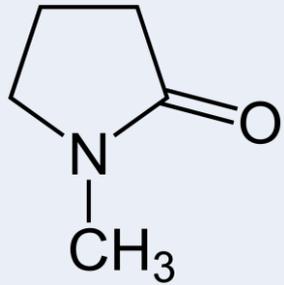


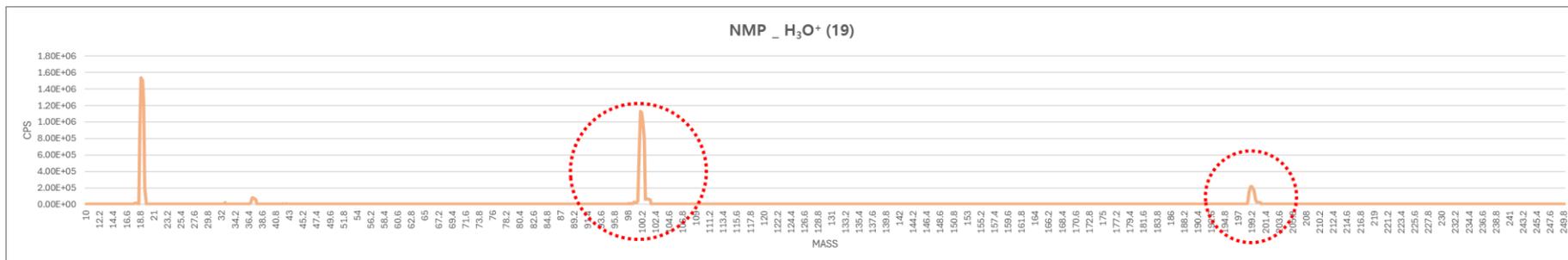
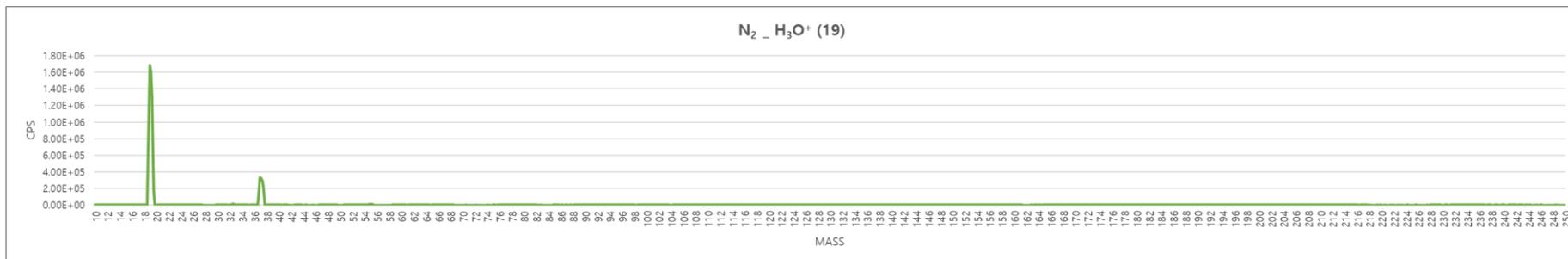
NMP Analysis

01. NMP Chemical Properties

Chemical name	N-Methyl-2-pyrrolidone
Formula	C ₅ H ₉ NO
CAS Registry Number	872-50-4
Molecular weight (g/mol)	99.133 (g/mol)
Density	1.028 g/cm ³
Boiling point	202 ~ 204 °C
Chemical Structure	 <p>The image shows the chemical structure of N-methyl-2-pyrrolidone. It consists of a five-membered ring with a nitrogen atom at the bottom position. A methyl group (CH₃) is attached to the nitrogen atom. At the 2-position of the ring, there is a carbonyl group (C=O) pointing to the right.</p>

02. NMP FULL SCAN _ Canister (a)

① Reagent ion H_3O^+ (19)



