

## **Supporting information for**

### **Rapid and simultaneous detection of N and S in seafood using solid sampling pyrolysis**

#### **adsorption-desorption thermal conductivity method**

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**Table S1.** Results of N recovery rate in live Fenneropenaeus chinensis flesh

sample number	Content of N (g/100g)	Average Content of N (g/100g)	Spiked content (g/100g)	detection result (g/100g)	recovery rate (%)
1	3.20	3.21	4.83	4.72	97.72
2	3.22		4.83	4.71	97.52
3	3.22		4.83	4.70	97.31
4	3.21		6.45	6.46	100.2
5	3.22		6.45	6.37	98.76
6	3.20		6.45	6.38	98.91

**Table S2.** Results of S recovery rate in live Fenneropenaeus chinensis flesh

sample number	Content of S (g/100g)	Average Content of S (g/100g)	Spiked content (g/100g)	detection result (g/100g)	recovery rate (%)
1	0.0074	0.0070	0.163	0.172	105.5
2	0.0071		0.163	0.158	96.93
3	0.0068		0.163	0.170	104.3
4	0.0066		0.319	0.326	102.2
5	0.0069		0.319	0.335	105.0
6	0.0073		0.319	0.316	99.06

**Table S3.** Results of recovery rate of N content in ground fish powder

sample number	Content of N (g/100g)	Average Content of N (g/100g)	Spiked content (g/100g)	detection result (g/100g)	recovery rate (%)
1	5.01	5.02	7.51	7.18	95.61
2	5.00		7.51	7.16	95.34
3	5.02		7.51	7.20	95.87
4	5.02		10.01	10.10	100.9
5	5.04		10.01	10.14	101.3
6	5.03		10.01	10.12	101.1

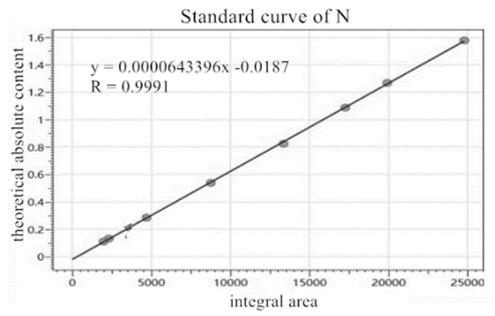
**Table S4.** Results of recovery rate of S content in ground fish powder

sample number	Content of S (g/100g)	Average Content of S (g/100g)	Spiked content (g/100g)	detection result (g/100g)	recovery rate (%)
1	0.0417	0.041	0.323	0.298	92.26
2	0.0406		0.323	0.323	100.0
3	0.0411		0.323	0.318	98.45
4	0.0412		0.605	0.606	100.2
5	0.0414		0.605	0.574	94.88
6	0.0405		0.605	0.595	98.35

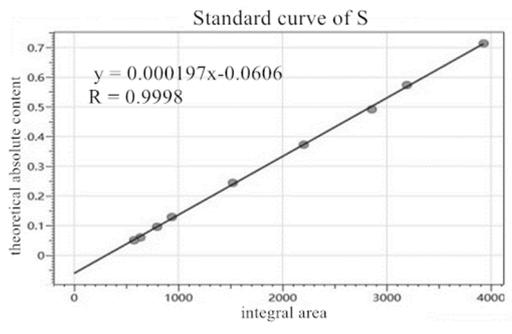
**Table S5.** Comparison between this method and national standard methods for N and S content detection in many seafood species (n =30)

