

Supporting Information

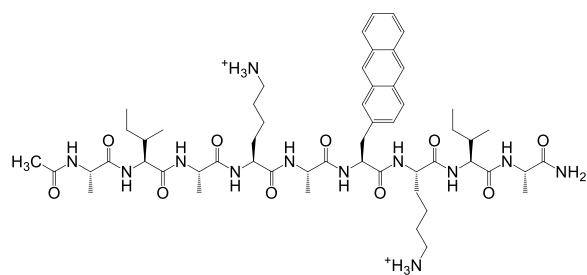
for

Miniaturization of Anthracene-Containing Nonapeptides for Selective Precipitation/Recovery of Metallic Gold from Aqueous Solutions Containing Gold and Platinum Ions

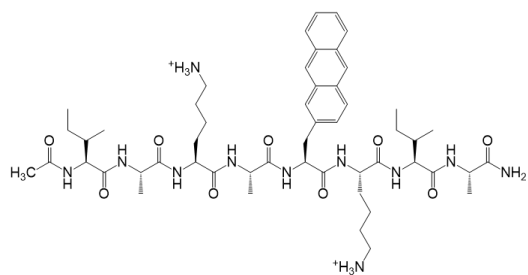
Kin-ya Tomizaki,^{*,a,b} Tatsuki Tonoda,^a Haruka Okazaki,^a Shungo Teramura,^a Takahito Imai,^a and Masahiro Asano^{*,c}

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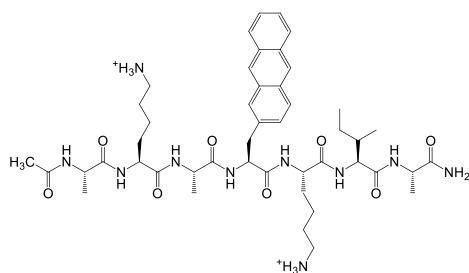
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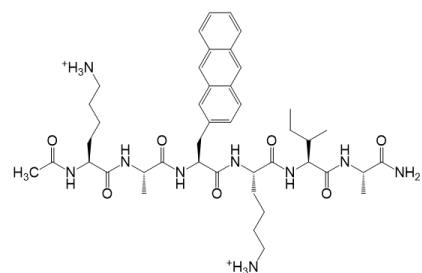
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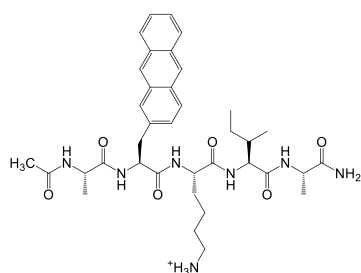
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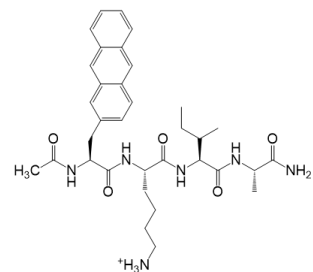
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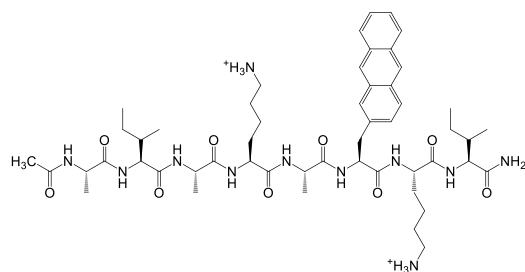
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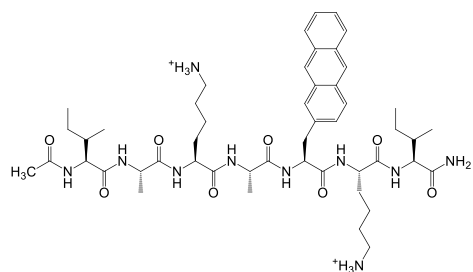
(e) RU065₅₋₉



(f) RU065₆₋₉

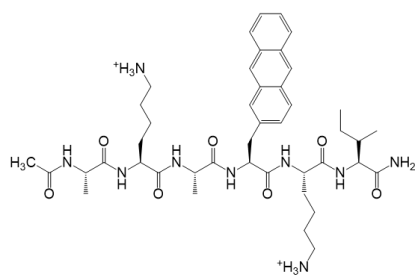


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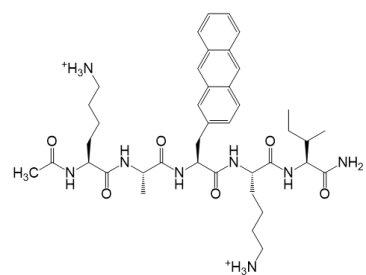


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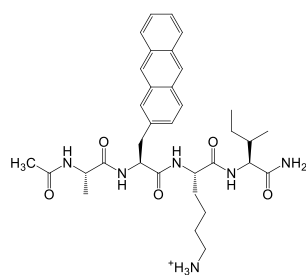
Figure S1. Chemical structures of RU065 and its fragment peptides.



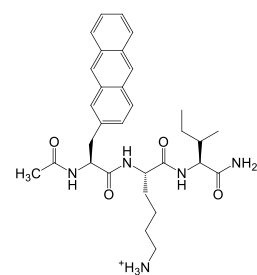
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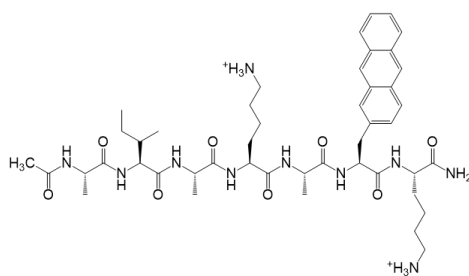
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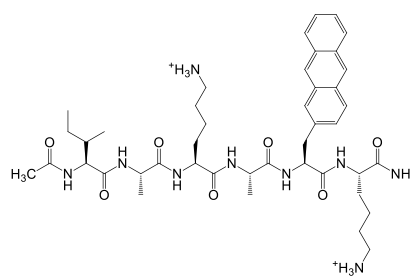
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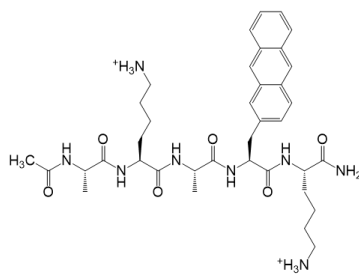
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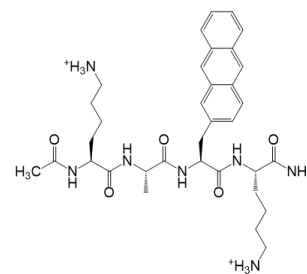
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(n) RU065₂₋₇

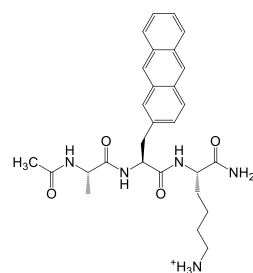


(o) RU065₃₋₇

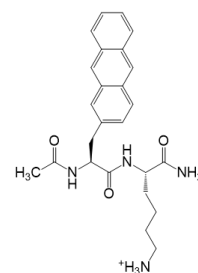


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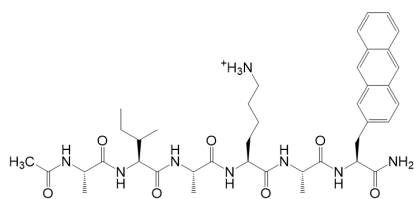
Figure S1 (continued). Chemical structures of RU065 and its fragment peptides.



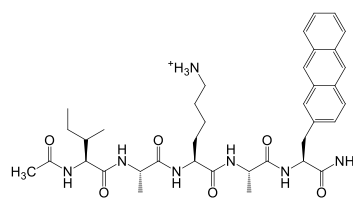
(q) RU065₅₋₇



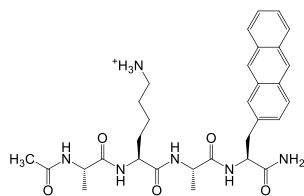
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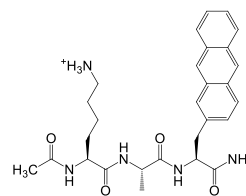
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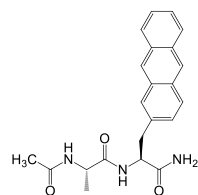
(t) RU065₂₋₆



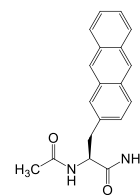
(u) RU065₃₋₆



(v) RU065₄₋₆



(w) RU065₅₋₆



(x) RU065₆

Figure S1 (continued). Chemical structures of RU065 and its fragment peptides.

Table S1. Summary of the molecular weight data calculated and observed by MALDI-TOFMS ($[M + H]^+$) for RU065 and its fragment peptides.

Peptide		Molecular weight (calculated)	Molecular weight (observed by MALDI-TOFMS, $[M + H]^+$)
(a)	RU065	1073.3	1074.7
(b)	RU065 ₂₋₉	1004.3	1006.0
(c)	RU065 ₃₋₉	891.1	890.4
(d)	RU065 ₄₋₉	820.0	819.7
(e)	RU065 ₅₋₉	690.6	691.4
(f)	RU065 ₆₋₉	619.8	619.2
(g)	RU065 ₁₋₈	1004.3	1004.7
(h)	RU065 ₂₋₈	933.2	933.4
(i)	RU065 ₃₋₈	820.0	820.1
(j)	RU065 ₄₋₈	749.0	748.9
(k)	RU065 ₅₋₈	619.8	620.3
(l)	RU065 ₆₋₈	548.7	547.5
(m)	RU065 ₁₋₇	891.1	891.1
(n)	RU065 ₂₋₇	820.0	820.8
(o)	RU065 ₃₋₇	706.9	707.8
(p)	RU065 ₄₋₇	635.8	636.5
(q)	RU065 ₅₋₇	506.6	507.9
(r)	RU065 ₆₋₇	435.5	435.4
(s)	RU065 ₁₋₆	761.9	762.5
(t)	RU065 ₂₋₆	690.9	692.8
(u)	RU065 ₃₋₆	577.7	575.3
(v)	RU065 ₄₋₆	506.6	505.2
(w)	RU065 ₅₋₆	377.4	378.0
(x)	RU065 ₆	306.4	305.6