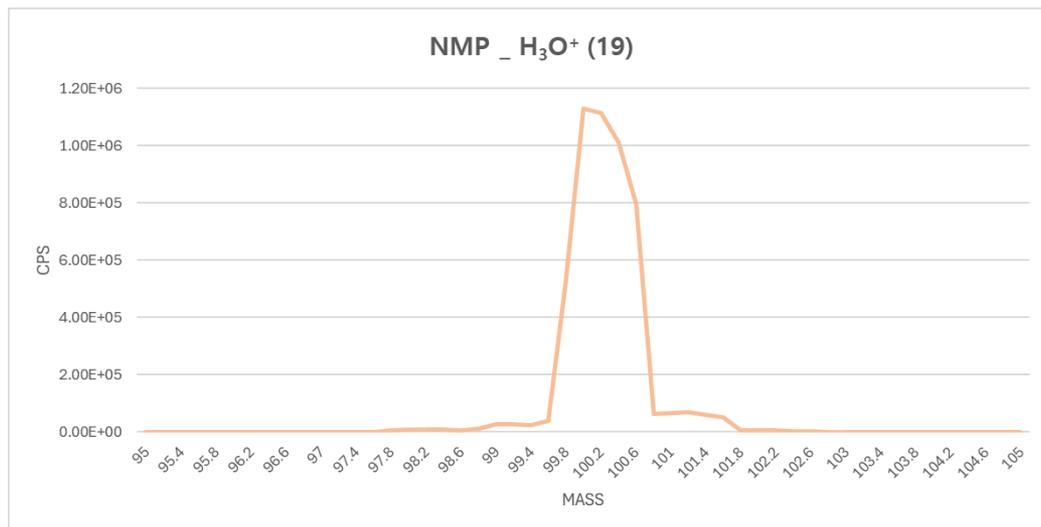
With reagent ion H_3O^+

NMP peak

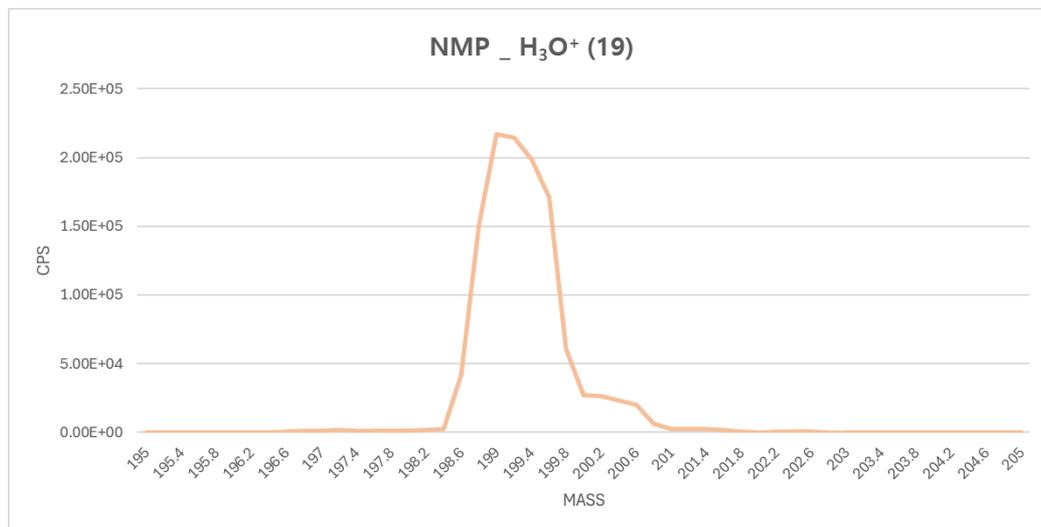
- mass 100
- mass 199

02. NMP FULL SCAN _ Canister (a)

① Reagent ion H_3O^+ (19) _ product ion

