

Supplementary Materials

A Newly Designed Sticker-Plastic Sheet Platform and Smartphone-Based Digital Imaging for Protein Assay in Food Samples with Downscaling Kjeldahl Digestion

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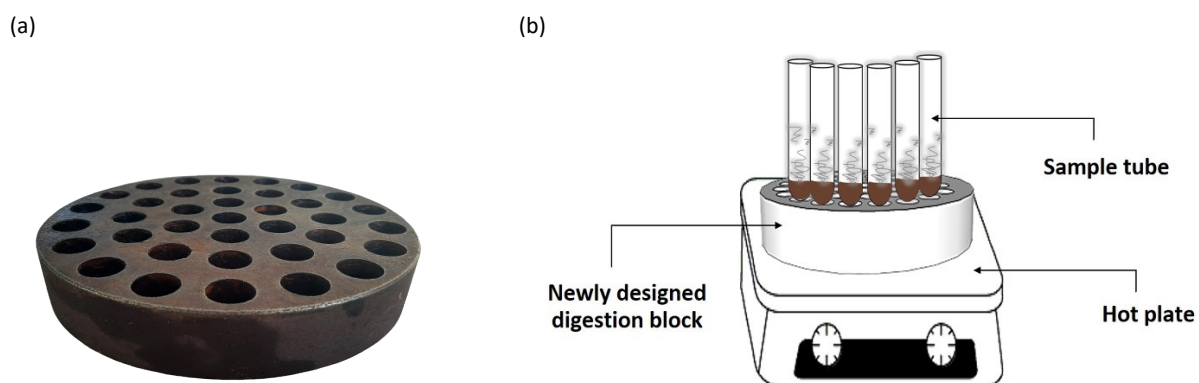


Fig. S1 (a) The newly designed digestion block and (b) its position on the hot plate for the digestion.

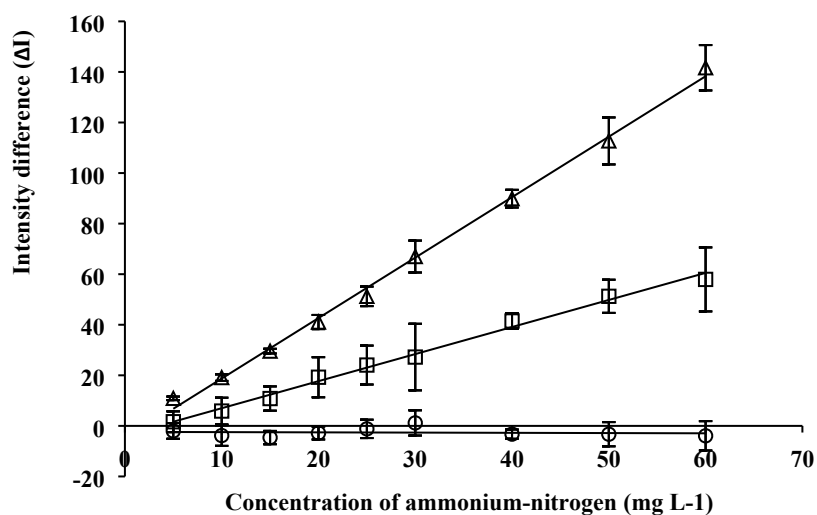


Fig. S2 The RGB intensity difference (ΔI) of the reaction zone for the determination and of ammonium-nitrogen 5 – 60 mg L^{-1} ; red intensity (\circ), green intensity (\square), blue intensity (Δ).