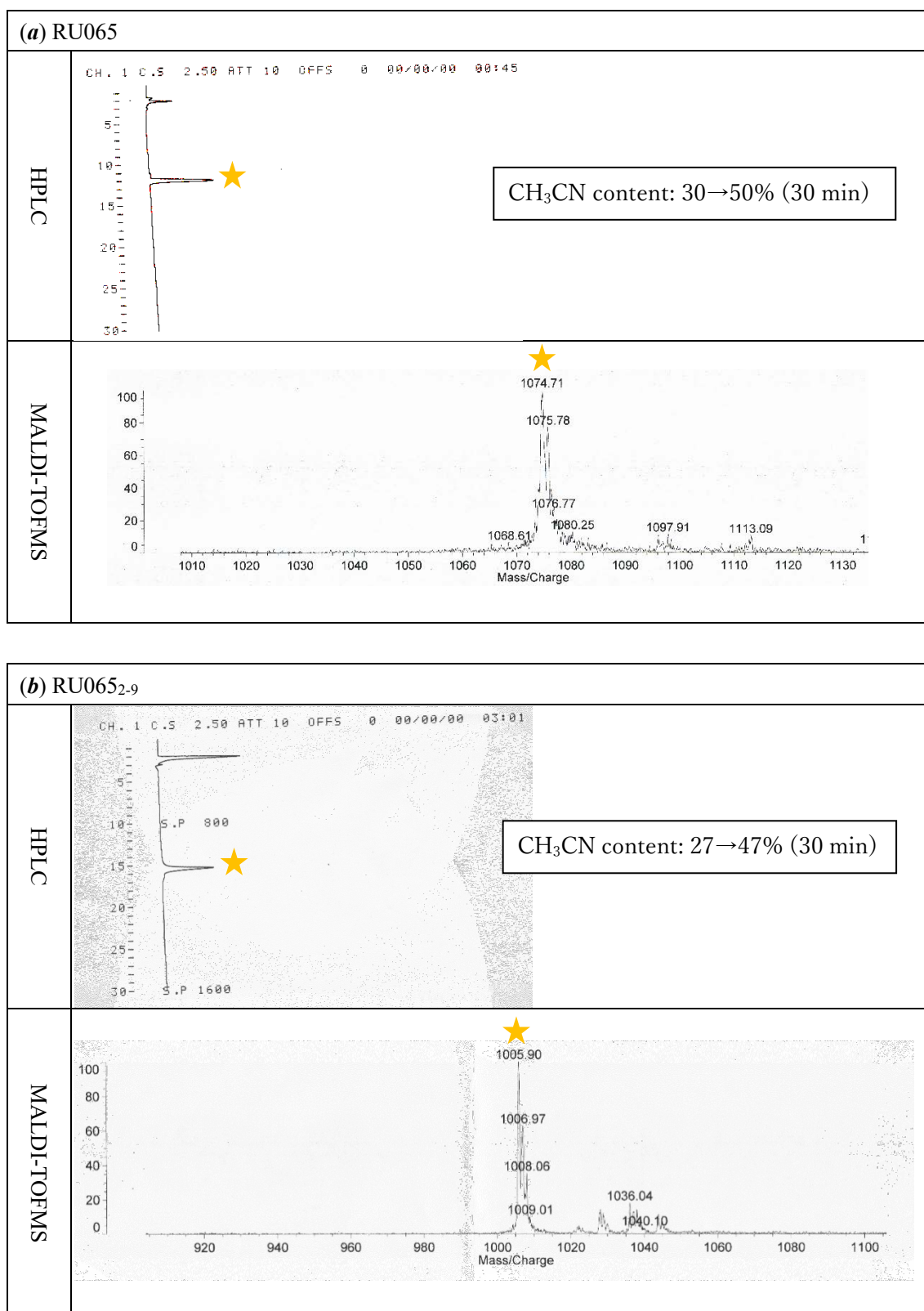


Figure S2. HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

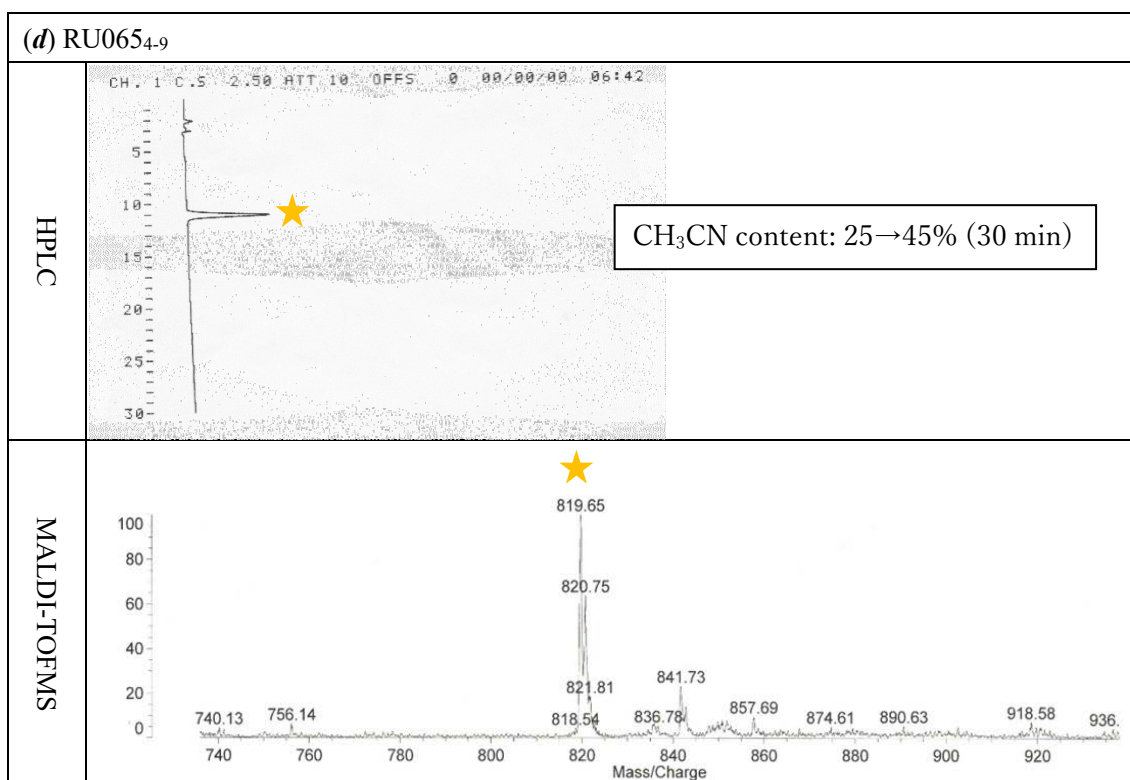
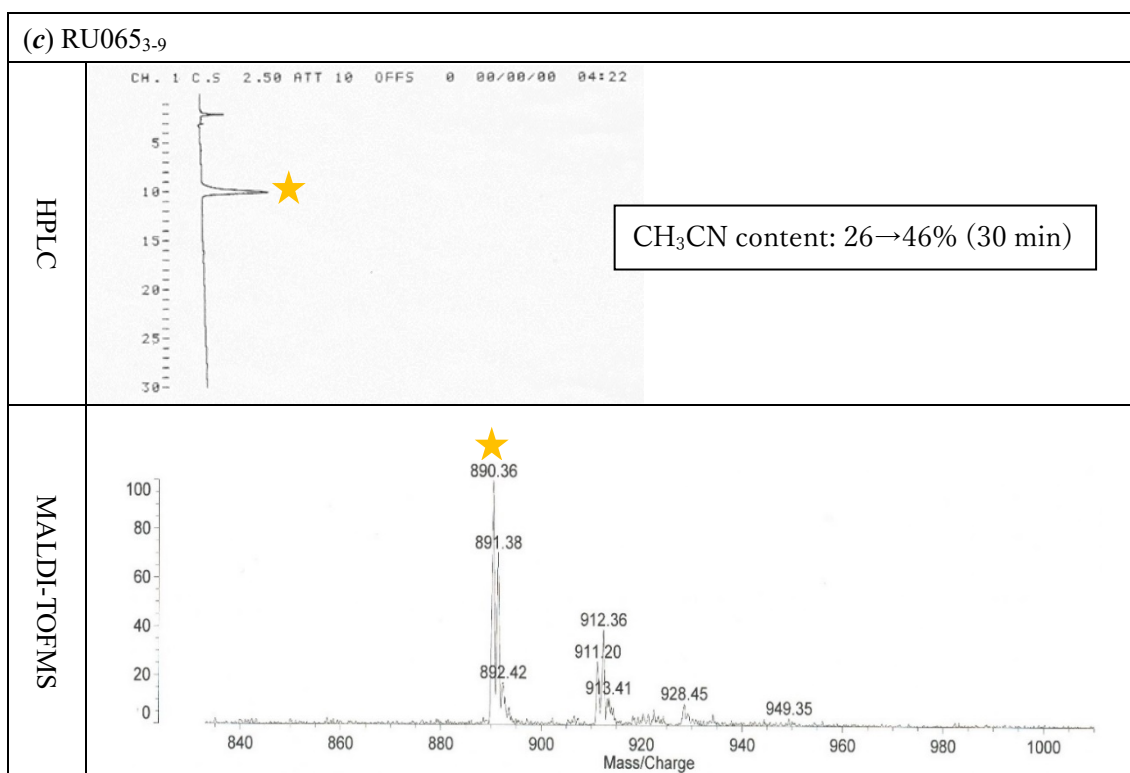


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

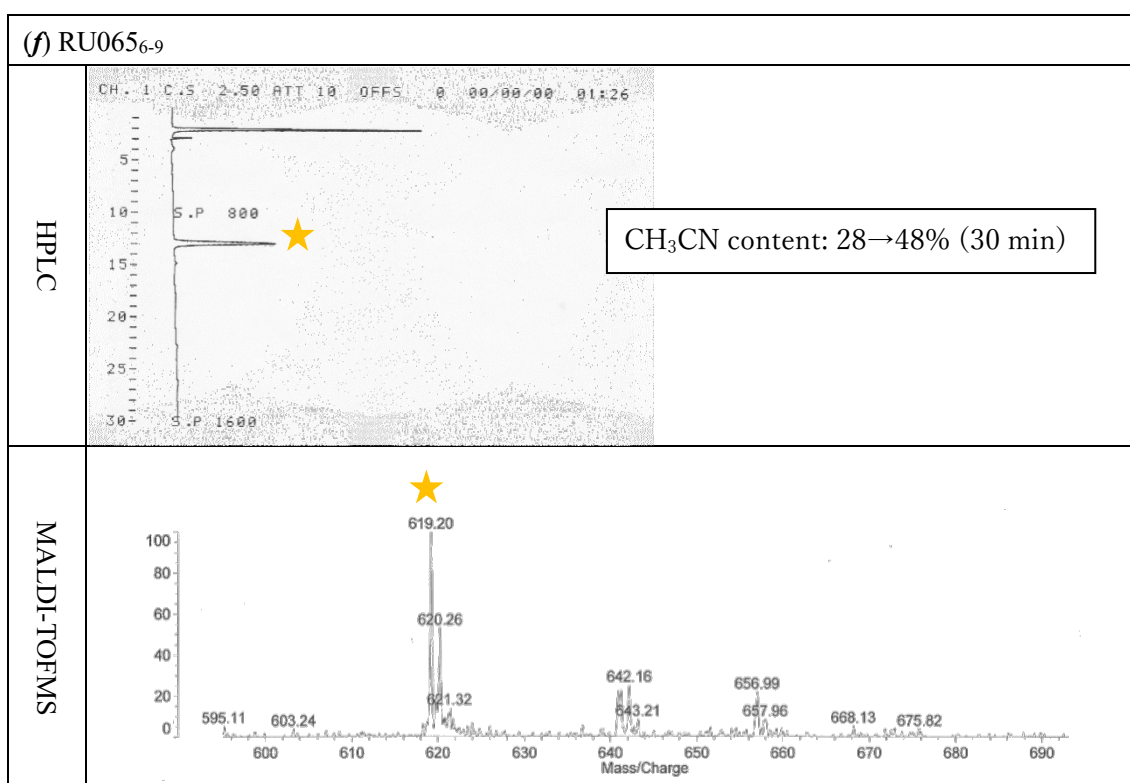
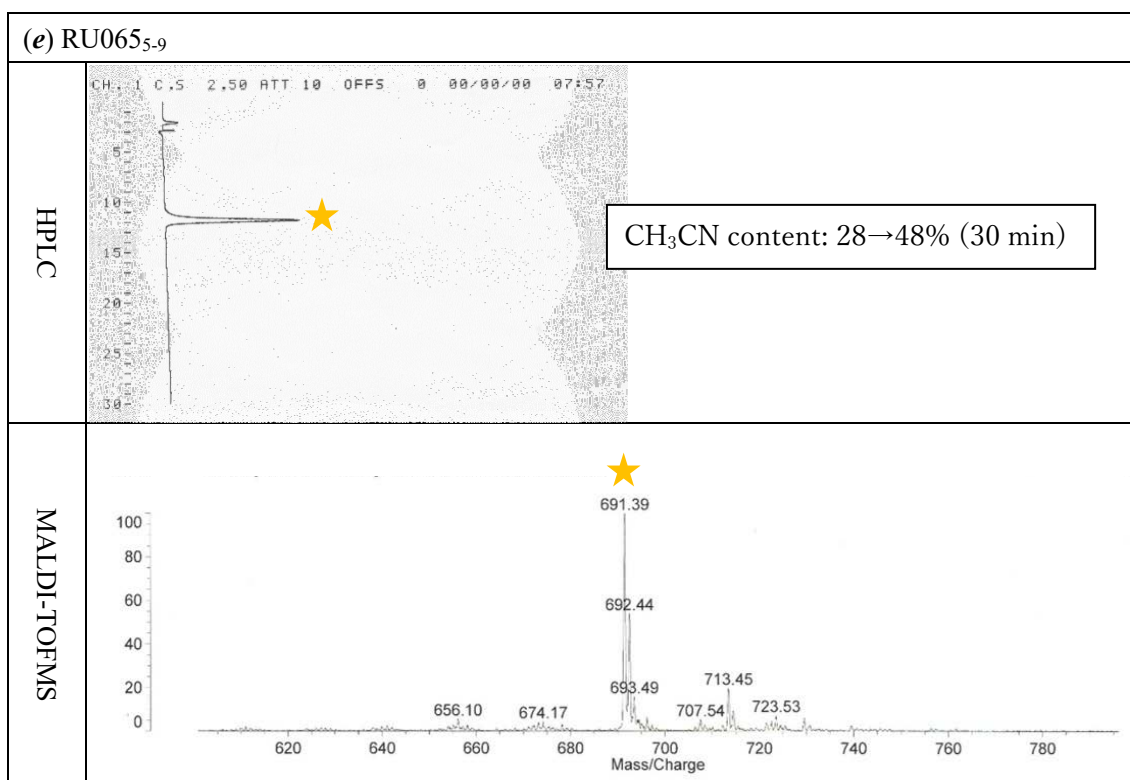


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

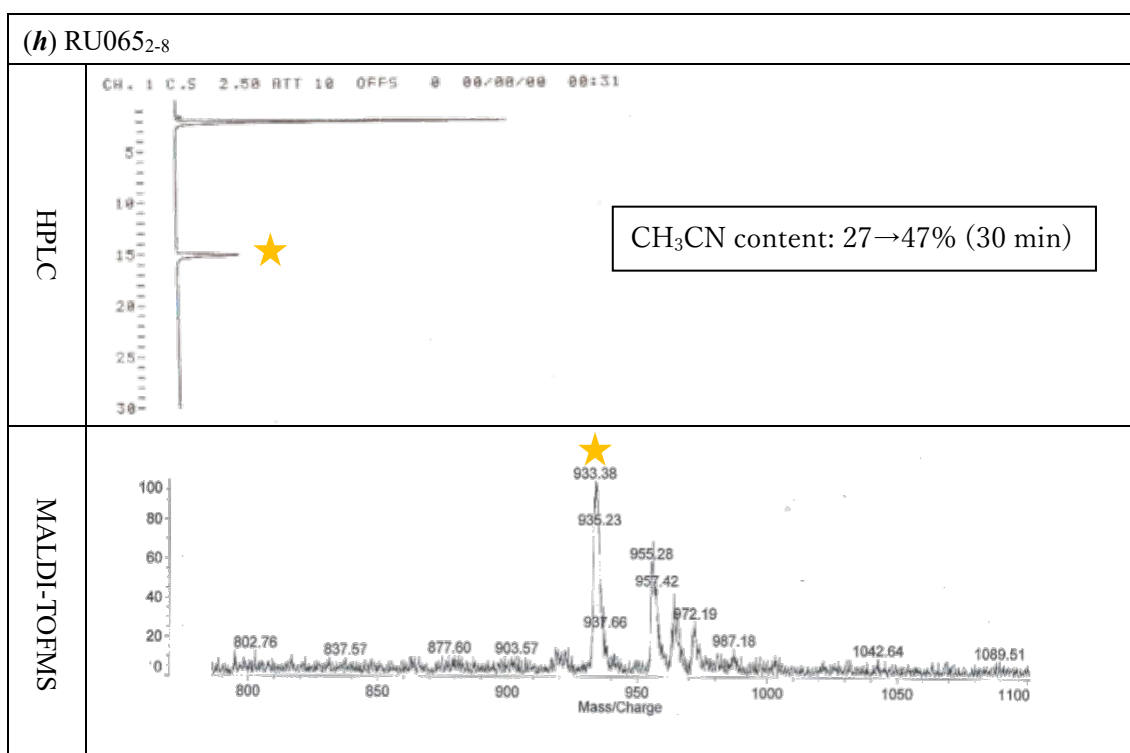
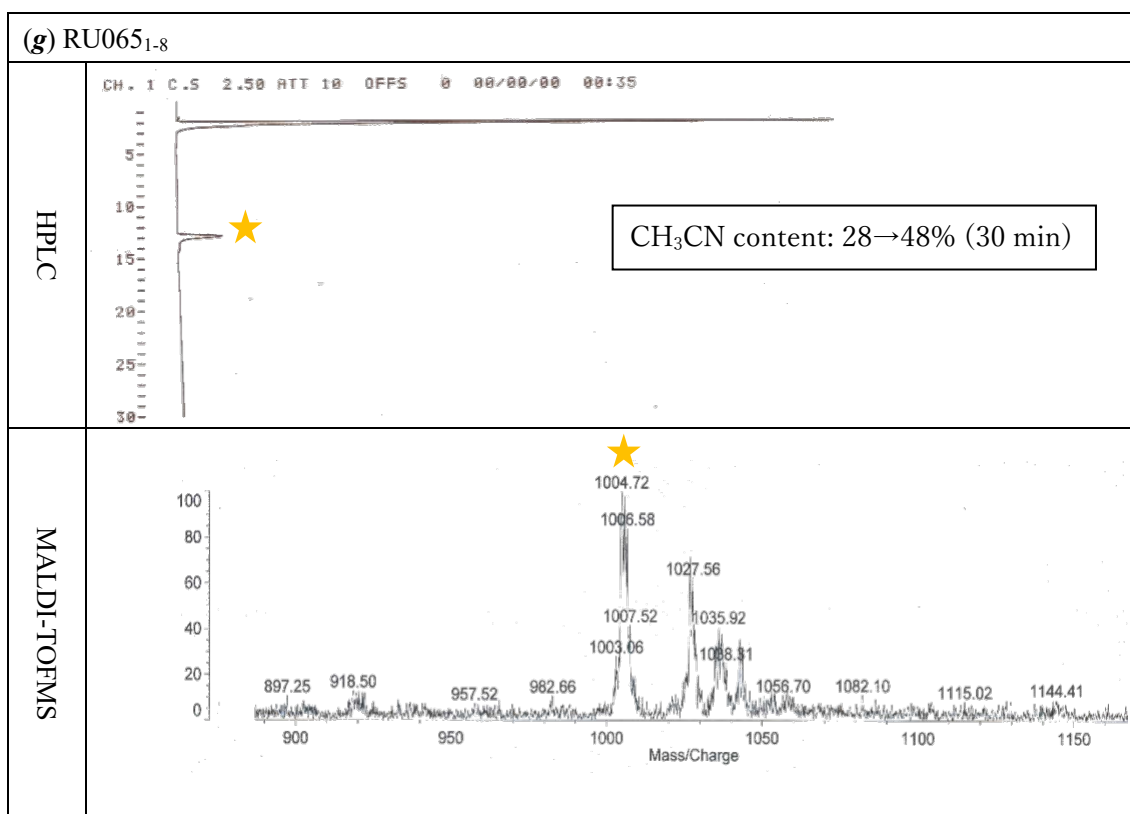