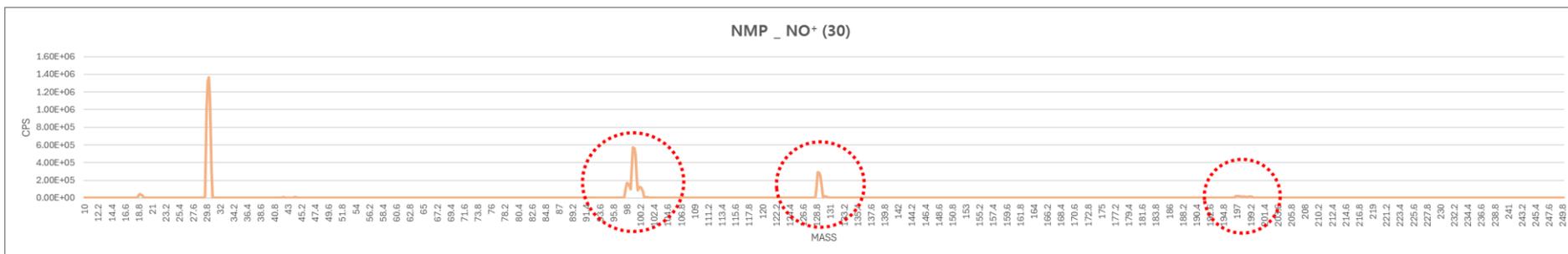
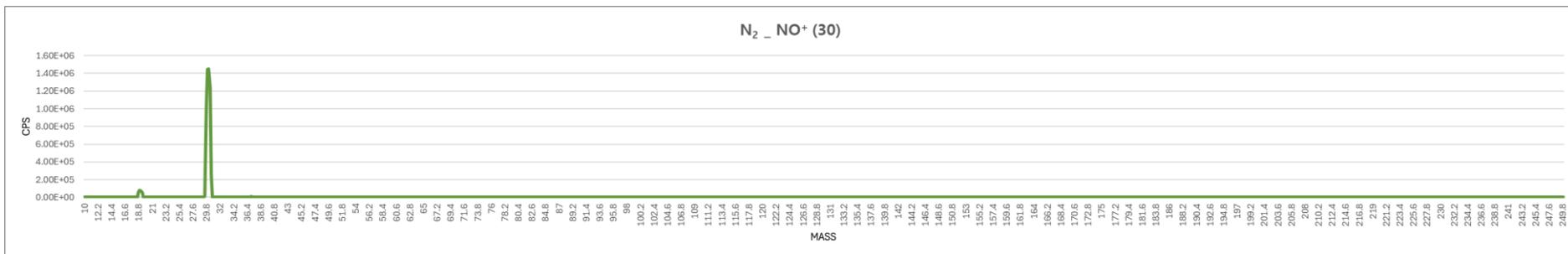


- product ion mass 100 : $\text{C}_5\text{H}_{10}\text{NO}^+$
- mass 199



02. NMP FULL SCAN _ Canister (a)

② Reagent ion NO⁺ (30)



