15th International Seaweed Conference EU
Seagriculture
16 - 18 JUNE 2026
GOTHENBURG, SWEDEN

Rapid real time spectroscopic methods for quality control of seaweed

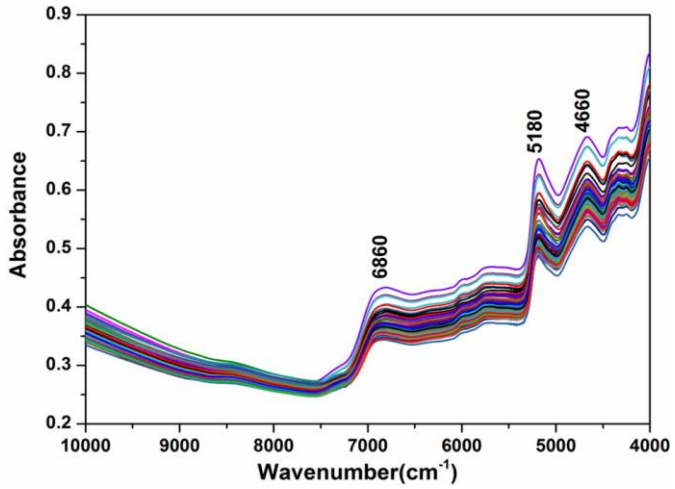
Dr. Anna Þóra Hrólfsdóttir
Project manager, Matís
annath@matis.is

Seaweed quality control

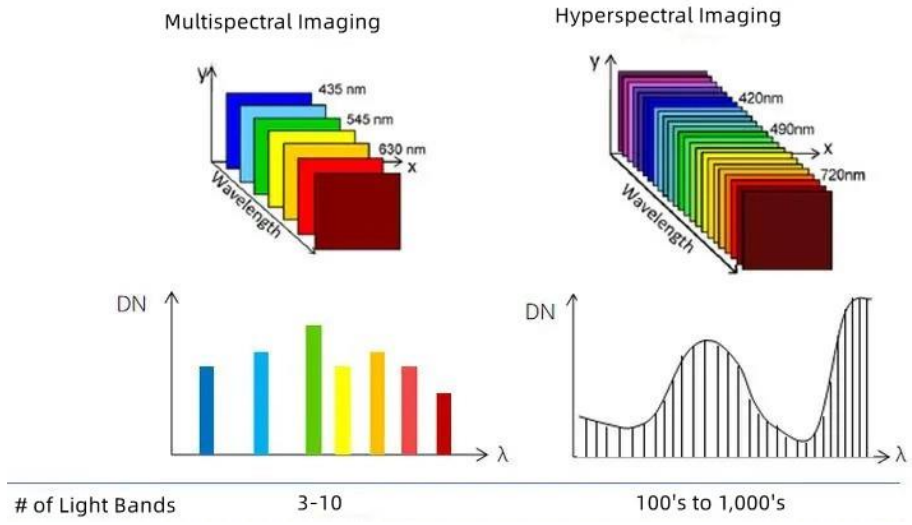
- Main methods used in quality control today include:
  - Chemical analysis
  - Visual inspection
- Traditional chemical analyses are:
  - Expensive
  - Time-consuming
  - Destroy the analysed sample