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

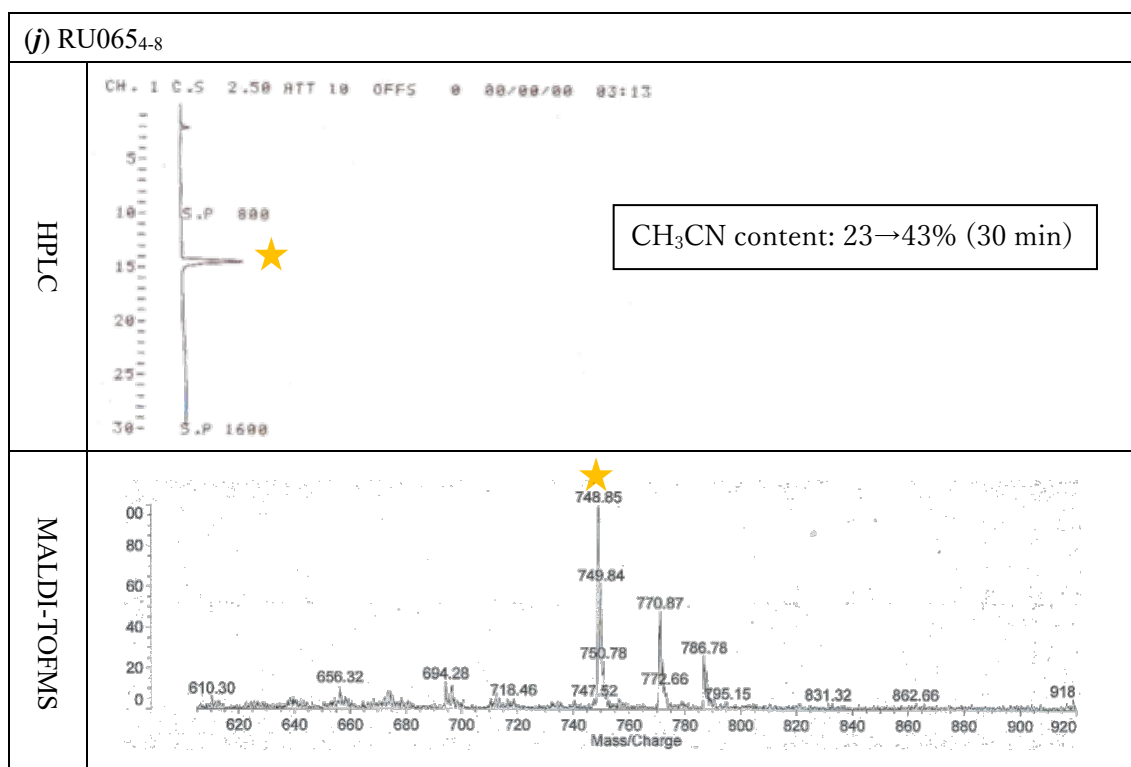
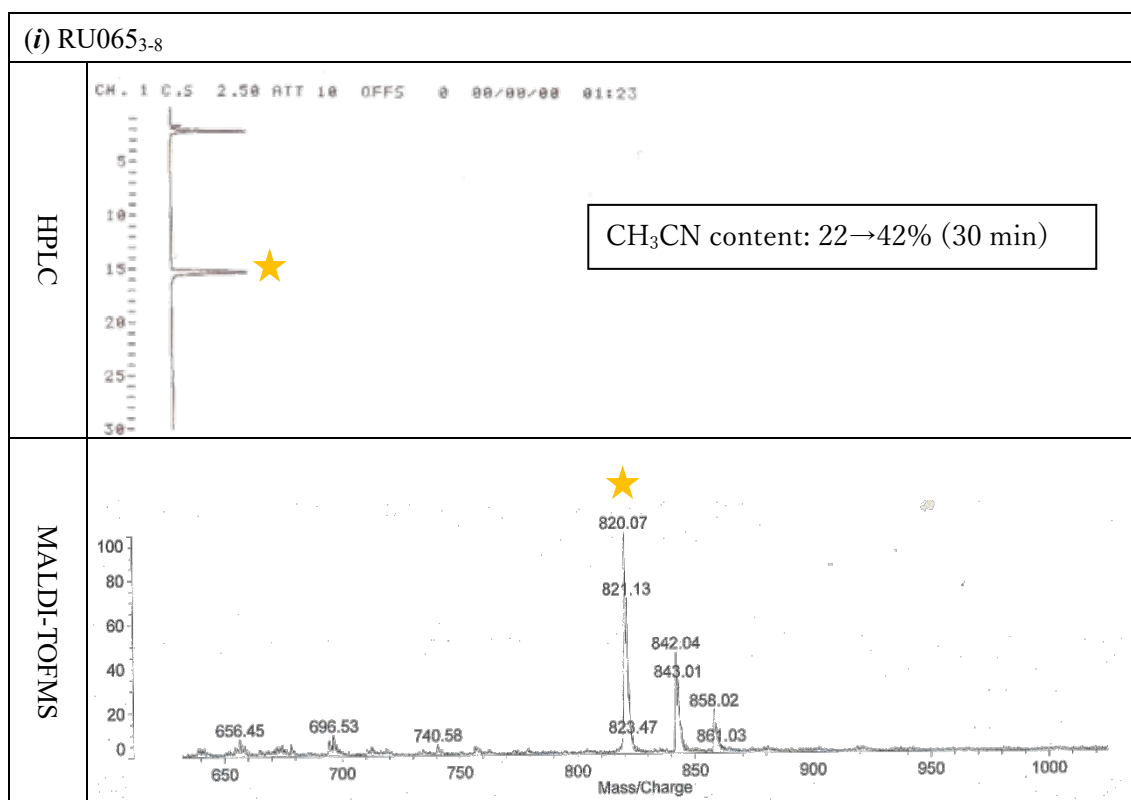


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

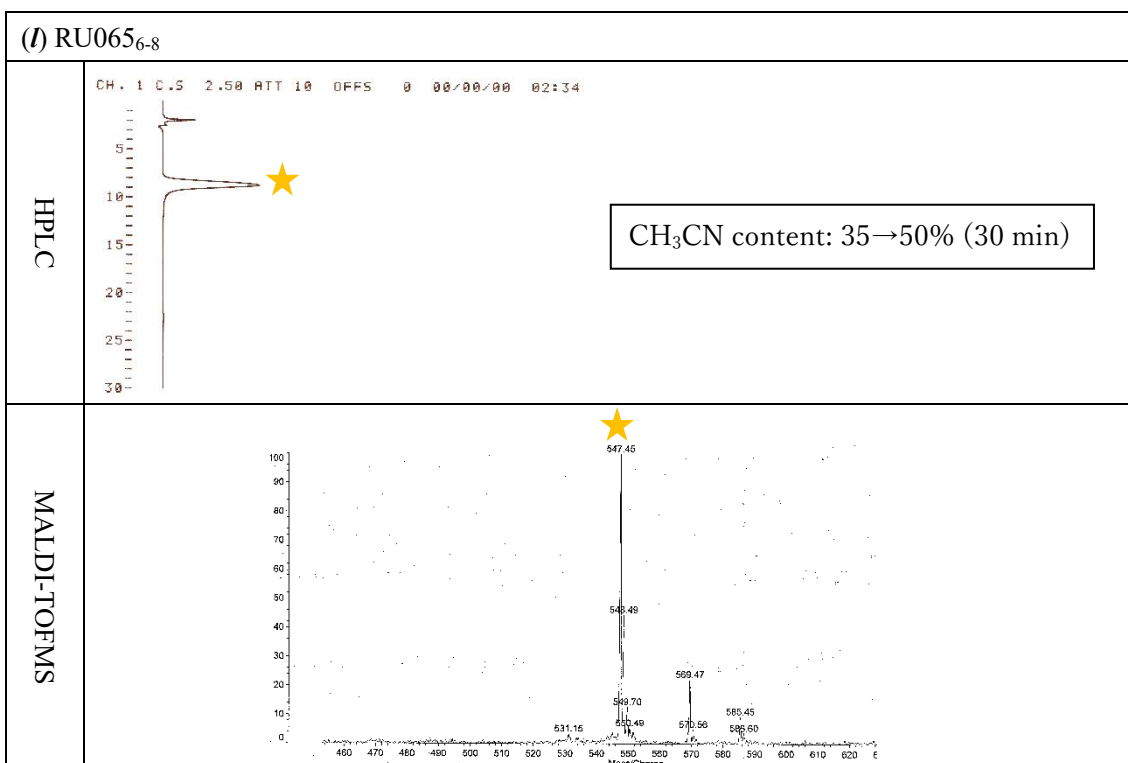
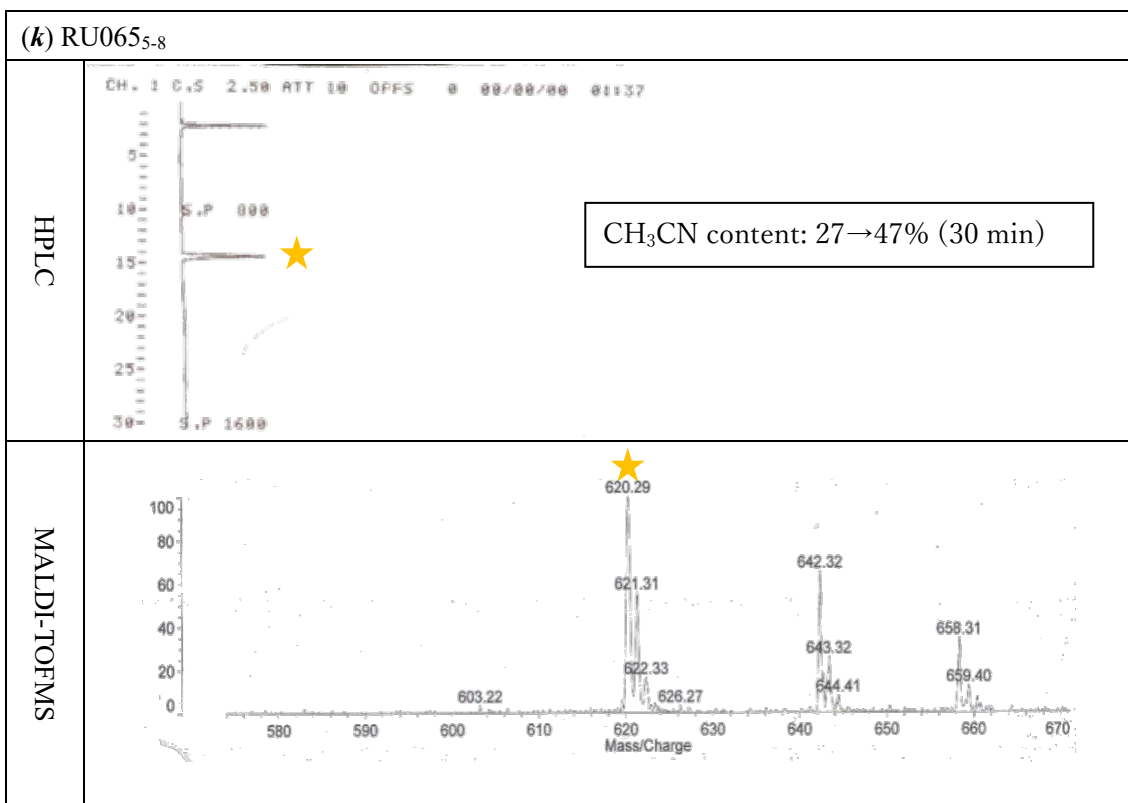