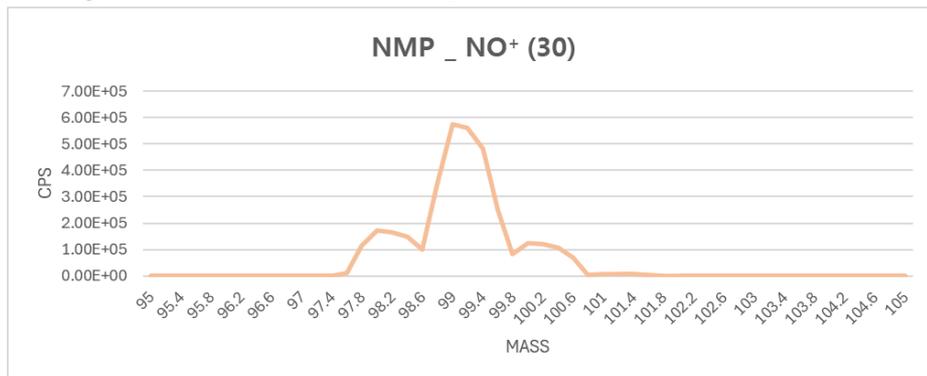
With reagent ion NO⁺

NMP peak

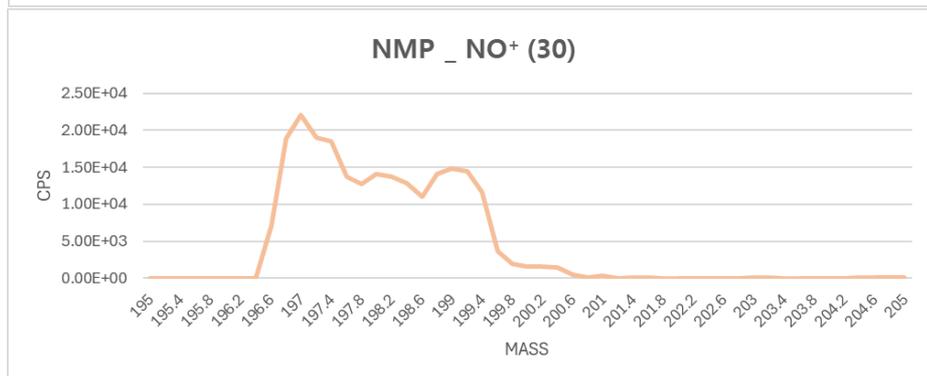
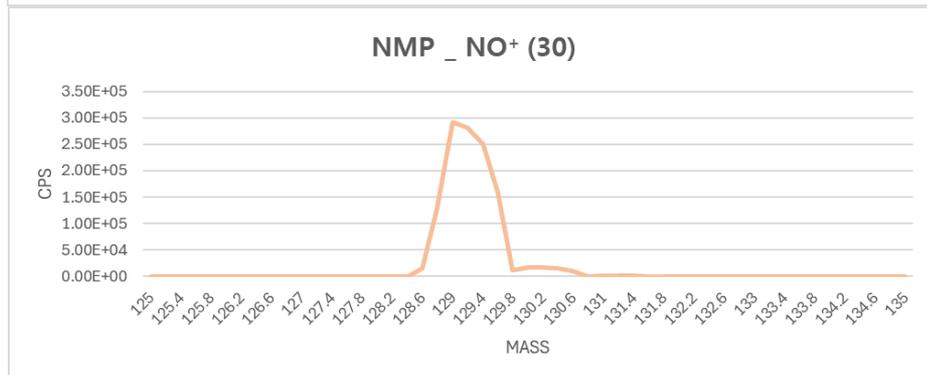
- mass 98
- mass 99
- mass 100
- mass 196~199

02. NMP FULL SCAN _ Canister (a)

② Reagent ion NO^+ (30) / product ion

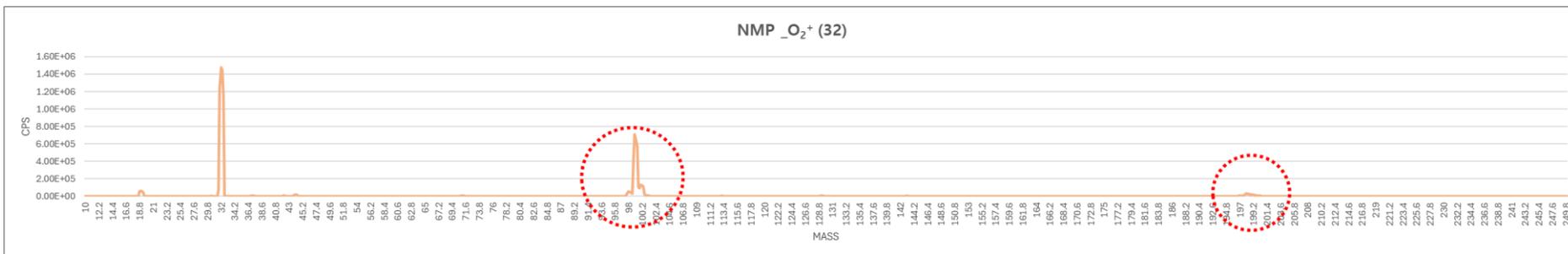
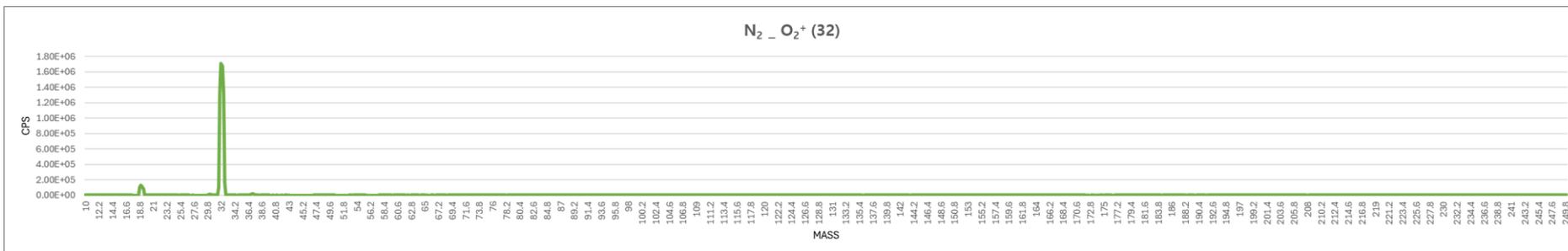