Sample	This method		GB 5009.5-2016	GB 5009.34-2016
	Content of N (%)	Content of S (g/kg)	Content of N (%)	Content of S (g/kg)
Sea cucumber	<b>6.86</b>	<b>&lt;0.01</b>	<b>6.88</b>	<b>&lt;0.01</b>
Dried shrimps	<b>6.36</b>	<b>0.02</b>	<b>6.33</b>	<b>0.02</b>
Grilled shredded squid	<b>4.91</b>	<b>&lt;0.01</b>	<b>4.94</b>	<b>&lt;0.01</b>
Grilled sea fish fillet	<b>6.55</b>	<b>&lt;0.01</b>	<b>6.51</b>	<b>&lt;0.01</b>
Roast cod fillets	<b>5.65</b>	<b>0.04</b>	<b>5.67</b>	<b>0.04</b>
Scallops	<b>6.72</b>	<b>ND</b>	<b>6.76</b>	<b>ND</b>
Roasted shrimp	<b>8.93</b>	<b>0.18</b>	<b>8.91</b>	<b>0.16</b>
Dried silver carp	<b>6.16</b>	<b>&lt;0.01</b>	<b>6.18</b>	<b>&lt;0.01</b>
Grilled fish slices	<b>5.04</b>	<b>0.04</b>	<b>5.02</b>	<b>0.03</b>
Japanese sea cucumber	<b>5.85</b>	<b>&lt;0.01</b>	<b>5.88</b>	<b>&lt;0.01</b>
Dalian sea cucumber	<b>7.42</b>	<b>&lt;0.01</b>	<b>7.45</b>	<b>&lt;0.01</b>
shrimp skin	<b>7.39</b>	<b>ND</b>	<b>7.28</b>	<b>ND</b>

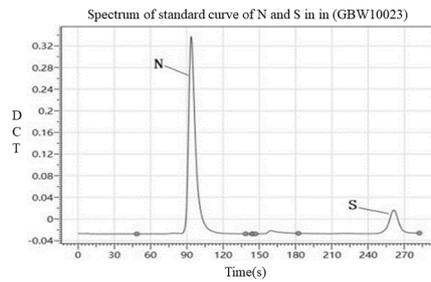
Sample	This method		GB 5009.5-2016	GB 5009.34-2016
	Content of N (%)	Content of S (g/kg)	Content of N (%)	Content of S (g/kg)
shrimp skin	<b>6.30</b>	<b>ND</b>	<b>6.36</b>	<b>ND</b>
hrimp skin	<b>6.82</b>	<b>ND</b>	<b>6.85</b>	<b>ND</b>
squid silk	4.29	<b>ND</b>	4.26	<b>ND</b>
grilled cod roe	5.17	<b>ND</b>	5.19	<b>ND</b>
squid litter	5.20	<b>ND</b>	5.24	<b>ND</b>
grilled Hippo fish	6.09	<b>ND</b>	6.05	<b>ND</b>
dried yellow croaker	8.38	<b>ND</b>	8.32	<b>ND</b>
Moringa fish	6.06	0.015	6.02	0.012
scallop drying	7.26	0.016	7.22	0.012
sea M	9.31	<0.01	9.36	<0.01
hemizygous fish	6.69	0.018	6.65	0.015
shrimp skin	4.59	0.069	4.47	0.066
smoked Spanish fish	4.71	<b>ND</b>	4.77	<b>ND</b>
dried pompano	5.90	0.014	5.94	0.012
fishstem	5.68	0.018	5.65	0.016
shortening crab	4.26	0.022	4.22	0.024
clam stem	5.91	0.021	5.87	0.018
eel trunk	6.02	0.014	6.04	0.013
Octopus trunk	4.18	<0.01	4.24	<0.01
dried carrier fish	5.07	<0.01	5.02	<0.01
tap fish dry	5.84	<0.01	5.81	<0.01
sea M	9.12	<0.01	9.14	<0.01
<b>Turbot</b>	<b>2.65</b>	/	<b>2.69</b>	/
<b>Snakehead</b>	<b>3.62</b>	/	<b>3.65</b>	/
<b>Mandarin fish</b>	<b>3.11</b>	/	<b>3.12</b>	/



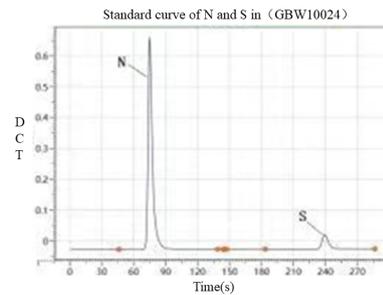
**Figure S1.** Standard curve of N ranging from 2.24mg to 31.61mg. A group of nori CRM (GBW10023) ( $5.0 \pm 0.3\%$ ) were measured under  $900^{\circ}\text{C}$  pyrolysis temperature, and other parameters are performed according to Table 1.