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

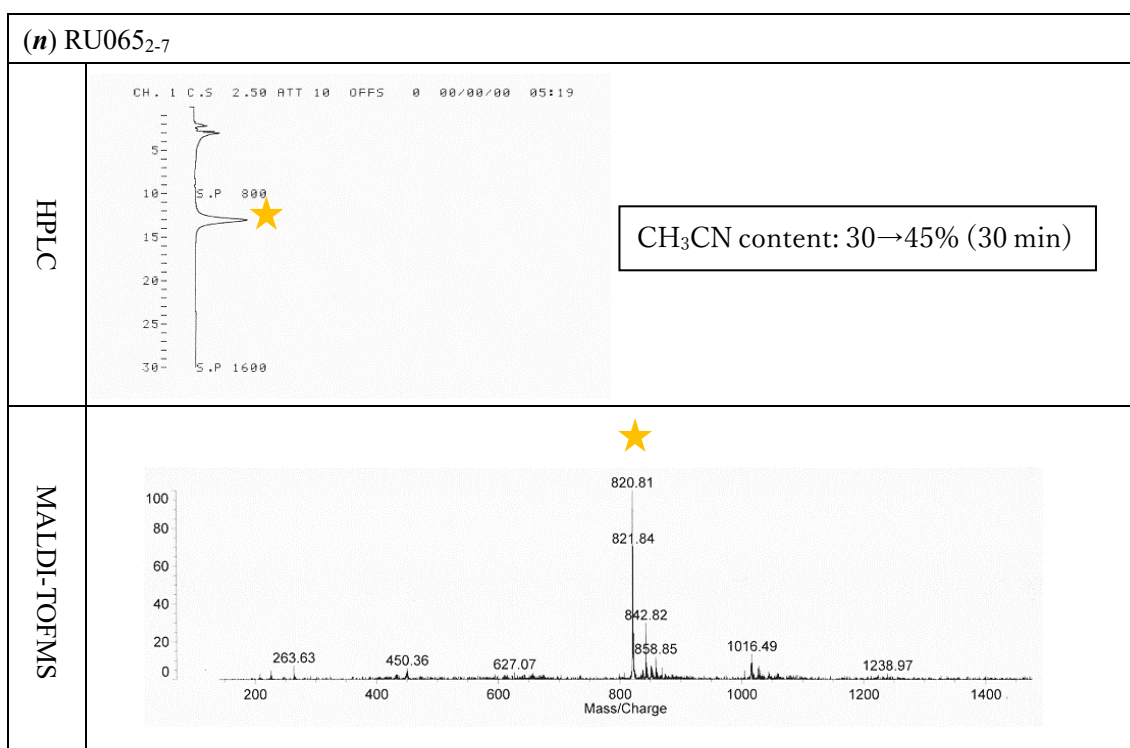
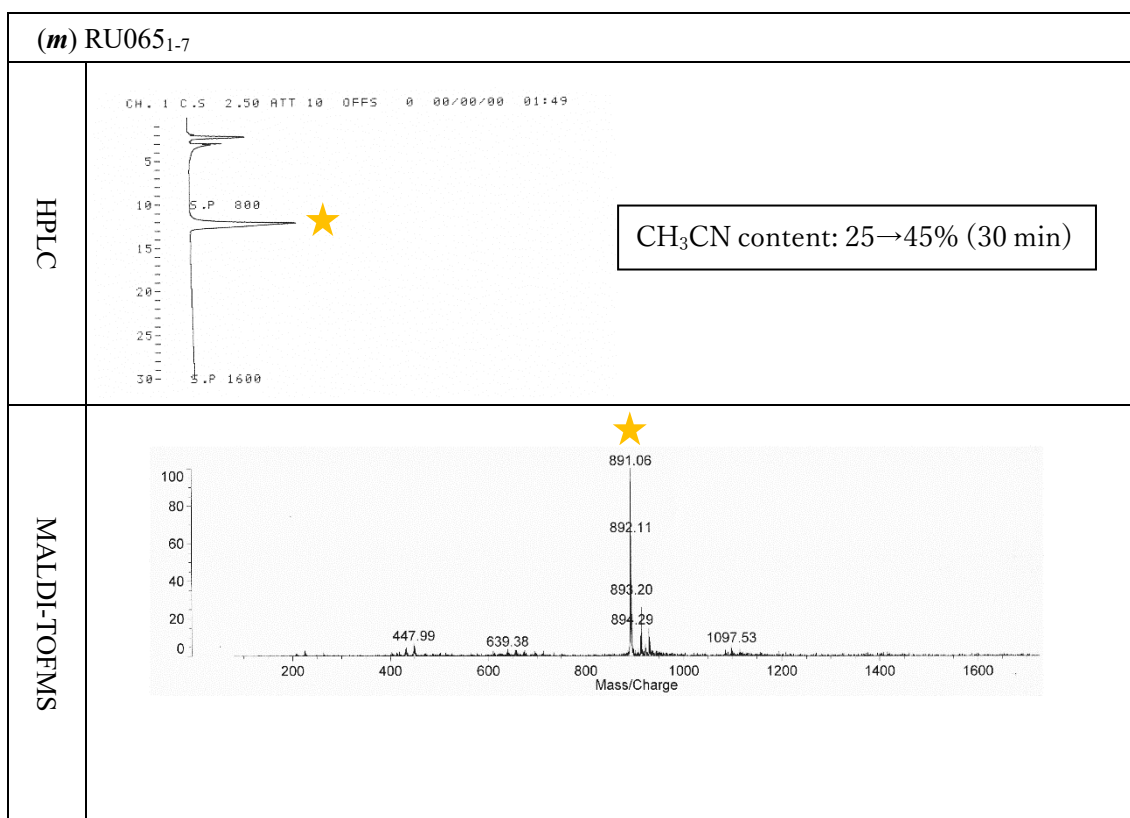


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

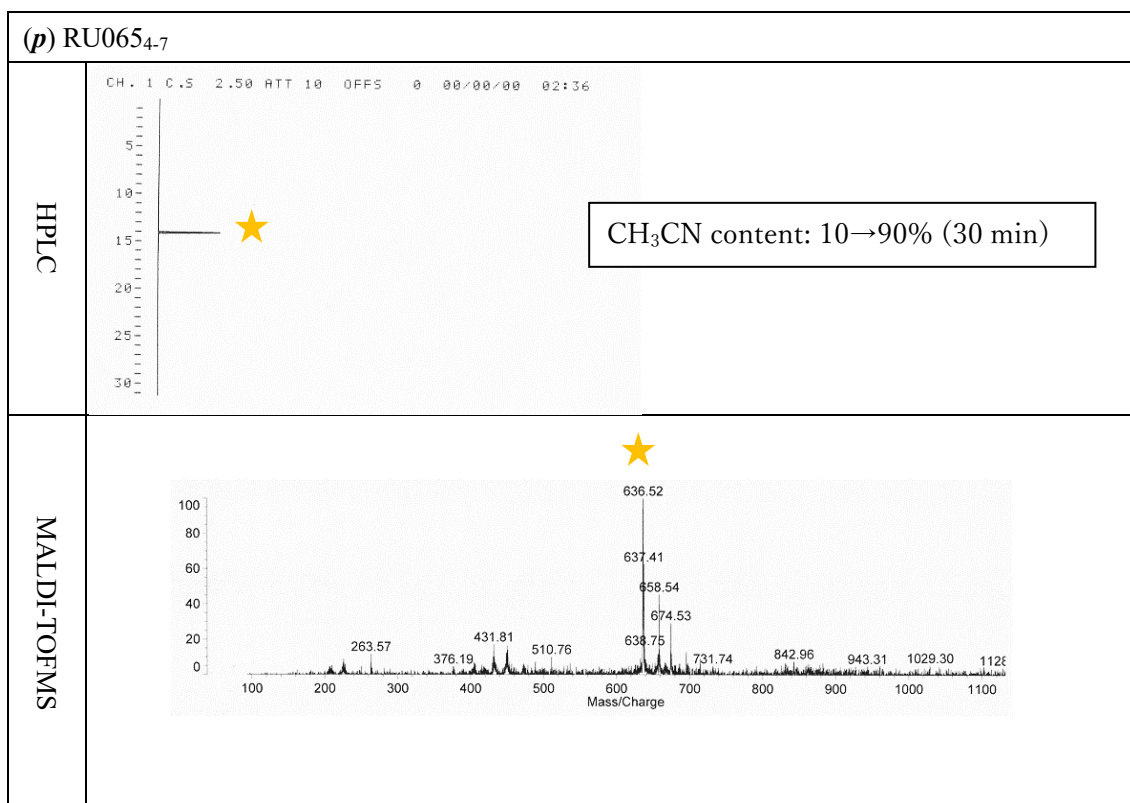
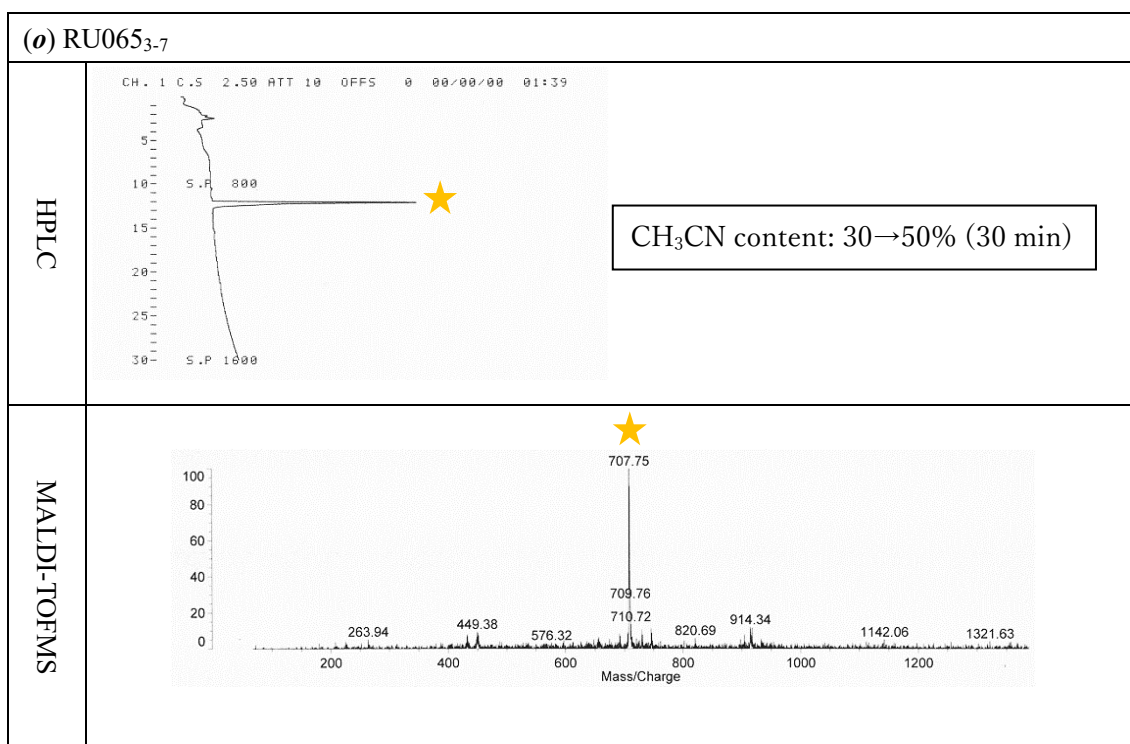


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

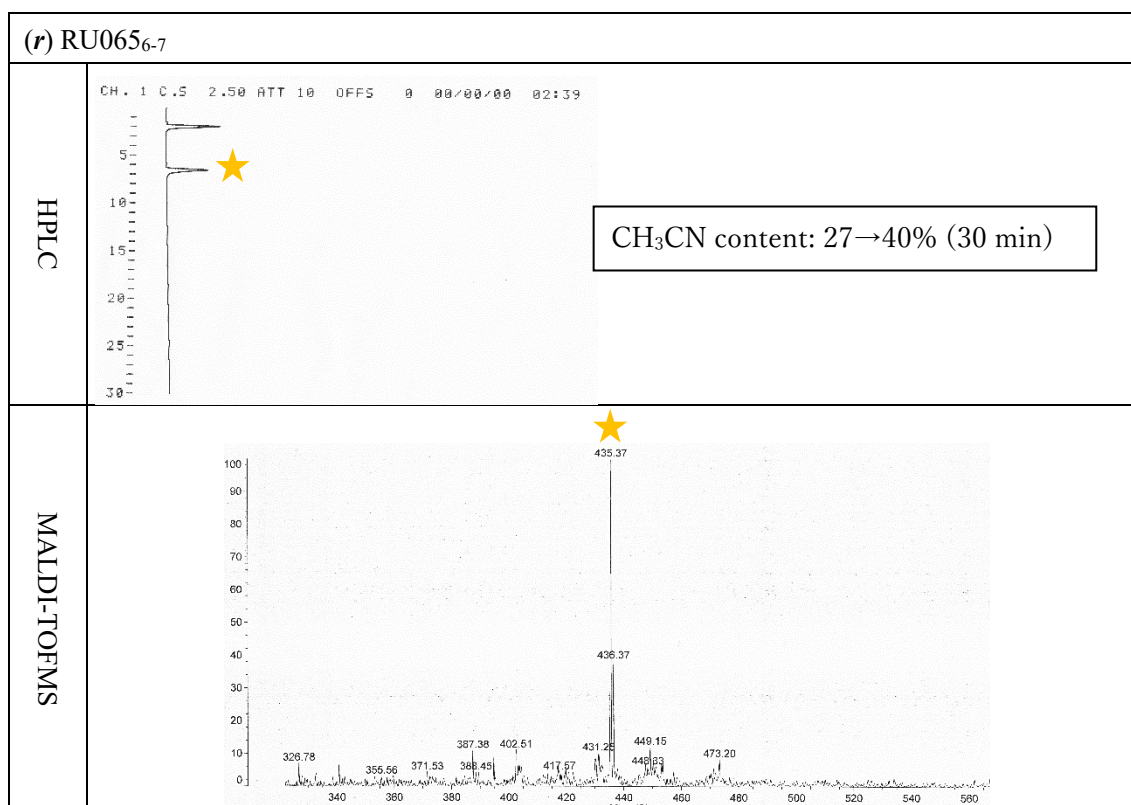
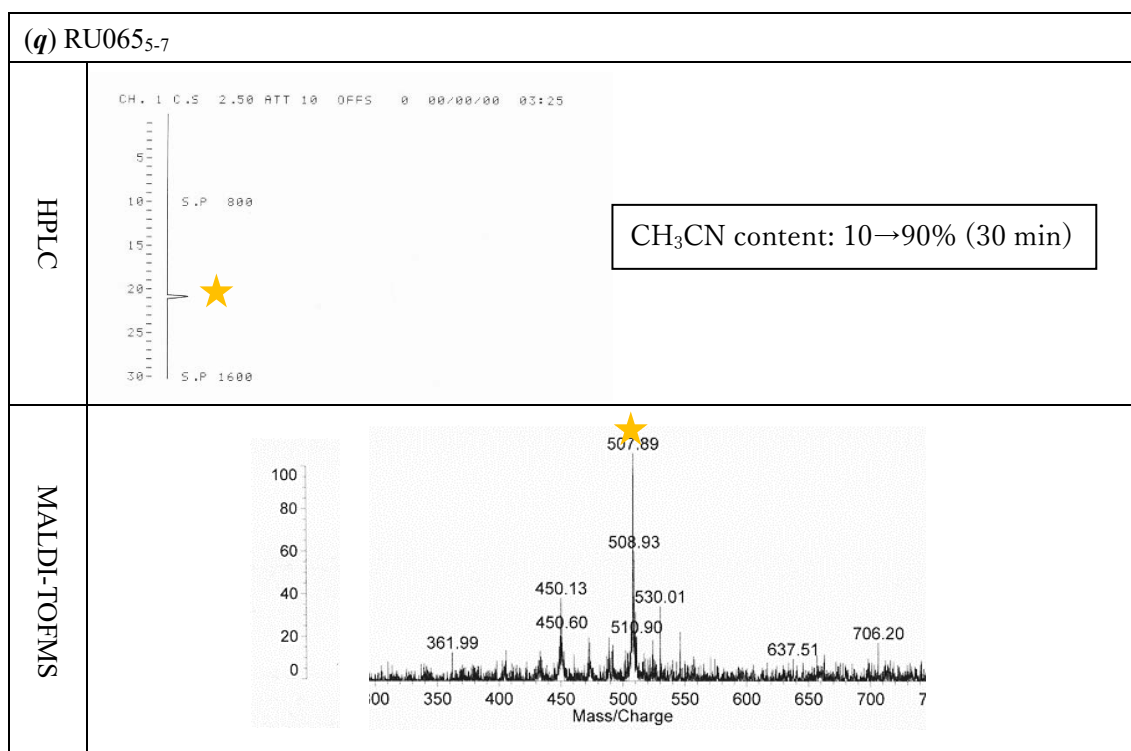