- product ion mass 98 : $\text{C}_5\text{H}_8\text{NO}^+$
- product ion mass 99 : $\text{C}_5\text{H}_9\text{NO}^+$
- product ion mass 100 : $\text{C}_5\text{H}_9\text{NONO}^+$
- mass 197~199



02. NMP FULL SCAN _ Canister (a)

③ Reagent ion O_2^+ (32)



With reagent ion O_2^+

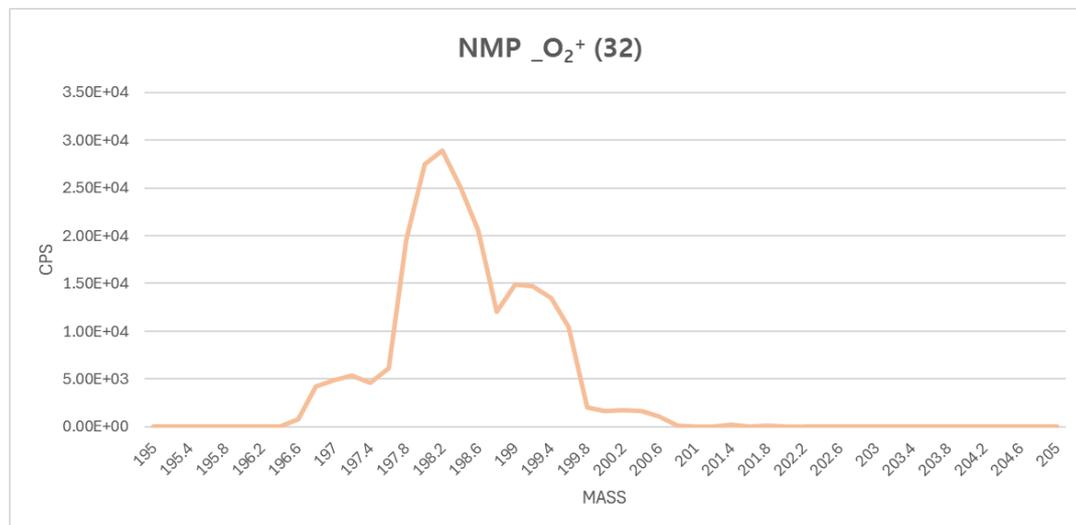
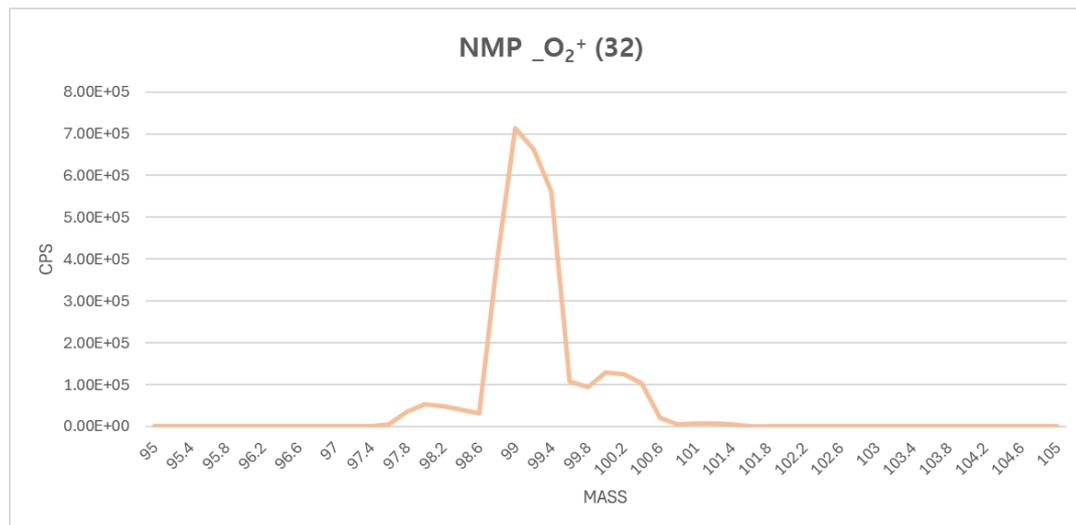
NMP peak