➢**Need for rapid non-destructive quality control**

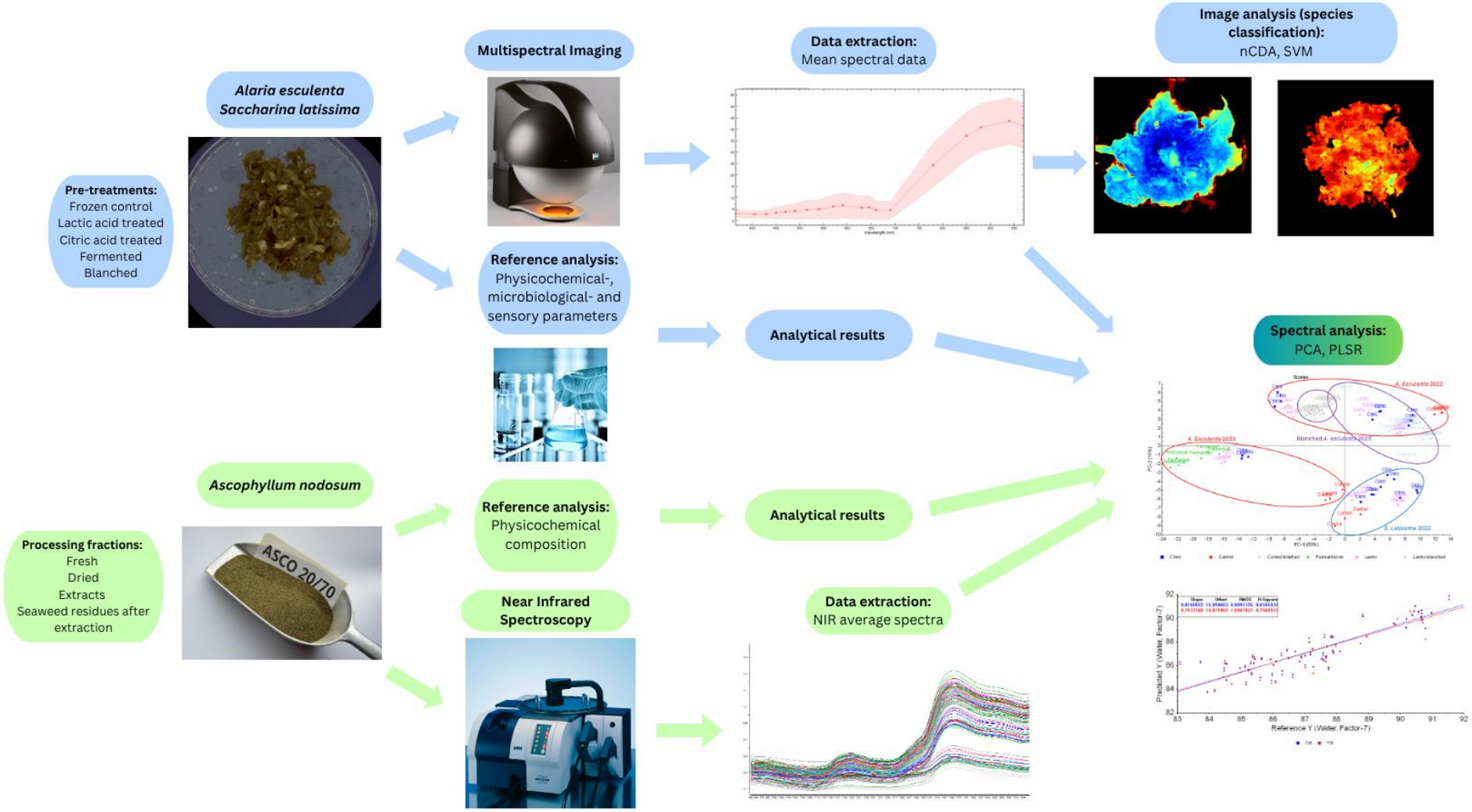