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

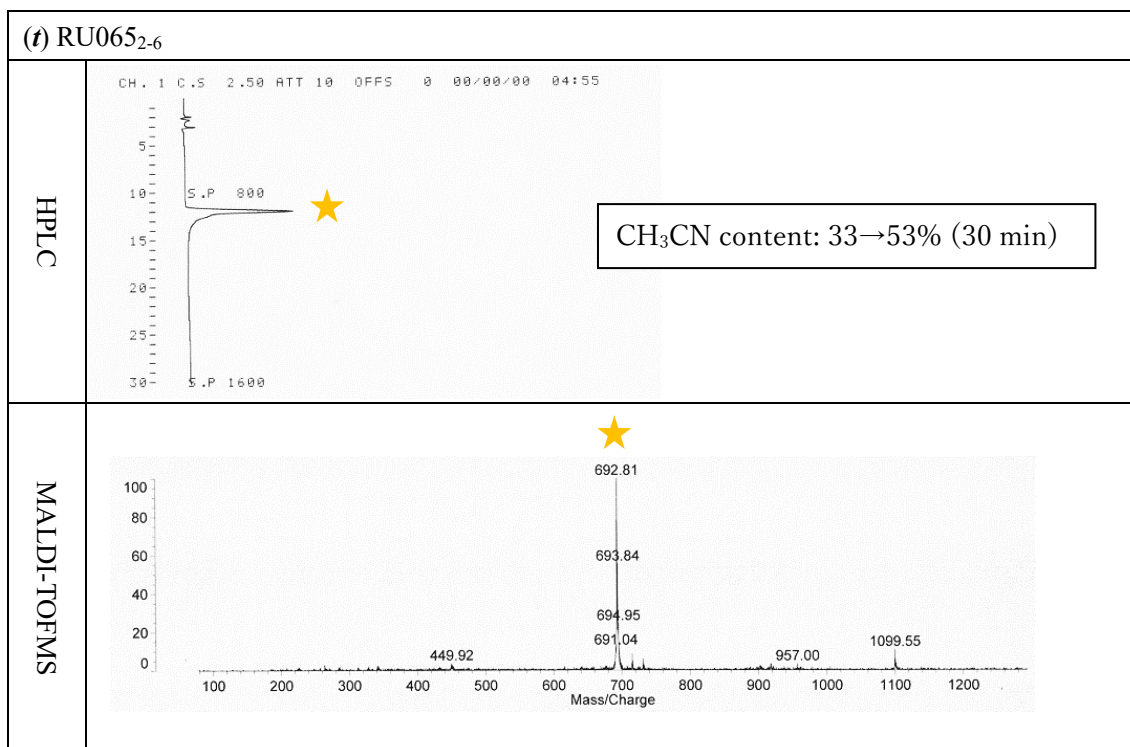
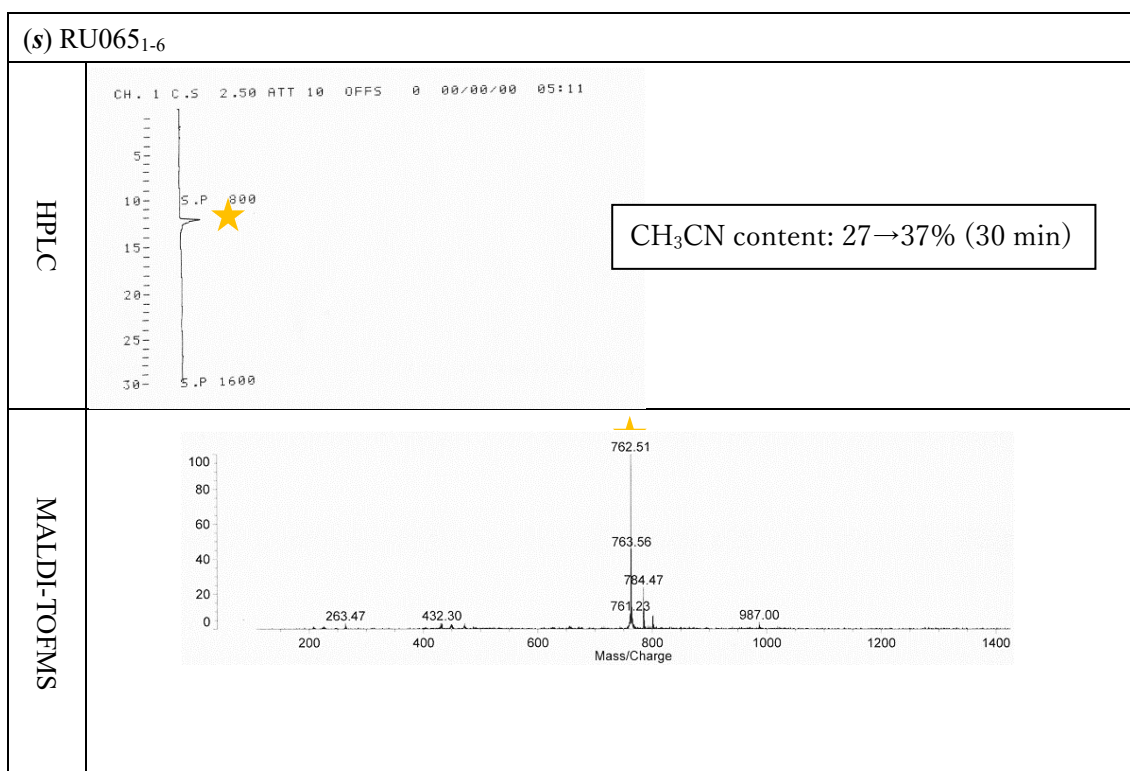


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

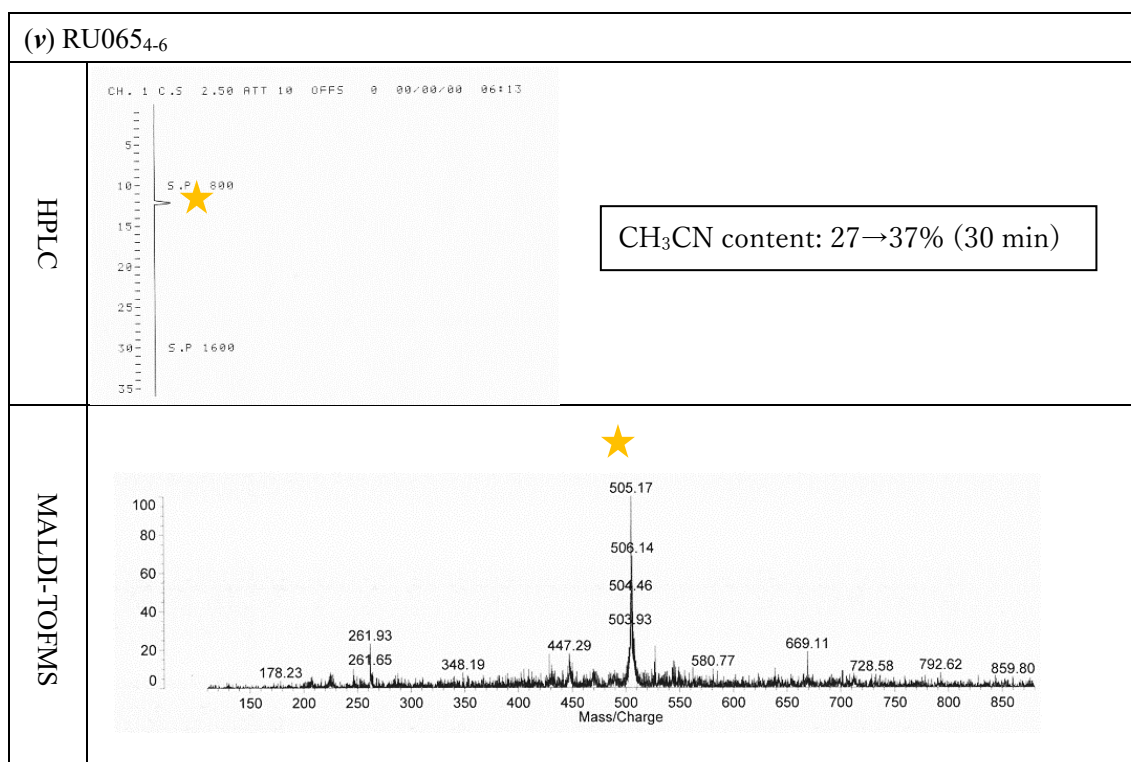
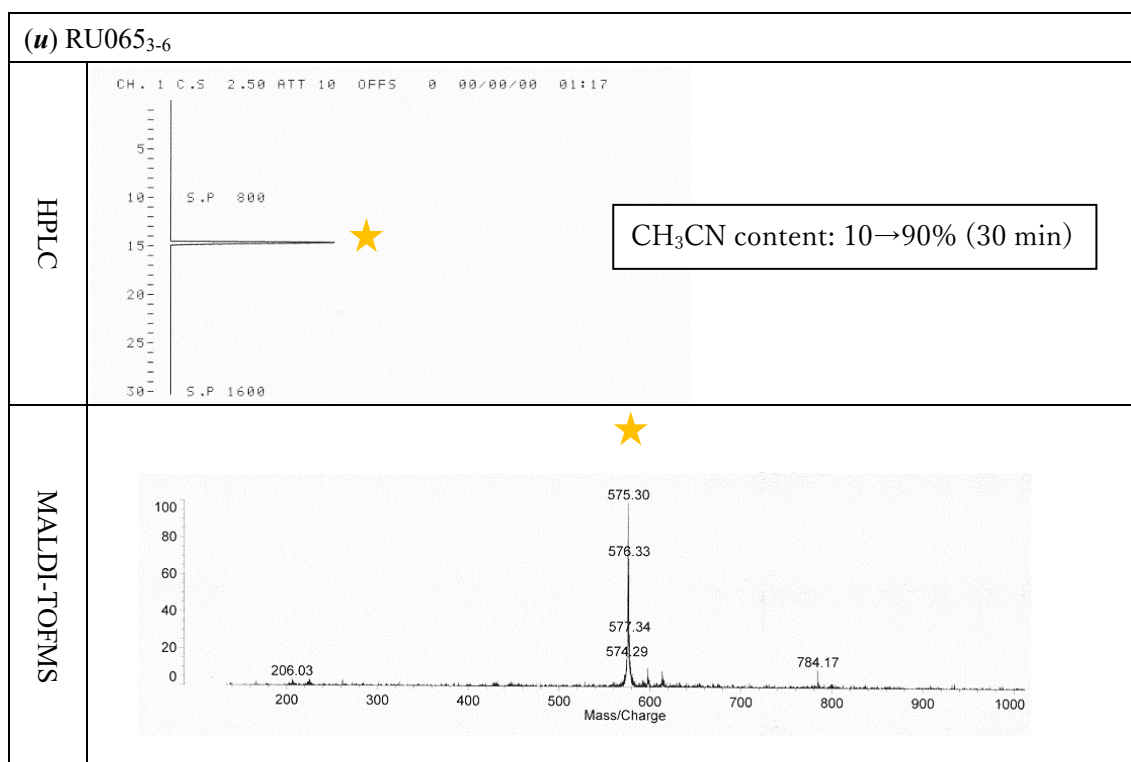