**Figure S2.** Standard curve of S ranging from 2.24mg to 31.61mg. A group of nori CRM (GBW10023) ( $2.26 \pm 0.14\%$ ) were measured under  $900^{\circ}\text{C}$  pyrolysis temperature, and other parameters are performed according to Table 1.

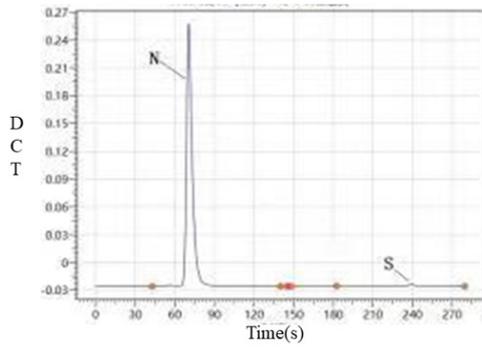


**Figure S3.** Spectrum of N and S in a nori CRM sample (GBW10023)

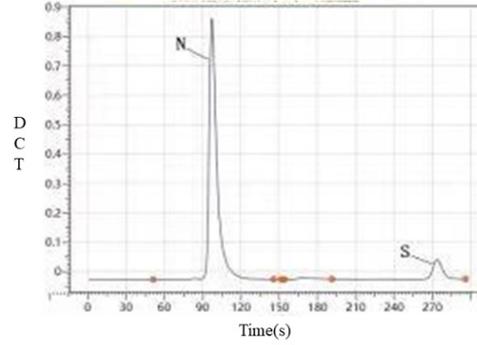


**Figure S4.** Spectrum of N and S in Standard substance Pectinidae (GBW10024)

a. Spectrum of standard curve of N and S in *Fenneropenaeus chinensis* (GBW10050) without standard addition

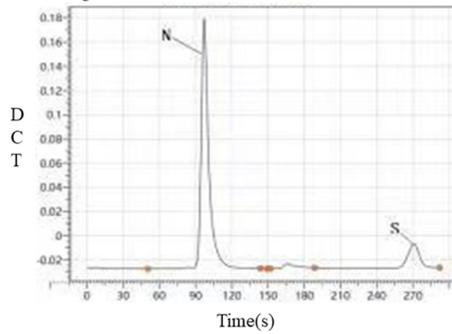


b. Spectrum of standard curve of N and S in *Fenneropenaeus chinensis* (GBW10050) with standard addition

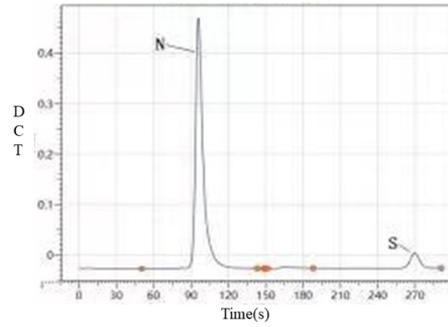


**Figure S5.** Spectrum of N and S of *Fenneropenaeus chinensis* (GBW10050). a: Spectrum of N and S of *Fenneropenaeus chinensis* (GBW10050) without standard addition; b: Spectrum of N and S of *Fenneropenaeus chinensis* (GBW10050) with standard addition.

a. Spectrum of standard curve of N and S grilled fish flakes without standard addition



b. Spectrum of standard curve of N and S grilled fish flakes with standard addition



**Figure S6.** Spectrum of N and S in grilled fish flakes. a: Spectrum of N and S in grilled fish flakes without standard addition; b: Spectrum of N and S in spiked grilled fish flakes with standard addition.