表現因子爲 0.42。

三、胺基甲酸乙酯之最低檢出量：

本研究將酒類樣品不經任何前處理，直接取樣注入 GC 中(Method I)，)樣品經濃縮後注入 GC 中(Method II)及以乙酸乙酯萃出濃縮後注入 GC 中(Method III)三種方法分析，採用 FID 爲檢測器，訊號設定 FID=1，且 attenuation=1 ，上述三種分析方法之 EC 最低檢出量分別在 0.5, 0.1 及 0.1 μg/mL 左右，如表三所示。

四、添加回收試驗：

表四、表五及表六分別爲5μg之胺基甲酸乙酯添加至六種酒類飲料(包括蒸餾酒及非蒸餾酒) ，然後分別以Method I、 Method II及 Method III三種方法分析之。結果顯示: Method I 之回收率爲95~119%，變異係數(cv%)均在9.2%以下。Method II之回收率爲96~112%，變異係數(cv%)均在8.9%以下。Method III之回收率爲96~107%，變異係數(cv%)均在7.3%以下。

五、市售酒精性飲料中胺基甲酸乙酯之含量

表七為市售蒸餾酒 21 件及非蒸餾酒 24 件，共 45 件樣品，分別以 Method I、 Method II 及 Method III 分析定量胺基甲酸乙酯之含量。以 Method I 分析之結果顯示: 21 件蒸餾酒中 EC 之含量在 0-2.74 μg/mL 和 24 件非蒸餾酒中 EC 含量為 0-1.01 μg/mL, 45 件樣品中 EC 之檢出率達 22%。 以 Method II 分析之結果顯示 ：21 件蒸餾酒中 EC 之含量在 0-2.28 μg/mL 和 24 件非蒸餾酒中 EC 含量為 0-1.12 μg/mL, 45 件樣品中 EC 之檢出率達 72%。 以 Method III 分析之結果顯示 ：21 件蒸餾酒中 EC 之含量在 0-2.57 μg/mL 和 24 件非蒸餾酒中 EC 含量為 0-1.35 μg/mL, 45 件樣品中 EC 之檢出率達 77%。由上述之結果顯示 Method II 及 Method III 之 EC 檢出率均較 Method I 為高, 此乃 Method I 之最低檢出濃度僅為 0.5 μg/mL(如表三所示), 即樣品中 EC 含量若在 0.5 μg/mL 以下以便無法檢出以 Method I 便無法檢出。

結論

本研究將酒精性飲料樣品，經簡易之前處理, 包括: (一)直接取樣(1 mL) 加入水溶性之內標準品(2-methyl-n-pentanoic acid , IS)後，直接注入GC分析(Method I) ; (二)酒類樣品(25 mL)加入內標準品, 經濃縮5-10倍後, 直接注入GC分析(Method II) ; 及(三) 酒類樣品(25 mL) 加入內標準品以乙酸乙酯(v/v=1/2)萃取2-3次, 且經濃縮至0.5 mL以下, 再注入GC分析 (Method III) 。 Oven temperature：起始溫100 ^{o}C，2分鐘後，以每分鐘3 ^{o}C之速率升溫至135 ^{o}C後, 以每分鐘5 ^{o}C之速率升溫至155 ^{o}C，再以每分鐘50 ^{o}C之速率升溫至300 ^{o}C，可以簡單、快速又精確的定量酒精性飲料之胺基甲酸乙酯，分析每一樣品全程僅需20-30分鐘左右。以本研究發展出來的三種方法，檢驗市售各種蒸餾酒及非蒸餾酒共45件之胺基甲酸乙酯含量。結果顯示，中胺基甲酸乙酯之檢出率分別達22、72及77%。以Method I 、Method II 及Method III對上述45件酒類樣品分析, 結果顯示45件酒精性飲料中胺基甲酸乙酯之含量分別為0～2.74、0～2.28及0～2.57 μg/mL。

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Table 1. Gas chromatographic retention time of some standard candidates

Compound	Retention time (min)[a]
Guaiacol	11.41
1,3-Butanediol	14.32
2-Methyl-n-pentanoic acid	14.68
3-Methyl-1,5-pentanediol	17.24
1,5-Pentanediol	18.57
1,6-Hexanediol	19.08

[a] CP-Wax column (0.53mm×30m, DF=1.5μm) was used.
Oven condition＝100℃(1min)@ 3℃/min→135℃@5℃/min →155℃/min@ 50℃/min →300℃.

Table 2. Relative response factor (RRF) and GC retention time (RT) of 2-methyl-n-pentanoic acid to ethyl carbamate

Compound	RRF[a]	RT[b]
Ethyl carbamate (EC)	0.42	12.73
2-Methyl-n-pentanoic acid (MePA)[c]	1.00	14.68

[a] RRF of 2-methyl-n-pentanoic acid to ethyl carbamate.
[b] CP-Wax column (0.53mm×30m, DF=1.5μm) was used.
[c] Internal standard. Oven condition＝100℃(1min)@ 3℃/min→135℃@5℃/min →155℃/min@ 50℃/min →300℃.

Table 3. Lowest quantitatively determinable concentration of ethyl carbamate by gas chromatography with FID detector

Sample preparation*	Concentration (μg/mL)	Detectability [a]	Recovery （%） [b]	RSD （%） [c]
Ⅰ	2.5	Yes	102.4	5.8
	1.0	Yes	104.9	6.6
	0.5	Yes	108.1	9.5
	0.25	No	--	--
	0.1	No	--	--
Ⅱ	2.5	Yes	99.1	4.9
	1.0	Yes	102.8	5.1
	0.5	yes	96.7	7.3
	0.25	yes	107.5	8.9
	0.1	Yes	118.4	12.7
	0.05	No	--	--
Ⅲ	2.5	yes	97.7	5.7
	1.0	yes	102.3	6.3
	0.5	yes	94.8	7.4
	0.25	Yes	105.6	8.4
	0.1	yes	117.3	13.9
	0.05	no	--	--

* Ⅰ = by direct injection method; Ⅱ =25mL sample was concentrated to 2-5mL, before injection; Ⅲ =25mL sample was extracted with ethyl acetate, and concentrated to 0.5-1 mL,before injection.