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

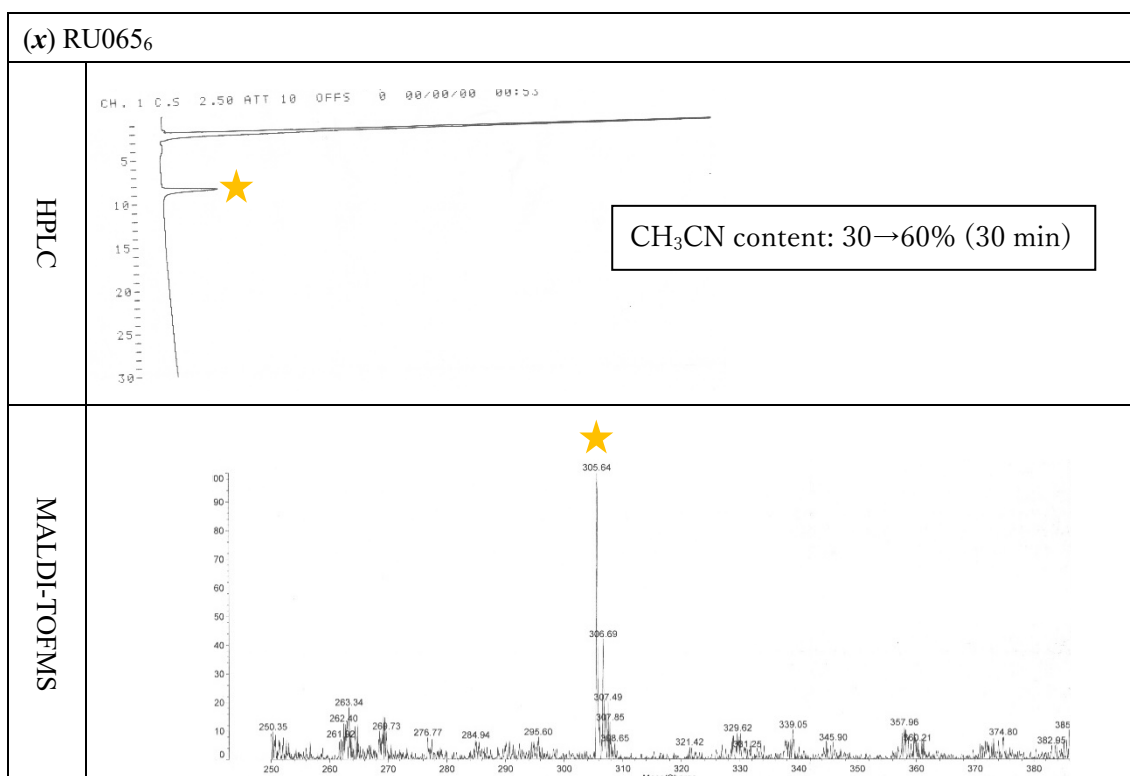
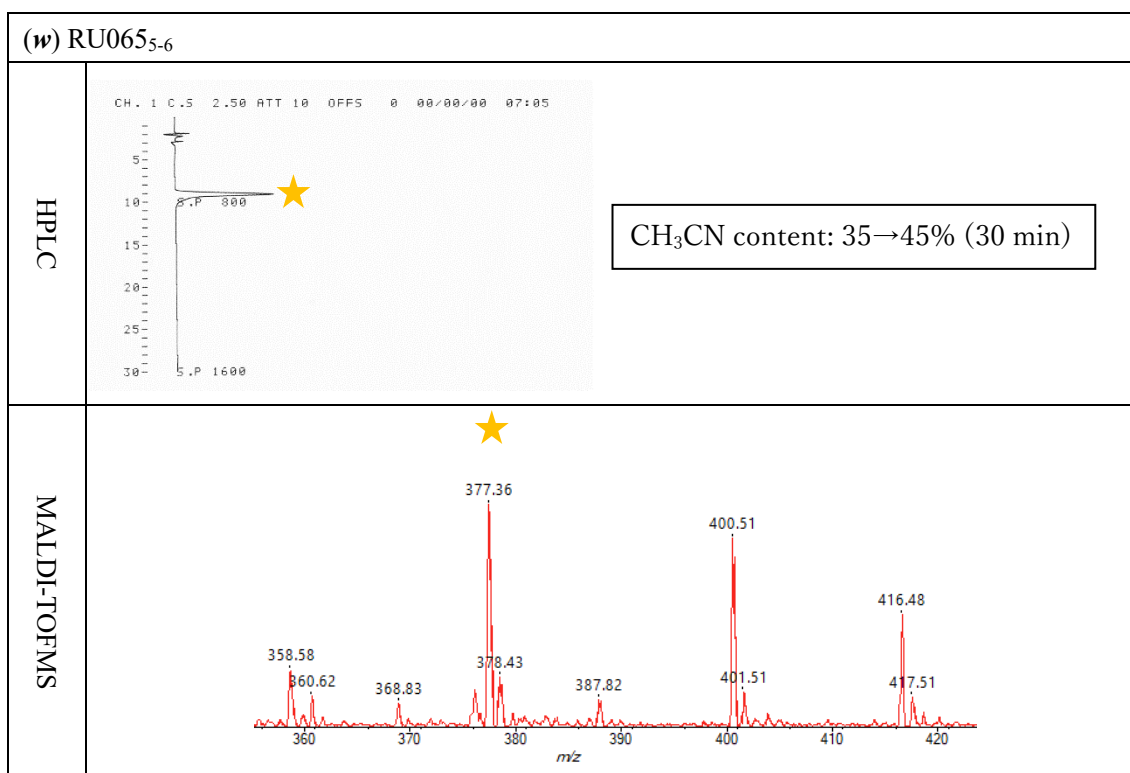


Figure S2 (continued). HPLC and MALDI-TOFMS data for RU065 and its fragment peptides. Inset: linear gradient of CH₃CN content for 30 min.

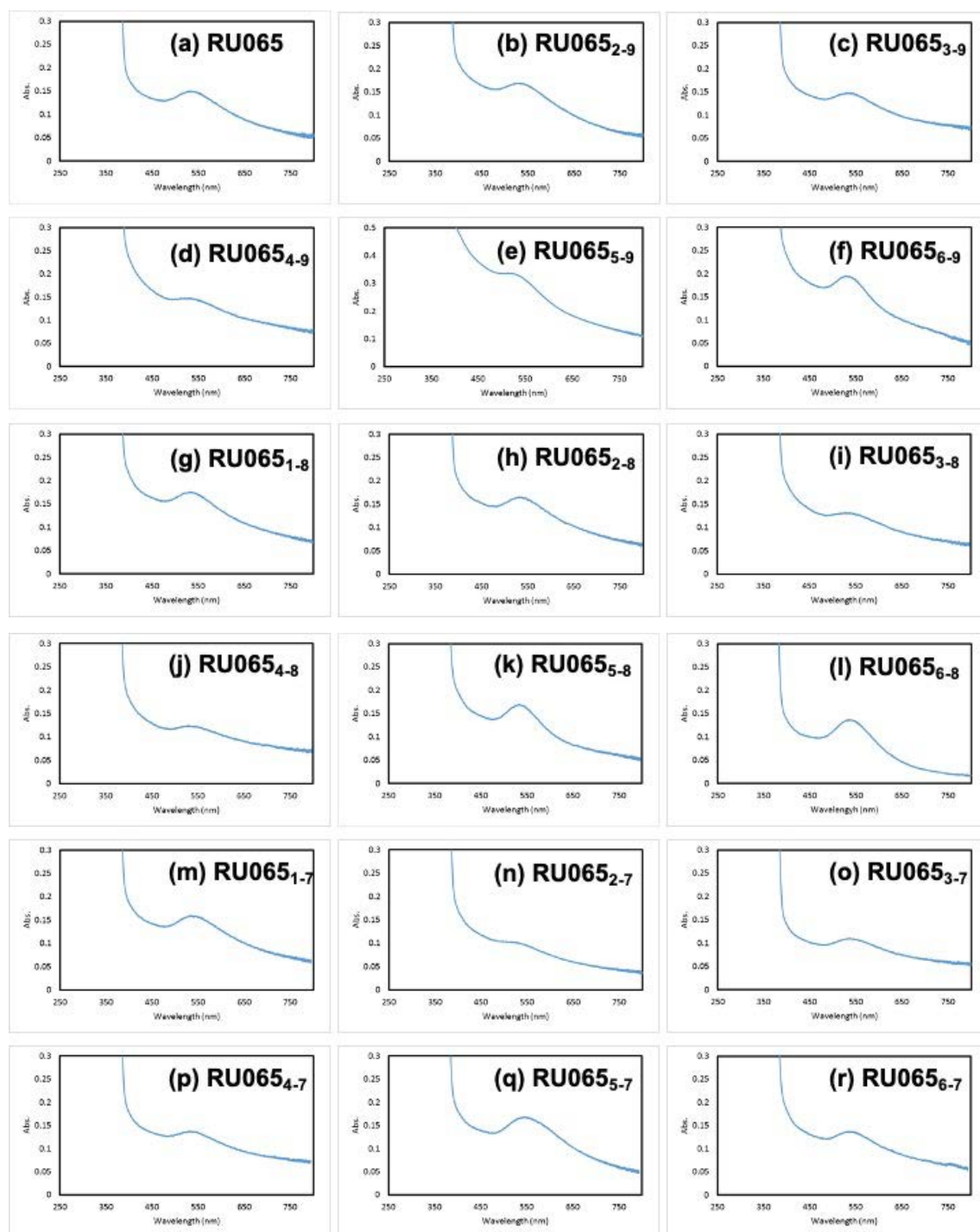


Figure S3. UV-vis spectra of the reaction mixtures of HAuCl₄, H₂PtCl₆, and RU065 (or its fragment peptide). [HAuCl₄] = [H₂PtCl₆] = 50 μ M, [peptide] = 200 μ M in water at 40 $^{\circ}$ C for 1 day.

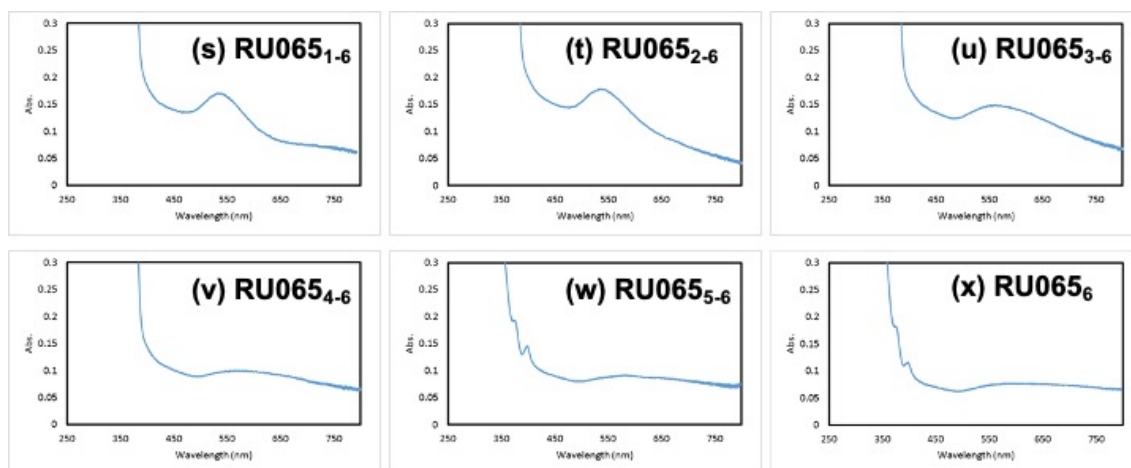


Figure S3 (continued). UV-vis spectra of the reaction mixtures of HAuCl₄, H₂PtCl₆, and RU065 (or its fragment peptide). [HAuCl₄] = [H₂PtCl₆] = 50 μ M, [peptide] = 200 μ M in water at 40 $^{\circ}$ C for 1 day.

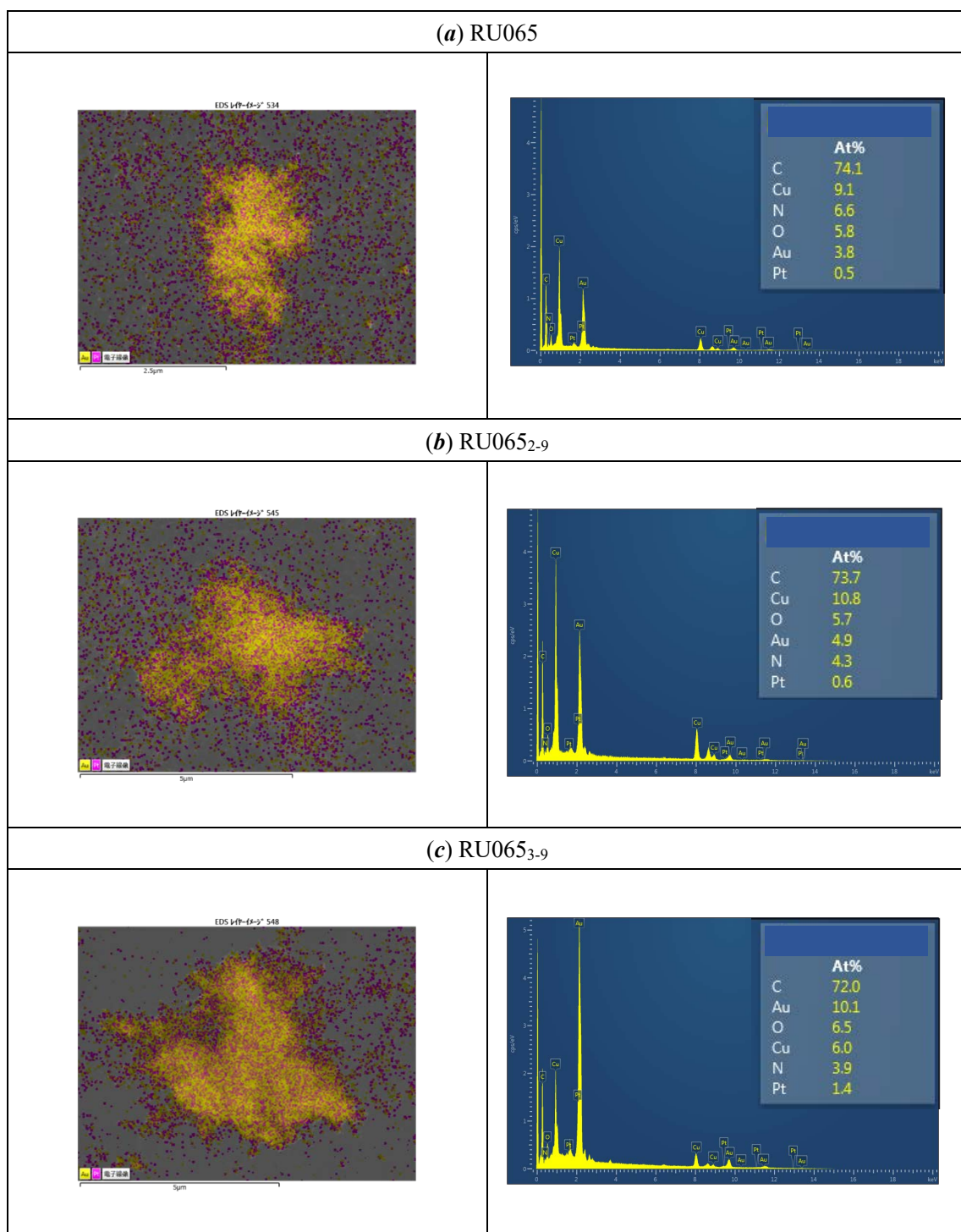


Figure S4. EDS-FESEM analysis of the precipitates from the reaction mixtures of HAuCl_4 , H_2PtCl_6 , and RU065 (or its fragment peptide). Au and Pt distributions are colored in yellow and purple, respectively. $[\text{Peptide}] = 2.0 \times 10^{-4} \text{ M}$ and $[\text{HAuCl}_4] = [\text{H}_2\text{PtCl}_6] = 5.0 \times 10^{-5} \text{ M}$, in water at 40°C for 1 day.