Near-infrared spectroscopy (NIR)



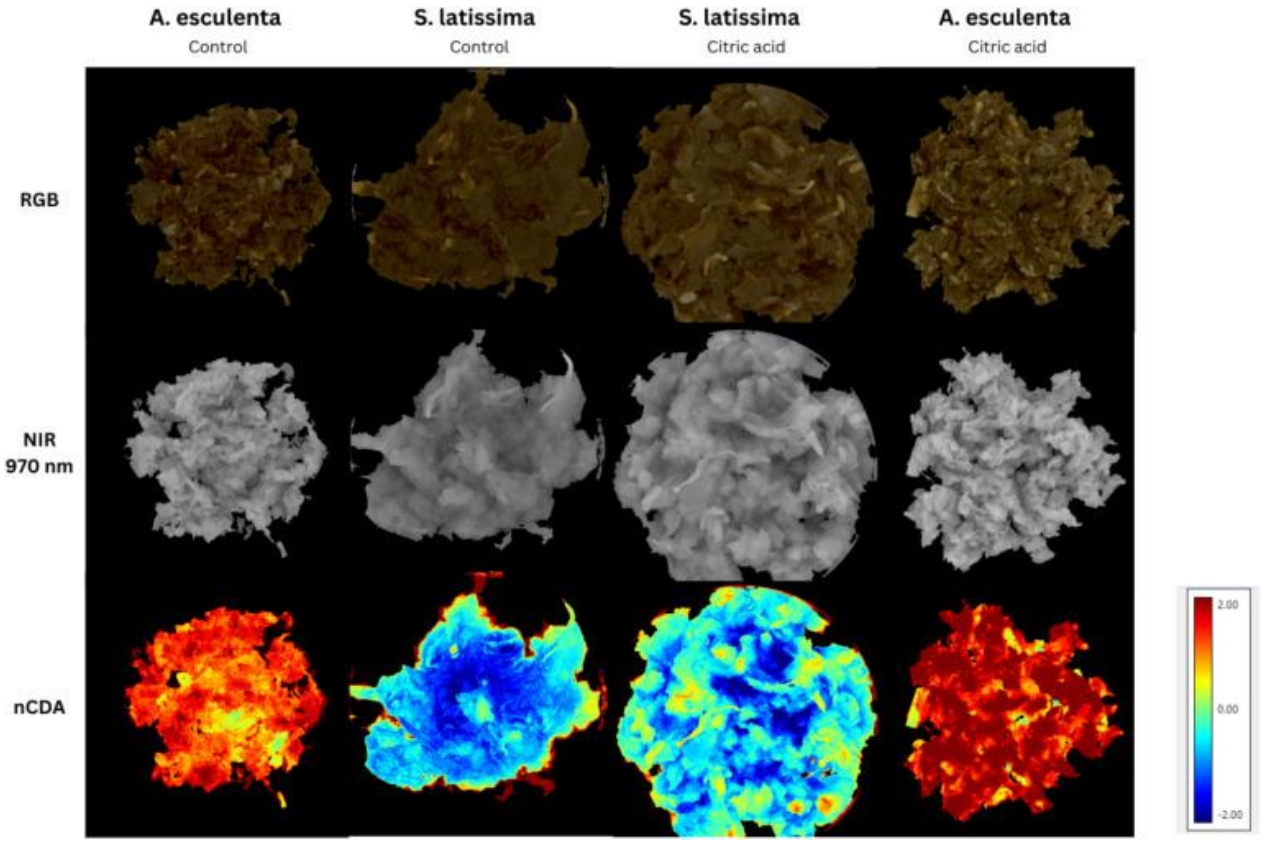
Spectral imaging (MSI/HSI)

