



A standard method to compare the functionality of food ingredients is needed

Authors: Floor Schreuders, Klaas-Jan Zuidam
Unilever, Wageningen, The Netherlands

Problem

When designing food products, knowledge about the functional properties of ingredients is essential. Solubility, but also other functional properties like emulsification, gelling, foaming, and viscosity, are important when producing food products like a meat analogue, beverage, or mayonnaise. However, there is a great variation in solubility methods used (Table 1), making comparison of solubility results among reports or suppliers impossible. Thus, it is difficult for companies (end users) to compare different protein/ingredient sources based on functionality since there is no standard test used in peer-reviewed articles and specification sheets.

Table 1. Procedural comparison of four protein quality indexes: nitrogen solubility index, protein dispersibility index, protein solubility in 0.2% KOH, and protein solubility index Liu, K. (2022).

Quality parameter Abbreviation	Nitrogen solubility index NSI ^a	Protein dispersibility index PDI ^b	Protein solubility in 0.2% KOH PS-KOH ^c	Protein solubility index PSI
Sample preparation	Grind to pass U.S. No. 100 (0.15 mm) mesh	As received, no requirement	Grind to pass 0.5 mm screen	Grind to pass 0.3 mm (U.S. No. 50) mesh
Sample mass	5 g	20 g	1.5 g	0.8 g
Solvent (extractant)	Water	Water	0.2% (35.7 mM) KOH, pH 12.5	5 mM NaOH
Solvent volume	200 ml initially, then to 250 ml	300 ml	75 ml	40 ml
Solid to solvent ratio (g:ml)	1:40 for extraction and 1:50 (final)	1:15	1:50	1:50
Container for extraction	500 ml beaker	Blender cup and 600 ml beaker	Unspecified	50 ml centrifuge tube, 12.7 × 7.9 mm (L × D) bar
Extraction equipment	Mechanical stirrer, 50 mm blade	Specified blender and blade kit	Magnetic stirring plate	Multi-position magnetic induction stirrer ^d
Extraction temperature	30°C	Room temperature (25°C)	Room temperature (25°C)	Room temperature (25°C)
Mixing speed and time	120 rpm and 2 h	8500 rpm and 10 min	Unspecified rpm and 20 min	750 rpm and 1 h
Material for centrifugation	40 ml top layer	50 ml top layer	The whole mixture (slurry)	The whole mixture (slurry)
Centrifugation parameters	1500 RPM, 10 min	2700 RPM, 10 min	2700 RPM for 15 min	2000 × g, 10 min
Treatment before N analysis	Filter extracts through glassfiber	No treatment	Filter extracts through glassfiber	Dry residues (100°C for 4 h)
Material used for N analysis	25 ml filtered extract	15 ml extract	15 ml filtered extract	0.10-0.15 g dried residue (precipitate)
N analysis method	Kjeldahl	Kjeldahl	Kjeldahl	Dumas (combustion)
Calculation of N in extracts	Direct	Direct	Direct	Indirect (by difference)
N to protein conversion factor	Not required	Required	Required	Not required

^aFrom AOCS (2017a).

^bFrom AOCS (2017b).

^cFrom Araba and Dale (1990).

^dAlthough a multi-position magnetic induction stirrer is preferred, other magnetic stirrers can also be used.



Solution

To better compare the functionality of ingredients, a standardized test per parameter of interest needs to be designed, used, and reported in specification sheets and peer-reviewed articles and thus eliminate the need for multiple procedures and terminologies which can be confusing.

Benefits

- More transparency
- Better for companies (end users) to compare different ingredients for their functionality.
- Companies (ingredients) can design ingredients based on functionality to be used in food products.

Application box

- o Application example: i.e. Plant-based mayonnaise
- o Functionality: i.e. Solubility = high
- o Plant-based ingredients: i.e. Soy/pea protein isolate, concentrate, or flour.
- o Specification sheet: Results of composition and functional properties. Each functionality is analyzed with one standard/uniform test, i.e. official method for measuring NSI (AOCS, 2017).

Practical recommendations

- Avoid the use of multiple methods to analyse the same functional property.
- Establish one method (standard operating procedure) per parameter for measuring functional properties, i.e. official method for measuring NSI (AOCS, 2017).

Further information

Further readings

- AOCS. (2017). Nitrogen solubility index (NSI). Method Ba 11-65. Official methods and recommended practices of the AOCS, American Oil Chemists' Society.
- Liu, K. (2022). A new method for determining protein solubility index (PSI) based on extraction with 5 mM alkali hydroxide and its correlation with trypsin inhibitor activity in soybean products. Journal of the American Oil Chemists' Society, 99(10), 855-871.

About this practice abstract and GIANT LEAPS

This practice abstract was developed in GIANT LEAPS project based on the EIP AGRI abstract format.



GIANT LEAPS is a project that has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No 101059632

Project website: www.giant-leaps.eu