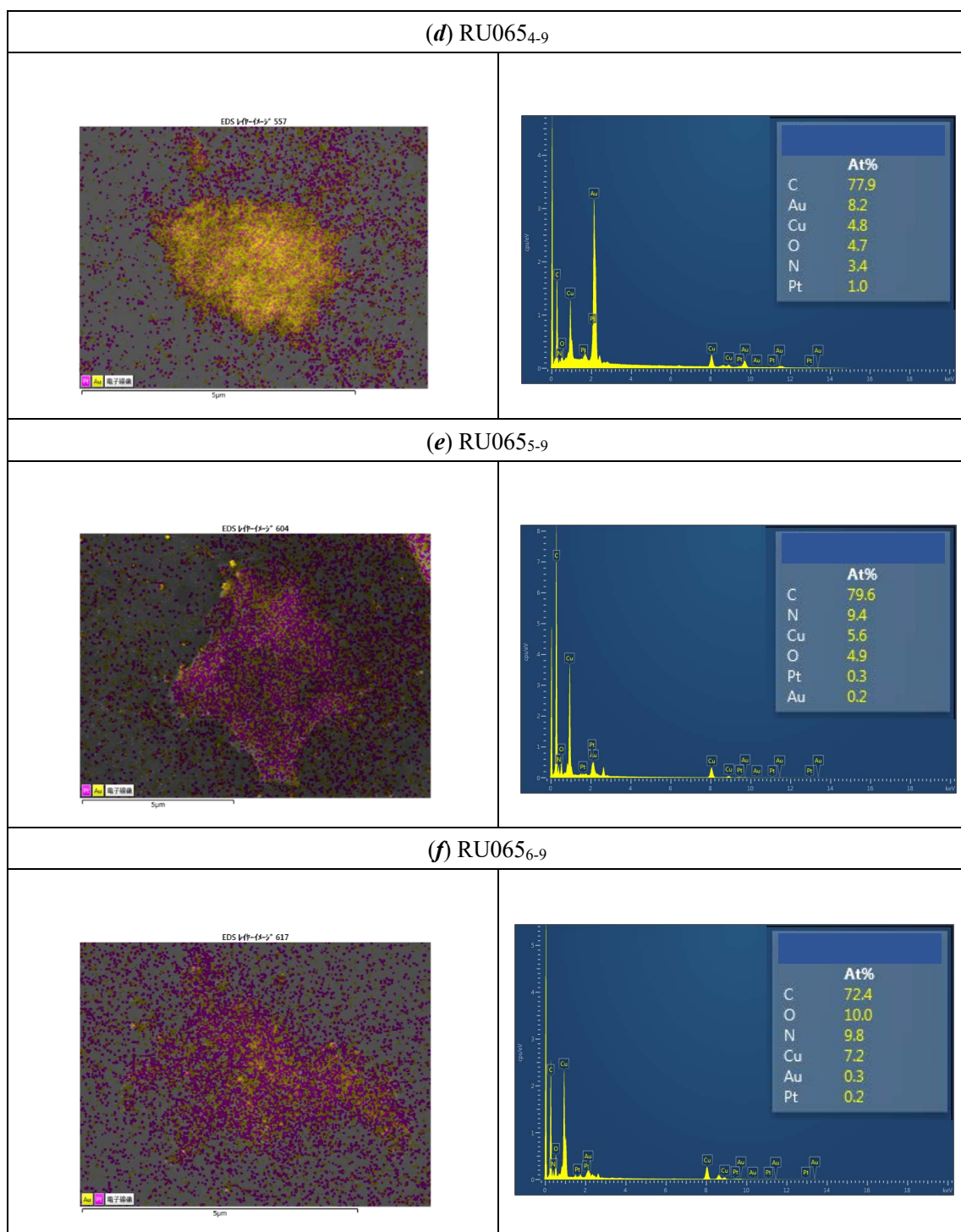


Figure S4 (continued). EDS-FESEM analysis of the precipitates from the reaction mixtures of HAuCl₄, H₂PtCl₆, and RU065 (or its fragment peptide). Au and Pt distributions are colored in yellow and purple, respectively. [Peptide] = 2.0×10^{-4} M and [HAuCl₄] = [H₂PtCl₆] = 5.0×10^{-5} M in water at 40 °C for 1 day.

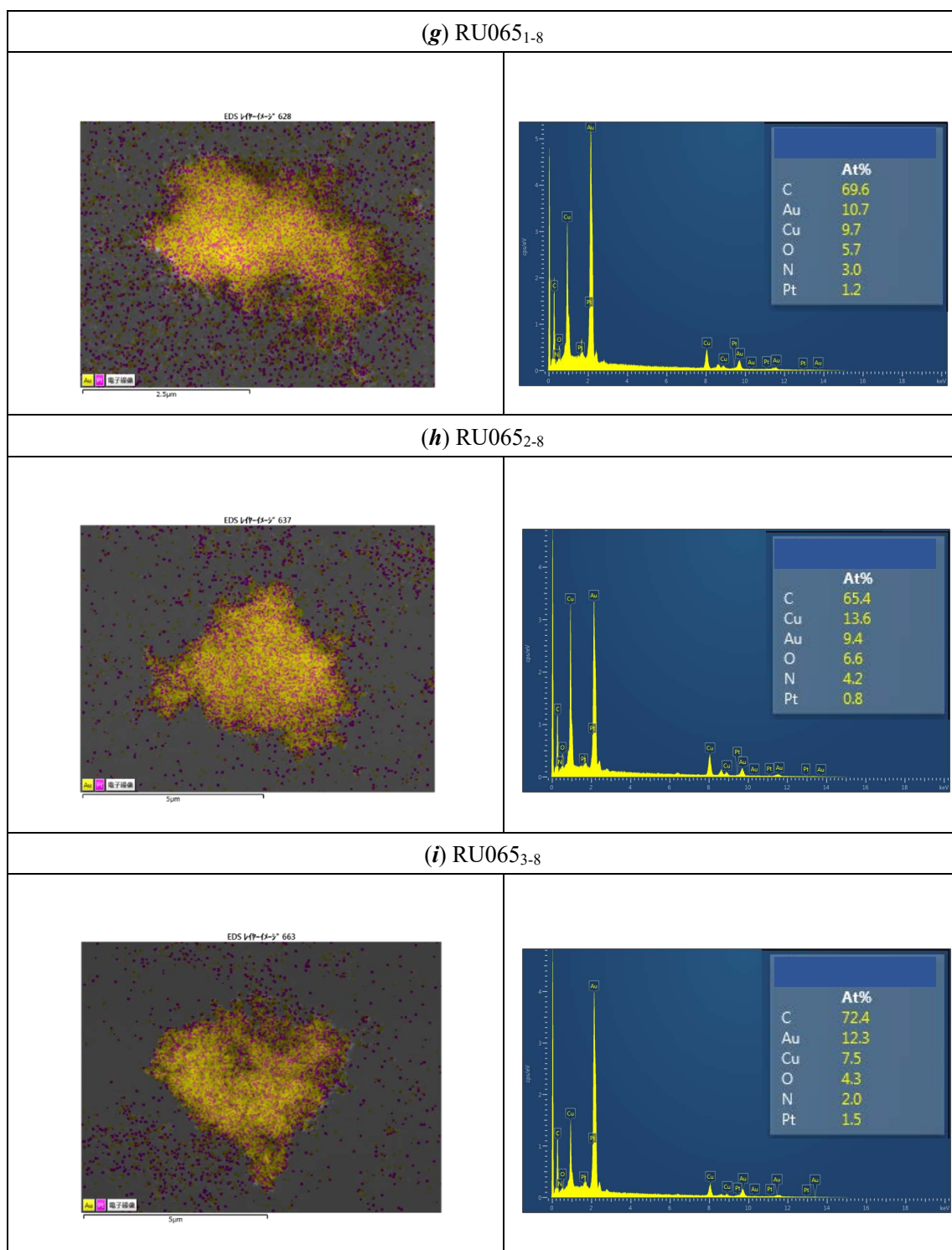


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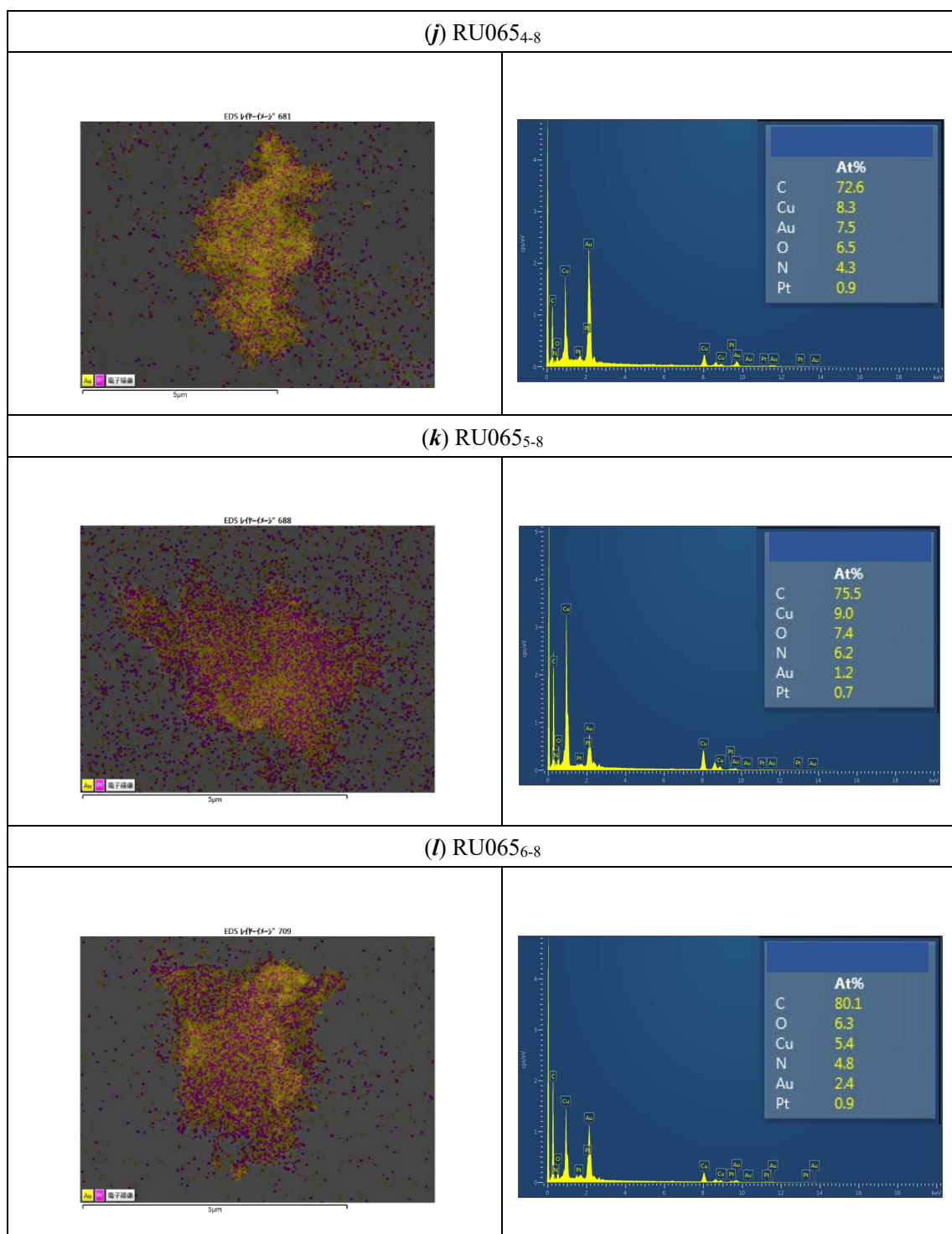


Figure S4 (continued). EDS-FESEM analysis of the precipitates from the reaction mixtures of HAuCl_4 , H_2PtCl_6 , and RU065 (or its fragment peptide). Au and Pt distributions are colored in yellow and purple, respectively. $[\text{Peptide}] = 2.0 \times 10^{-4} \text{ M}$ and $[\text{HAuCl}_4] = [\text{H}_2\text{PtCl}_6] = 5.0 \times 10^{-5} \text{ M}$ in water at 40°C for 1 day.

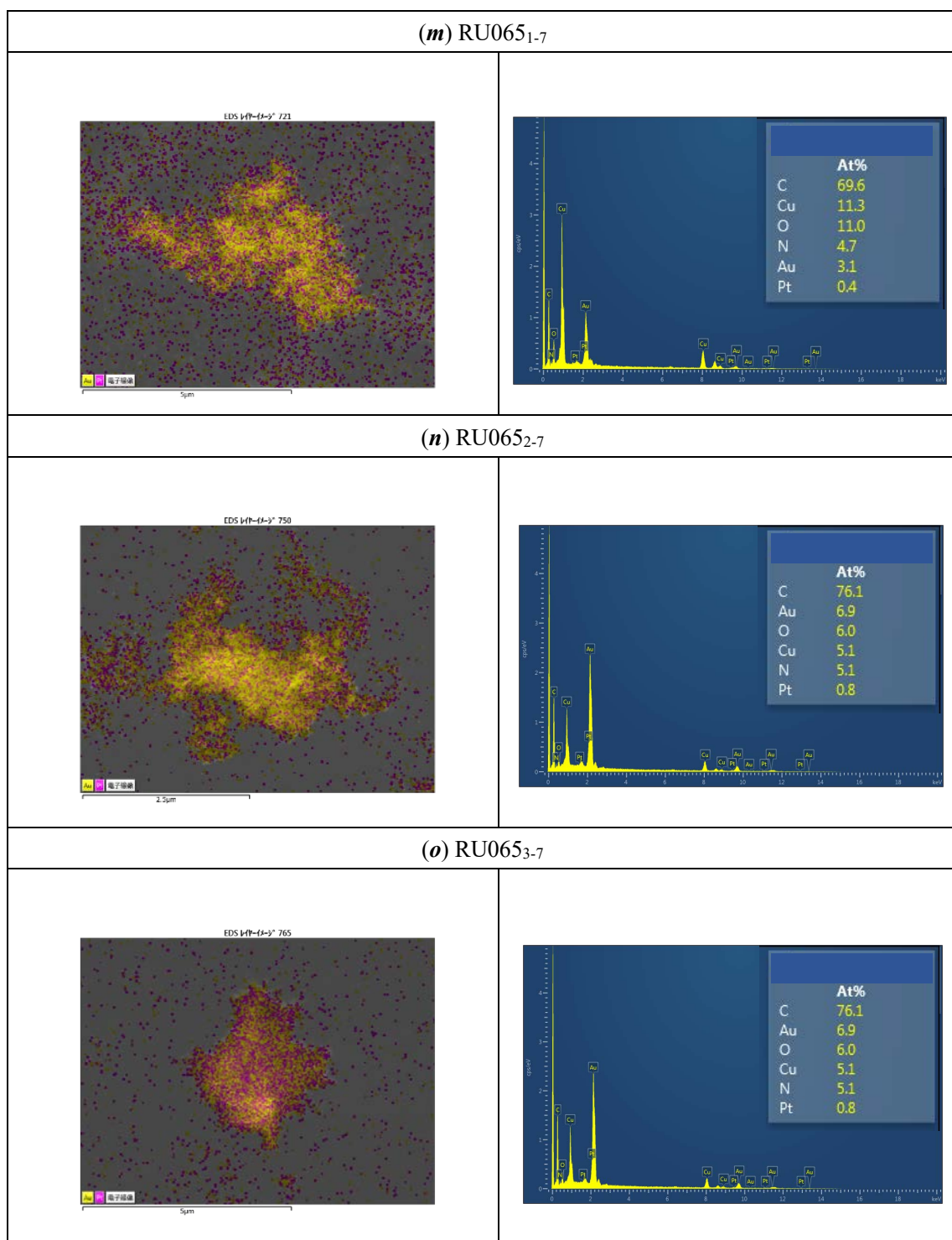


Figure S4 (continued). EDS-FESEM analysis of the precipitates from the reaction mixtures of H₂AuCl₄, H₂PtCl₆, and RU065 (or its fragment peptide). Au and Pt distributions are colored in yellow and purple, respectively. [Peptide] = 2.0 × 10⁻⁴ M and [H₂AuCl₄] = [H₂PtCl₆] = 5.0 × 10⁻⁵ M in water at 40 °C for 1 day.