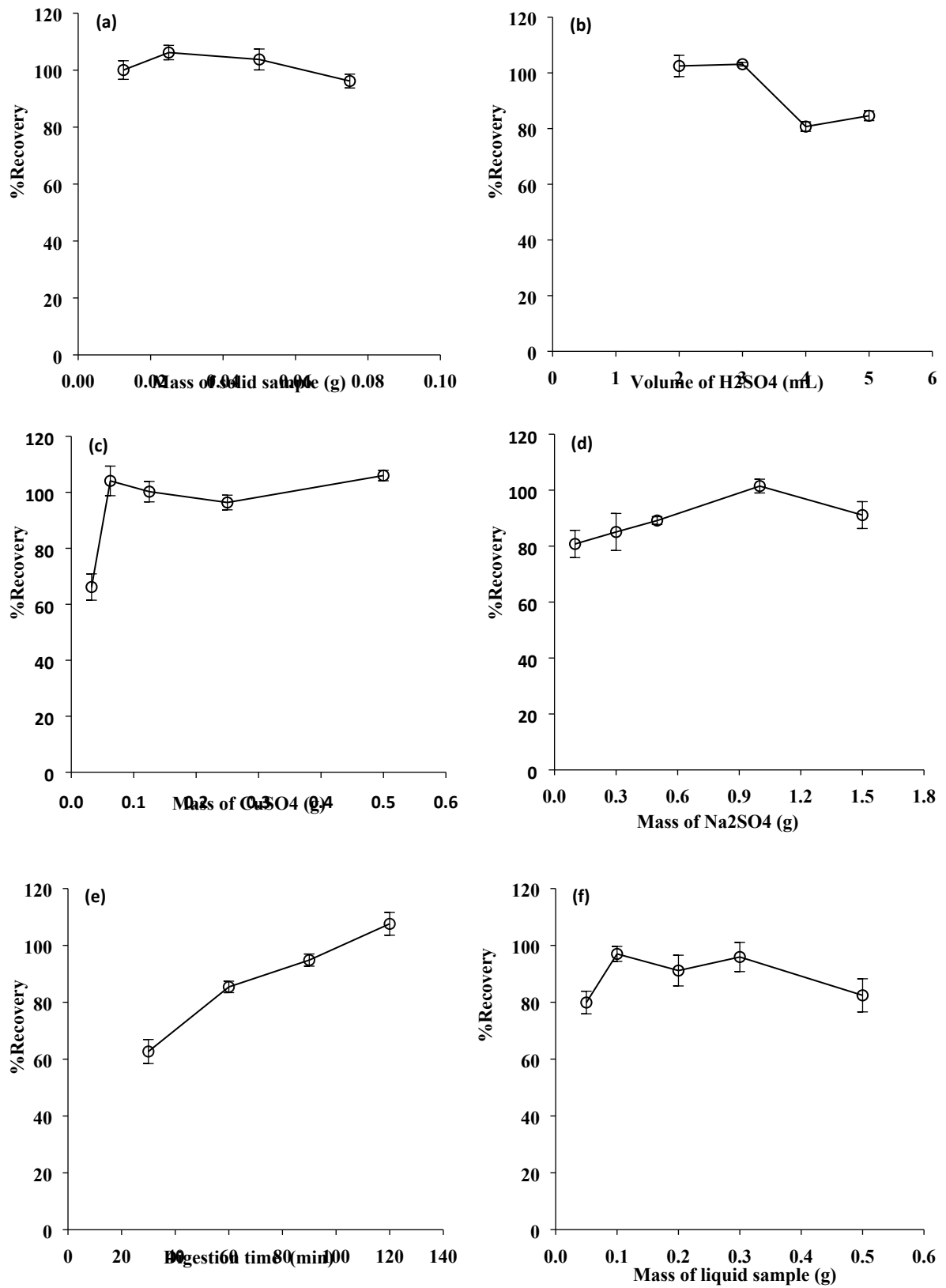


Fig. S3 Optimization of down scaled Kjeldahl digestion for sample preparation (a) mass of solid sample, (b) volume of H₂SO₄, (c) mass of CuSO₄, (d) mass of Na₂SO₄, (e) digestion time and (f) mass of liquid sample.

Table S1 Literature reports for the determination of protein in food samples

Sample treatment	Detection method	Detection device/reagent	Sample	Concentrated acid (mL)	Linear range (mg L ⁻¹ N)	Limit of detection (mg L ⁻¹ N)	Precision (%RSD)	References
Kjeldahl digestion	Kjeldahl	Distillation of ammonia and titrimetric	Soy sauce	10 mL H ₂ SO ₄	-	-	0.4-1.9	16
Kjeldahl digestion	FI-conductometric system	Conductometric flow through cell	Milk and chicken meat	7 mL H ₂ SO ₄	10-100	1	0.3	17
Kjeldahl digestion	Digital Image-based Colorimetry	Colorimetric/ biuret reagent	Rice	-	5 - 13 g/100g	-	-	18
Down scaled Kjeldahl digestion	FI-conductometric system	Conductometric flow through cell	Northern Thai foods	3 mL H ₂ SO ₄	4-100	0.05	0.04	9
Microwave/ultrasound assisted digestion	Spectrophotometry	Spectrophotometer/ Nessler reagent	Rice, polenta, oat and flour	10 mL H ₂ SO ₄ and 5 mL H ₂ O ₂	-	-	0.5–6	10
Ultrasound assisted digestion	Spectrophotometry	Spectrophotometer/ Biuret reagent	Maize seeds	-	0-4 mg/mL zein	-	-	11
Precipitation by the salting-out effect	Digital Image-based Colorimetry	Photometric	Milk	-	0.36 - 3.6% (w/v)	0.03% (w/v)	3.0	12
Precipitation	Spectrophotometry (Lowry)	Spectrophotometer/ Lowry reagent	Milk or whey protein	-	10-200	8.78	-	13
Extraction with chloroform and methanol	Spectrophotometry (Bradford)	Spectrophotometer/ Bradford reagent	Cow milk powder	-	1-5	-	1.08	14
Extraction with phosphate-buffered saline with 0.05% Tween	Spectrophotometry (Bicinchoninic)	Spectrophotometer/ Bicinchoninic reagent	Soy and Peanut Oils	-	2-40	-	2.48	15
Down scaled Kjeldahl digestion	Digital Image-based Colorimetry	Miniaturized 96 well sticker-plastic sheet/Nessler reagent	Soyfoods, protein-based foods	3 mL H ₂ SO ₄	5-60	2.76	6.7	This work