- mass 98
- mass 99
- mass 196~199

02. NMP FULL SCAN _ Canister (a)

③ Reagent ion O_2^+ (32) _ product ion

- product ion mass 98 : $C_5H_8NO^+$
- product ion mass 99 : $C_5H_9NO^+$
- mass 196~199



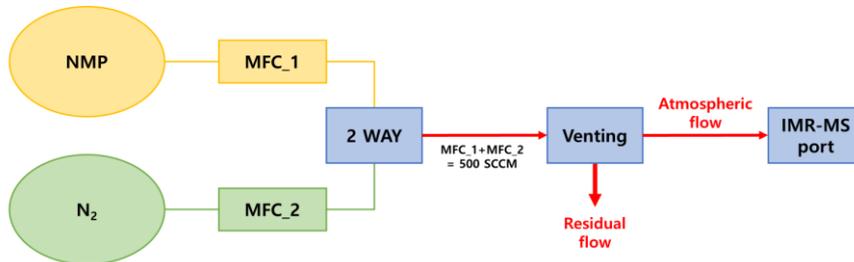
02. NMP FULL SCAN _ Canister (a)

④ Branch ratio

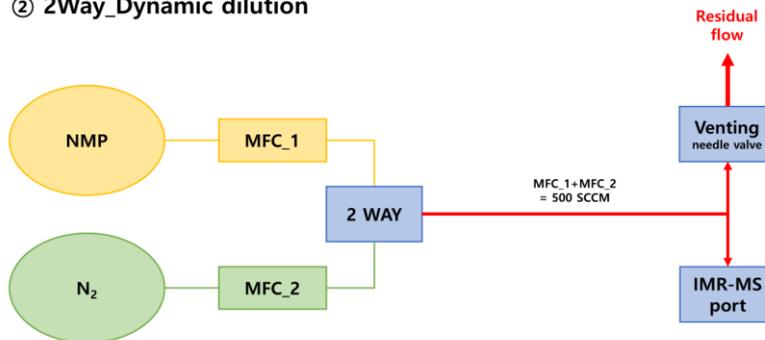
Reagent	product ion formula	product ion mass	branch ratio
H_3O^+	$\text{C}_5\text{H}_{10}\text{NO}^+$	100	1
NO^+	$\text{C}_5\text{H}_9\text{NO}^+$	99	0.7
	$\text{C}_5\text{H}_9\text{NO}\cdot\text{NO}^+$	129	0.15
	$\text{C}_5\text{H}_8\text{NO}^+$	98	0.15
O_2^+	$\text{C}_5\text{H}_9\text{NO}^+$	99	0.95
	$\text{C}_5\text{H}_8\text{NO}^+$	98	0.05