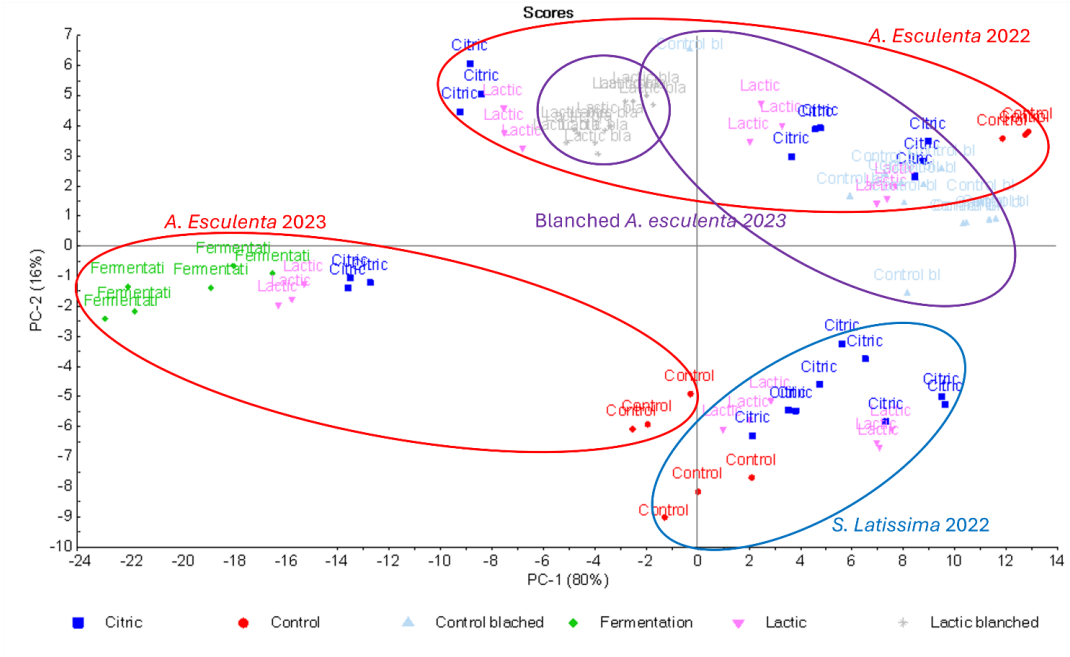


Experimental design



Results Multispectral imaging
- Species recognition and PCA -





PLSR models – Multispectral imaging

	Calibration		Validation				
Parameter analyzed	R_C^2	RMSEC	R_{CV}^2	RMSECV	Range	Sample size	Number of factors
Proximate composition – direct correlations							
Water (g/100 g sample)	0.82	0.90	0.76	1.05	83.0-91.5	78	7
Lipids (g/100 g sample)	0.34	0.08	0.18	0.09	0.0-0.5	54	4
Carbohydrates (g/100 g sample)	0.91	0.66	0.89	0.76	3.0-10.9	54	6
Protein (g/100 g sample)	0.95	0.10	0.94	0.12	0.6-2.2	54	4
Salt (g/100 g sample)	0.91	0.33	0.86	0.41	0.1-3.1	54	7
Ash (g/100 g sample)	0.88	0.39	0.80	0.51	1.6-4.4	54	7
Minerals and heavy metals –indirect correlations							
Iodine (µg/g sample)	0.89	31	0.83	39	60-420	39	6
Arsenic (mg/kg sample)	0.87	0.95	0.75	1.33	3.4-10.2	39	6
Cadmium (mg/kg sample)	0.82	0.02	0.73	0.03	0.1-0.3	39	7
Lead (mg/kg sample)	0.86	0.003	0.82	0.004	0.01-0.05	39	5
TVB-N (mg N/100 g sample)	0.55	2.46	0.40	2.92	0.5-15.9	54	4
Colour -Non-linear parameters							
L-value	0.70	3.00	0.65	3.32	16.8-45	78	5
a^*-value	0.93	0.67	0.91	0.79	-6.3-4.6	78	6
b^*-value	0.65	3.32	0.53	3.97	2.9-33	78	7
Water activity (A_w)	0.41	0.00	0.25	0.00	0.98-1	54	6
Acid addition							
pH	0.96	0.25	0.94	0.28	3.0-6.7	78	6
Bioactivity - Indirect correlations							
TPC (g PGE/100 g extract)	0.94	0.20	0.92	0.24	0.4-3.2	39	4
DPPH (IC50)	0.92	0.75	0.91	0.81	0.3-8.2	39	2
ORAC (µmol TE/g extract)	0.93	9.73	0.89	11.70	10-113	39	5
Total viable count (TVC) (log cfu/g sample)	0.72	0.79	0.67	0.93	1.8-6.2	48	4

PLSR models – Near infrared spectroscopy

		Calibration		Validation		
	Parameter analysed	R_C^2	RMSEC	R_{CV}^2	RMSECV	Range
Proximate composition – direct correlations	Water (g/100 g sample)	0.92	0.64	0.90	0.69	2-17%
	Protein (g/100 g sample)	0.83	0.21	0.80	0.34	0,1-2%
	Ash (g/100 g sample)	0.91	0.58	0.89	0.66	0,5-7%
	Salt (g/100 g sample)	0.27	0.25	0.11	0.28	0,4-1,4%
	Carbohydrates (g/100 g sample)	0.68	3.41	0.48	4.13	18-44%
Carbohydrate composition direct correlations	Alginate g/100g DM	0.96	1.34	0.93	2.19	0,5-20,5 g/100 g DM
	Glucuronic acid g/100g DM	0.91	0.54	0.88	0.70	0,5-6,5 g/100 g DM
	Mannuronic acid g/100g DM	0.94	0.99	0.90	1.41	0,5-14,0 g/100 g DM
	Mannitol g/100g DM	0.92	1.50	0.89	1.93	2-19 g/100 g DM
	Fucose g/100g DM	0.93	0.68	0.89	0.90	0,5-9 g/100 g DM
	Glucose g/100g DM	0.80	0.81	0.79	0.88	3,5-10,5 g/100 g DM
	Xylose g/100g DM	0.91	0.23	0.86	0.31	0,2-2,9 g/100 g DM
Bioactivity - Indirect correlations	Total phenolic content (TPC)	0.66	1.93	0.61	2.21	7,5-19
	Oxygen radical absorbance capacity (ORAC)	0.90	112.5	0.57	248.29	750-2300
	DPPH radical scavenging activity	0.77	1.55	0.52	2.40	80-94

Acknowledgements

Technology Development Fund

Blue BIO COFUND

Matvælasjóður

matís

matís

vito

Anteo

Seaweed Solutions

SINTEF

TALLINN UNIVERSITY

nutrition sciences

ÞÖRUNGAVERKSMIÐJAN HF.

Algalcloister

ora

matís

ELSEVIER

Algal Research
Volume 88, June 2025, 104009

Multispectral imaging techniques for evaluating physicochemical-, antioxidant, and sensory properties of *Alaria esculenta* and *Saccharina latissima*

Anna Þóra Hrólfsdóttir [a b 1], Andrea Rakel Sigurðardóttir [a 1], Hildur Inga Sveinsdóttir [a b], Sigurjón Arason [a b], Nette Schultz [c], Hafsteinn Einarsson [d], María Gudjónsdóttir [a b]

Anna Þóra Hrólfsdóttir, Project Manager
annath@matis.is