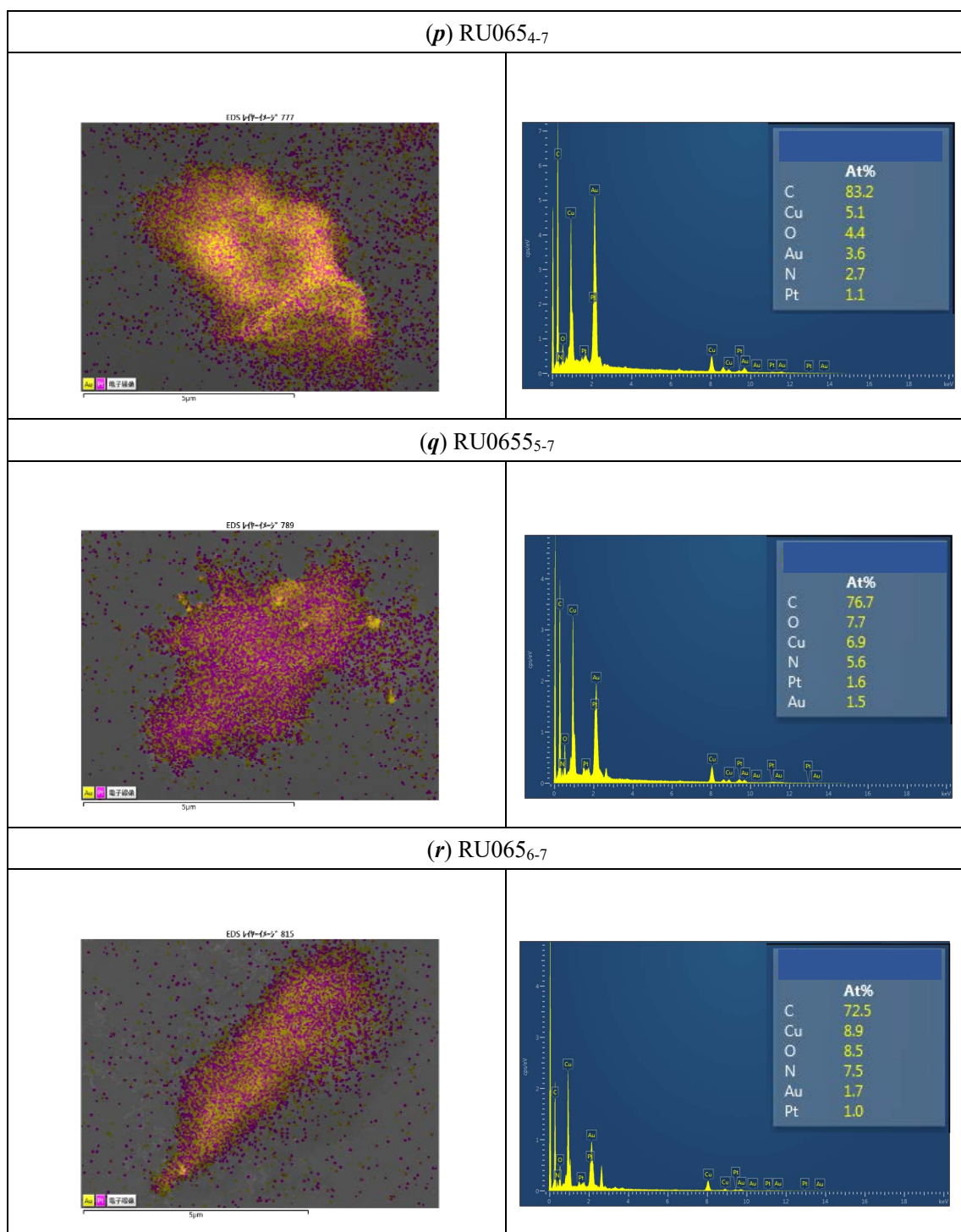


Figure S4 (continued). EDS-FESEM analysis of the precipitates from the reaction mixtures of HAuCl₄, H₂PtCl₆, and RU065 (or its fragment peptide). Au and Pt distributions are colored in yellow and purple, respectively. [Peptide] = 2.0×10^{-4} M and [HAuCl₄] = [H₂PtCl₆] = 5.0×10^{-5} M in water at 40 °C for 1 day.

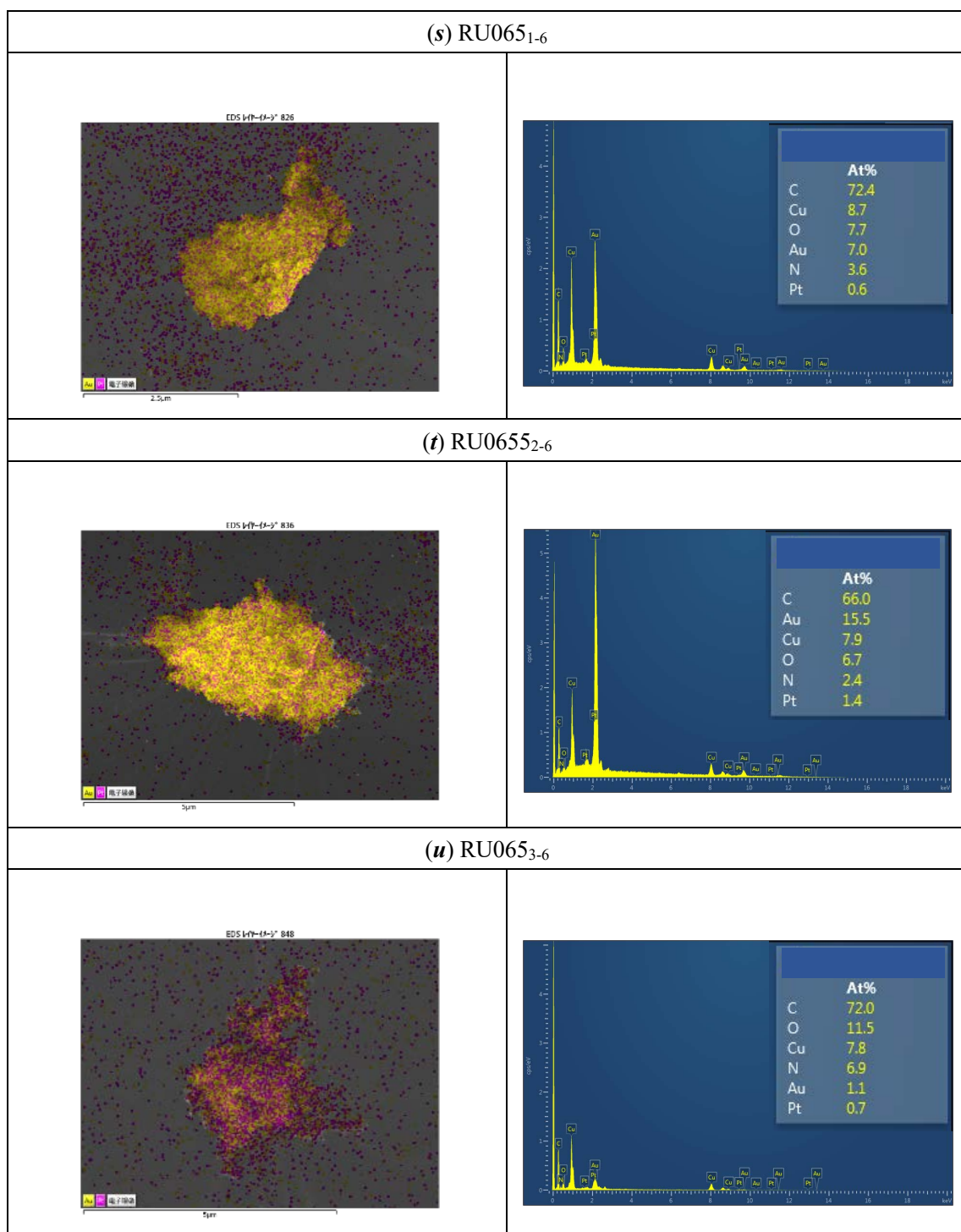


Figure S4 (continued). EDS-FESEM analysis of the precipitates from the reaction mixtures of HAuCl₄, H₂PtCl₆, and RU065 (or its fragment peptide). Au and Pt distributions are colored in yellow and purple, respectively. [Peptide] = 2.0×10^{-4} M and [HAuCl₄] = [H₂PtCl₆] = 5.0×10^{-5} M in water at 40 °C for 1 day.

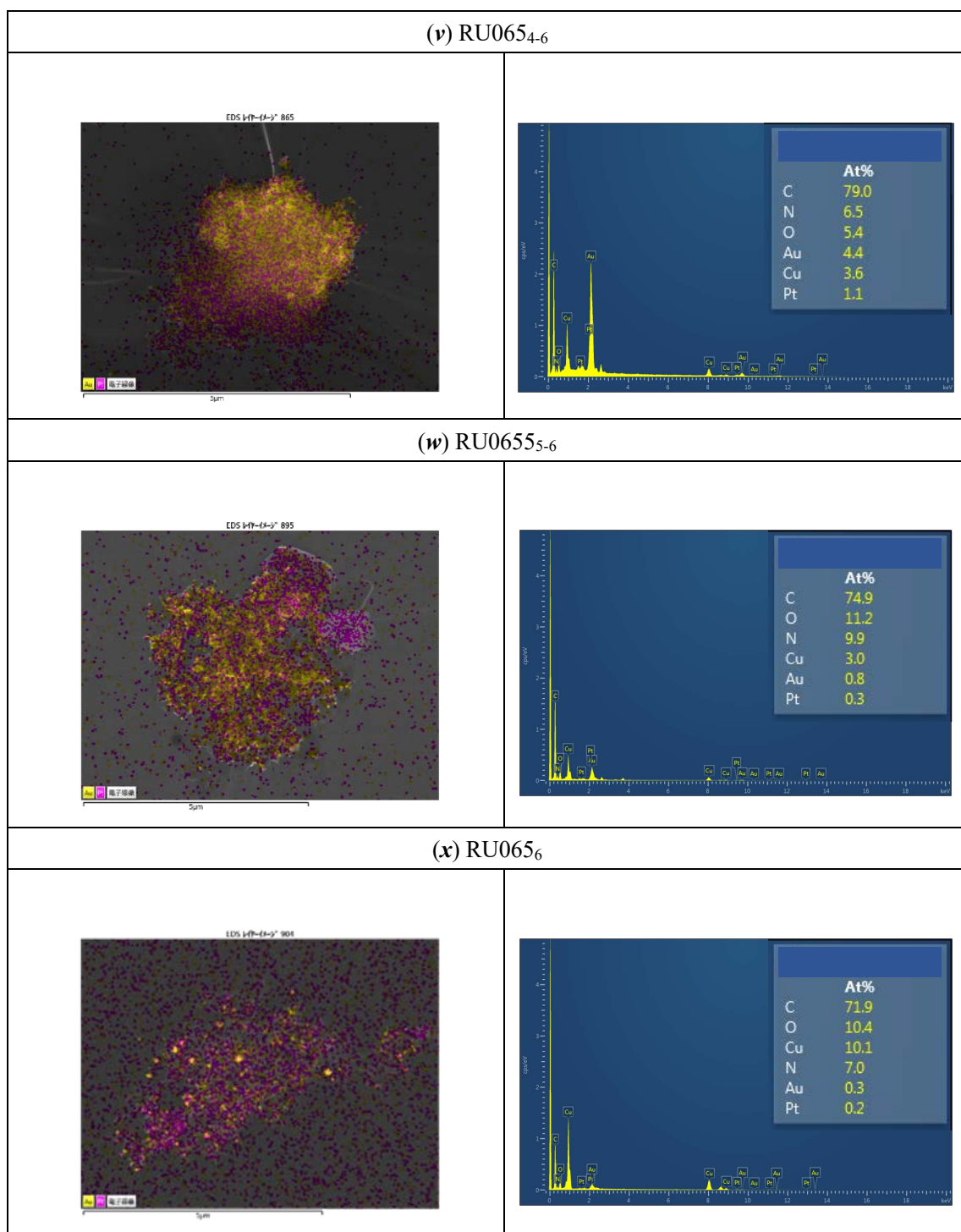


Figure S4 (continued). EDS-FESEM analysis of the precipitates from the reaction mixtures of HAuCl_4 , H_2PtCl_6 , and RU065 (or its fragment peptide). Au and Pt distributions are colored in yellow and purple, respectively. $[\text{Peptide}] = 2.0 \times 10^{-4} \text{ M}$ and $[\text{HAuCl}_4] = [\text{H}_2\text{PtCl}_6] = 5.0 \times 10^{-5} \text{ M}$ in water at 40°C for 1 day.

Table S2. Summary of HPLC retention time and relative hydrophobic index (*H*) data for RU065 and its fragment peptides.

	Peptide	Retention time / min	Relative hydrophobic index (<i>H</i>)
(a)	RU065	15.15	+1.48
(b)	RU065 ₂₋₉	15.06	+1.24
(c)	RU065 ₃₋₉	13.60	-2.39
(d)	RU065 ₄₋₉	13.57	-2.44
(e)	RU065 ₅₋₉	14.99	+1.06
(f)	RU065 ₆₋₉	15.37	+2.01
(g)	RU065 ₁₋₈	15.20	+1.59
(h)	RU065 ₂₋₈	15.18	+1.55
(i)	RU065 ₃₋₈	13.80	-1.87
(j)	RU065 ₄₋₈	13.80	-1.89
(k)	RU065 ₅₋₈	15.24	+1.69
(l)	RU065 ₆₋₈	15.57	+2.50
(m)	RU065 ₁₋₇	15.50	+2.34
(n)	RU065 ₂₋₇	14.16	-0.98
(o)	RU065 ₃₋₇	12.57	-4.93
(p)	RU065 ₄₋₇ ^a	12.54	-5.00
(q)	RU065 ₅₋₇	13.84	-1.78
(r)	RU065 ₆₋₇	14.10	-1.14
(s)	RU065 ₁₋₆	15.53	+2.42
(t)	RU065 ₂₋₆	15.53	+2.41
(u)	RU065 ₃₋₆	13.91	-1.60
(v)	RU065 ₄₋₆	13.86	-1.72
(w)	RU065 ₅₋₆	15.57	+2.52
(x)	RU065 ₆ ^b	16.57	+5.00

^aThe most hydrophilic peptide had the most negative *H* value of -5.00.

^bThe most hydrophobic peptide had the most positive *H* value of +5.00.