03. 2-Way Dynamic dilution

① 2Way_Dynamic dilution



② 2Way_Dynamic dilution



Sample loading into the system using 2-way dynamic dilution

04. NMP SIM SCAN _ Canister ①

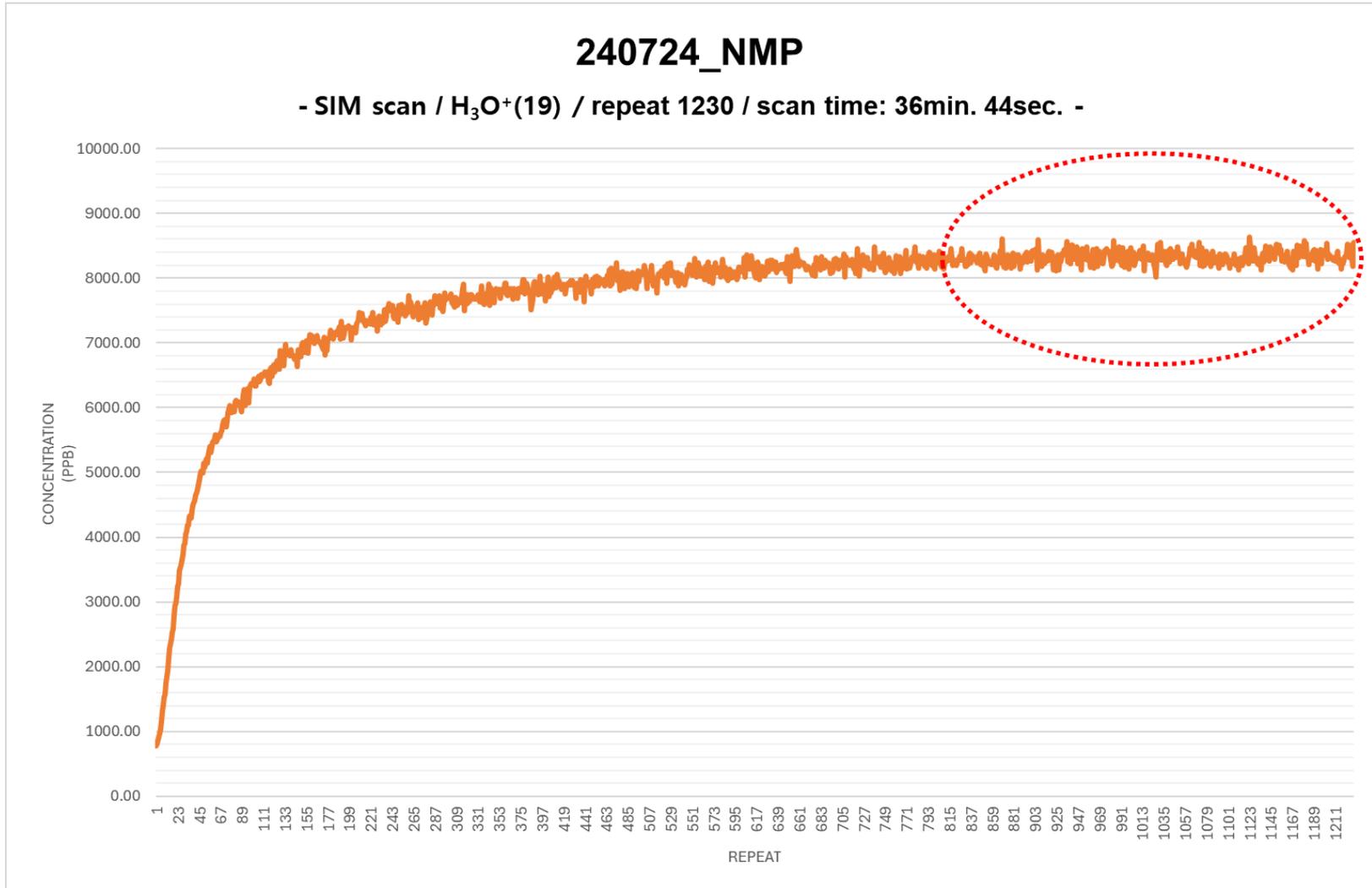
① Result

M21	MFC_2 N ₂ SCCM	MFC_1 NMP SCCM	Dilution factor	Calculated Concentration (ppb)	Measurement AVERAGE (ppb)	%RSD
1WAY	41	-	-	0.00	14.54	27.90
2WAY	500	0	0	0.00	11.14	27.21
1WAY	-	41	-	13725.10	8340.70	1.23
2WAY	250	250	0.5	6862.55	5850.75	1.36
	350	150	0.3	4117.53	3464.17	1.52
	450	50	0.1	1372.51	1101.81	2.12
	470	30	0.06	823.51	638.35	2.92
	490	10	0.02	274.50	205.82	5.17
	495	5	0.01	137.25	106.31	8.05
	499	1	0.002	27.45	40.23	11.44

ppb	N ₂	27.45	137.25	274.50	823.51	1372.51	4117.53	6862.55
AVERAGE (100)	11.14	40.23	106.31	205.82	638.35	1101.81	3464.17	5850.75
STDEV.P	3.03	4.60	8.56	10.65	18.67	23.35	52.57	79.34
%RSD	27.21	11.44	8.05	5.17	2.92	2.12	1.52	1.36