[a] FID range＝1, Attenuation＝1.

[b] Average of three analyses.

[c] Coefficient of variation （cv%）.

Table 4. Recoveries of the spiked ethyl carbamate from various alcoholic liquor or beverages by spitless direct injection GC method (method Ⅰ)

Sample	Blank [a] (μg) (A)	Amount added (μg)(B)	Amount found (μg) [b] (C)	Recovery (%)[c]	CV (%)[d]
Whisky 1	ND	5.12	5.79	113.09	7.62
Kaoliang 1	ND	5.12	5.61	109.60	4.38
Medecine wine	ND	5.12	6.14	119.92	9.17
Red wine 1	ND	5.12	5.07	99.02	7.39
Grape wine 1*	3.37	5.12	9.29	109.42	8.27
Plum wine	ND	5.12	4.87	95.12	7.69

[a] Ethyl carbamate in 1 mL whisky.

[b] Average of triplicate analyses.

[c] Recovery（%）＝（C－A）/ B×100%.

[d] Coefficient of variation （cv%）.

Table 5. Recoveries of the spiked ethyl carbamate from various alcoholic liquor or beverages by concentration-direct injection GC method (method Ⅱ)

Sample	Blank [a] (μg) (A)	Amount added (μg)(B)	Amount found (μg) [b] (C)	Recovery (%)[c]	CV (%)[d]
Whisky 1	1.25	5.12	6.23	97.80	3.47
Kaoliang 1	1.71	5.12	7.17	104.97	5.81
Medecine wine	ND	5.12	4.91	95.90	7.38
Red wine 1	0.38	5.12	6.18	112.36	8.92
Grape wine 1*	4.49	5.12	9.33	97.09	5.67
Plum wine	1.39	5.12	6.71	103.07	2.19

[a] Ethyl carbamate in 25 mL whisky.

[b] Average of triplicate analyses.

[c] Recovery（%）＝（C－A）/ B×100%.

[d] Coefficient of variation （cv%）.

Table 6. Recoveries of the spiked ethyl carbamate from various alcoholic liquor or beverages by solvent extraction-spitless direct injection GC method (method Ⅲ)

Sample	Blank [a] (μg) (A)	Amount added (μg)(B)	Amount found (μg) [b] (C)	Recovery (%)[c]	CV (%)[d]
Whisky 1	1.32	5.12	6.86	106.52	3.89
Kaoliang 1	1.36	5.12	6.25	96.45	5.64
Medecine wine	ND	5.12	5.48	107.03	7.28
Red wine 1	ND	5.12	4.98	97.27	6.89
Grape wine 1*	4.58	5.12	15.02	103.29	7.34
Plum wine	1.12	5.12	6.37	102.08	5.43

[a] Ethyl carbamate in 25 mL whisky.

[b] Average of three analyses.

[c] Recovery（%）＝（C－A）/ B×100%.

[d] Coefficient of variation （cv%）.

Table 7. Ethyl carbamate levels found in some alcoholic beverage

Sample	EC content （μg/mL）		
	Method Ⅰ	Method Ⅱ	Method Ⅲ
Distilled spirit			
Whisky 1	1.02	1.25	1.32
Whisky 2	ND	0.78	0.85
White liquor 1	ND	ND	ND
Kao liang 1	1.34	1.71	1.25
Kao liang 2	0.93	0.83	0.79
Kirin whisky	ND	0.26	0.31
XO-1	ND	0.20	0.18
XO-2(J)	ND	ND	0.14
VSOP-A	ND	0.32	0.41
VSOP-B	ND	0.24	0.31
Drambule-B	2.74	2.28	2.91
Kliporiff-c	ND	0.56	0.62
Drambule-d	2.43	1.82	2.57
Martell-e	ND	ND	ND
Pushkin-f	ND	ND	ND
Smirnoff-g	ND	ND	ND
Cocorico-h	1.46	1.72	1.28
J&B-I	2.01	1.23	1.59
Rice wine 1	ND	0.21	0.15
Rine wine 2	ND	0.20	0.13
Rine wine heads	ND	0.18	0.14
Non-distilled spirit			
Plum wine 1	ND	0.59	0.72
Plum wine 2	ND	0.43	0.35
Plum wine 3	ND	0.23	0.37
Red wine 1	ND	ND	0.12
Red wine 2	ND	ND	ND
Red wine 3	ND	ND	0.13
Red rose 1	ND	ND	ND
Red rose 2	ND	ND	0.13
Red rose 3	ND	ND	0.11
White wine 1	ND	ND	0.14
White wine 2	ND	ND	0.11
White wine 3	ND	ND	0.17
Yellow wine 1	ND	0.62	0.84
Yellow wine 2	ND	0.54	0.73
Shao-Hsing wine 1	0.88	1.12	1.35
Shao-Hsing wine 2	0.74	0.69	0.85
Taiwan beer 1	ND	0.28	0.34
Taiwan beer 2	ND	0.37	0.41
Beer 3	ND	0.22	0.37
Beer 4	ND	0.38	0.42
Medecine wine 1	ND	ND	ND
Medecine wine 2	1.01	0.82	0.75
Medecine wine 3	ND	0.15	0.19
Medecine wine 4	ND	ND	0.11
Detectability (%)	22.22%	71.79%	76.92%

[a] Average of two analyses.