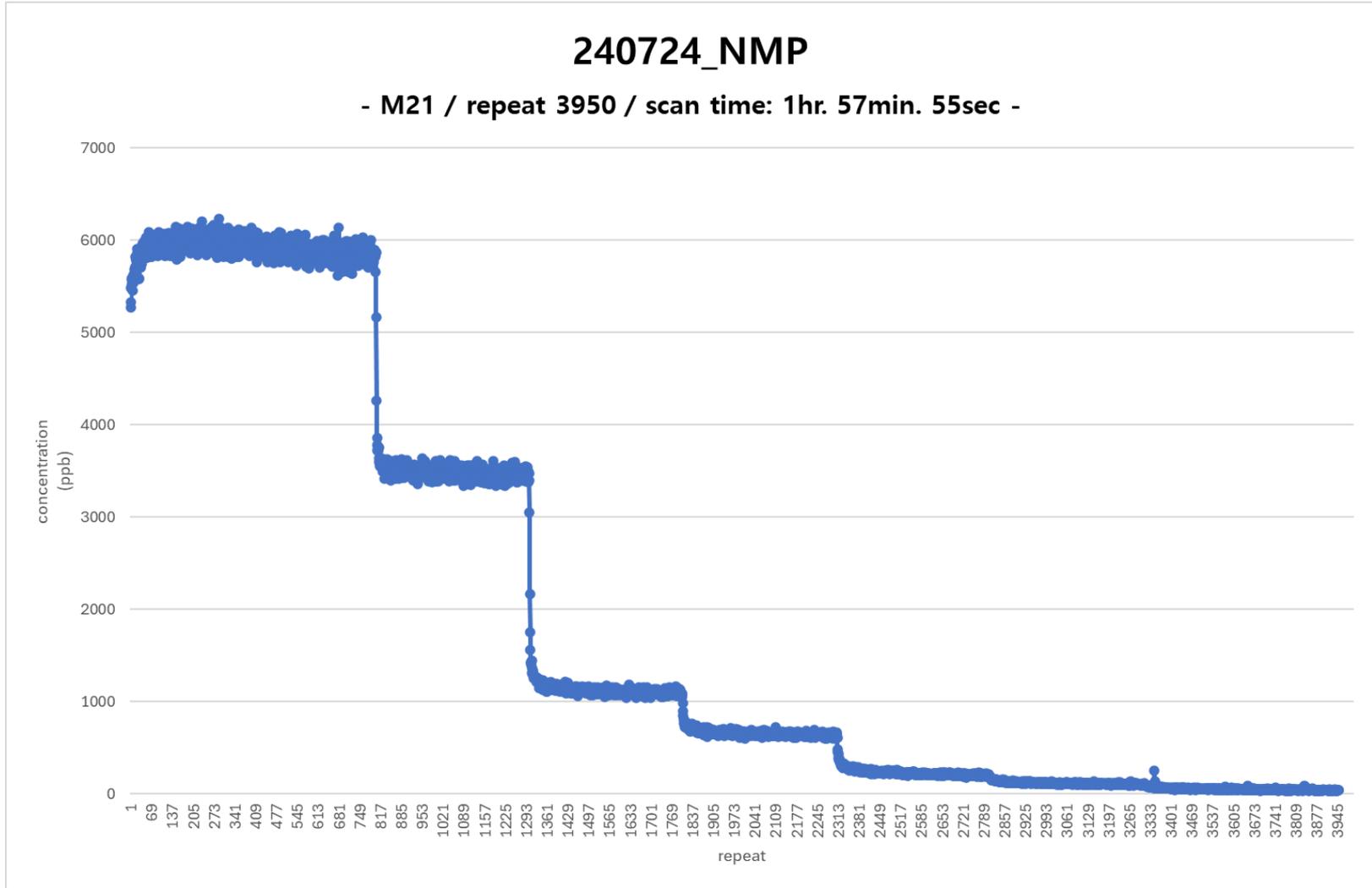
04. NMP SIM SCAN _ Canister ①

② 1Way, Saturation



04. NMP SIM SCAN _ Canister ③

③ 2Way



04. NMP SIM SCAN _ Canister ④

④ 2Way NMP Linearity

