

Safety assessment of the proteins extracted from legume by-products

Hitika Shah, Lubna Ahmed, and Catherine Barry-Ryan
Technological University Dublin, Grangegorman-City Campus, Dublin, Ireland
Email: hitika.shah@tudublin.ie

INTRODUCTION

The EU is 95% dependent on imported soy or cereals to meet the current protein demands. However, these current sources of proteins are becoming unsustainable from an economic as well as an environmental point of view. Biorefineries for the valorisation of **macroalgal residual biomass** and **legume processing by-products** to obtain new protein value chains for high-value food and feed applications (ALEHOOP) will produce biofunctional proteins from sustainable and under-exploited biomass. This under-exploited biomass does not compete with the traditional food crops for space and resources. ALEHOOP will attempt to reduce the EU's dependency on protein imports and contribute to the raw material security through the **circular bioeconomy**. The project will develop two new ingredients, one based on legumes and the other based on seaweed (macroalgae). The new proteins will be validated in foods for elderly, sporty and overweight people, vegetarians, and healthy consumers as well as for the animal feed.

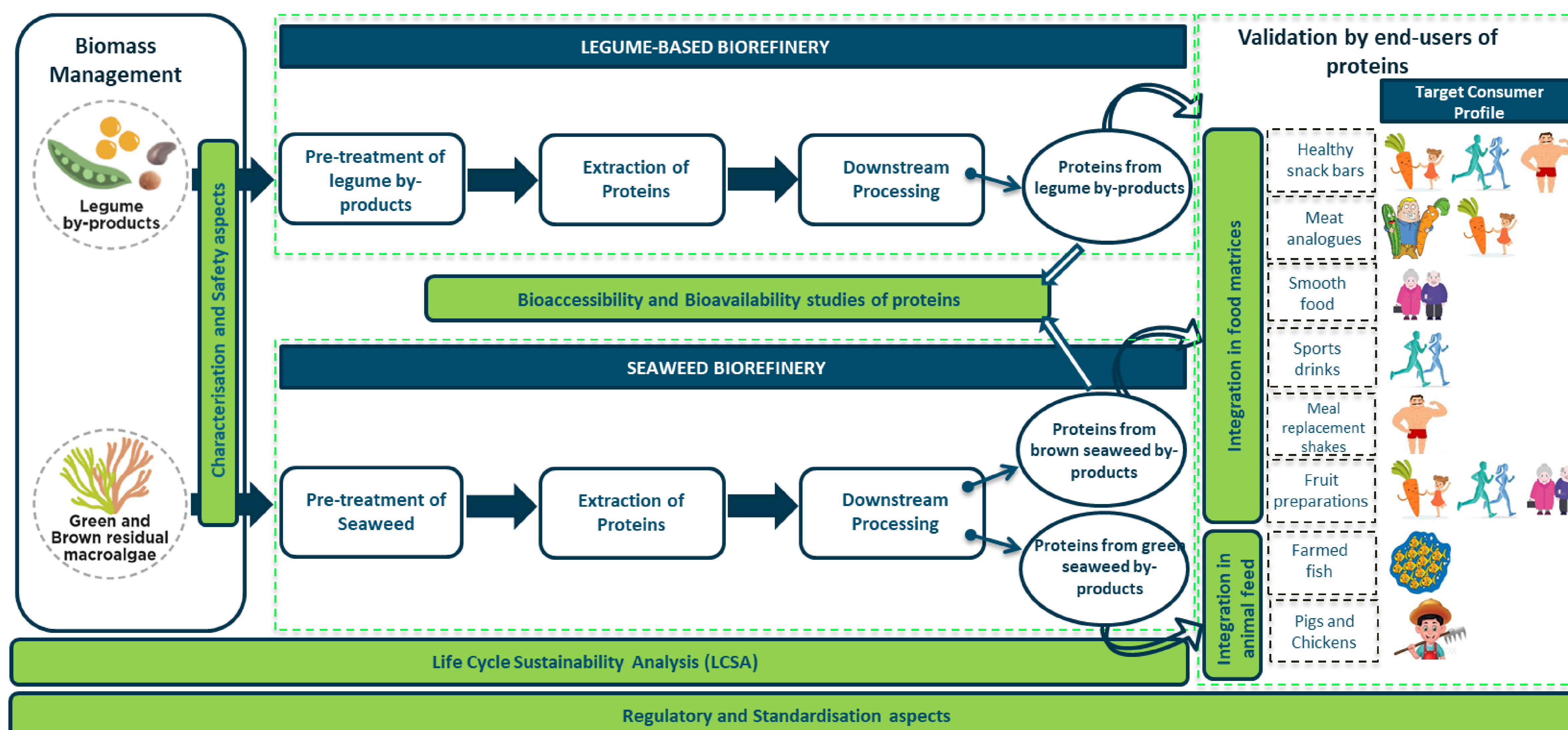


Figure 1: Schematic representation of the ALEHOOP Project

METHODOLOGY

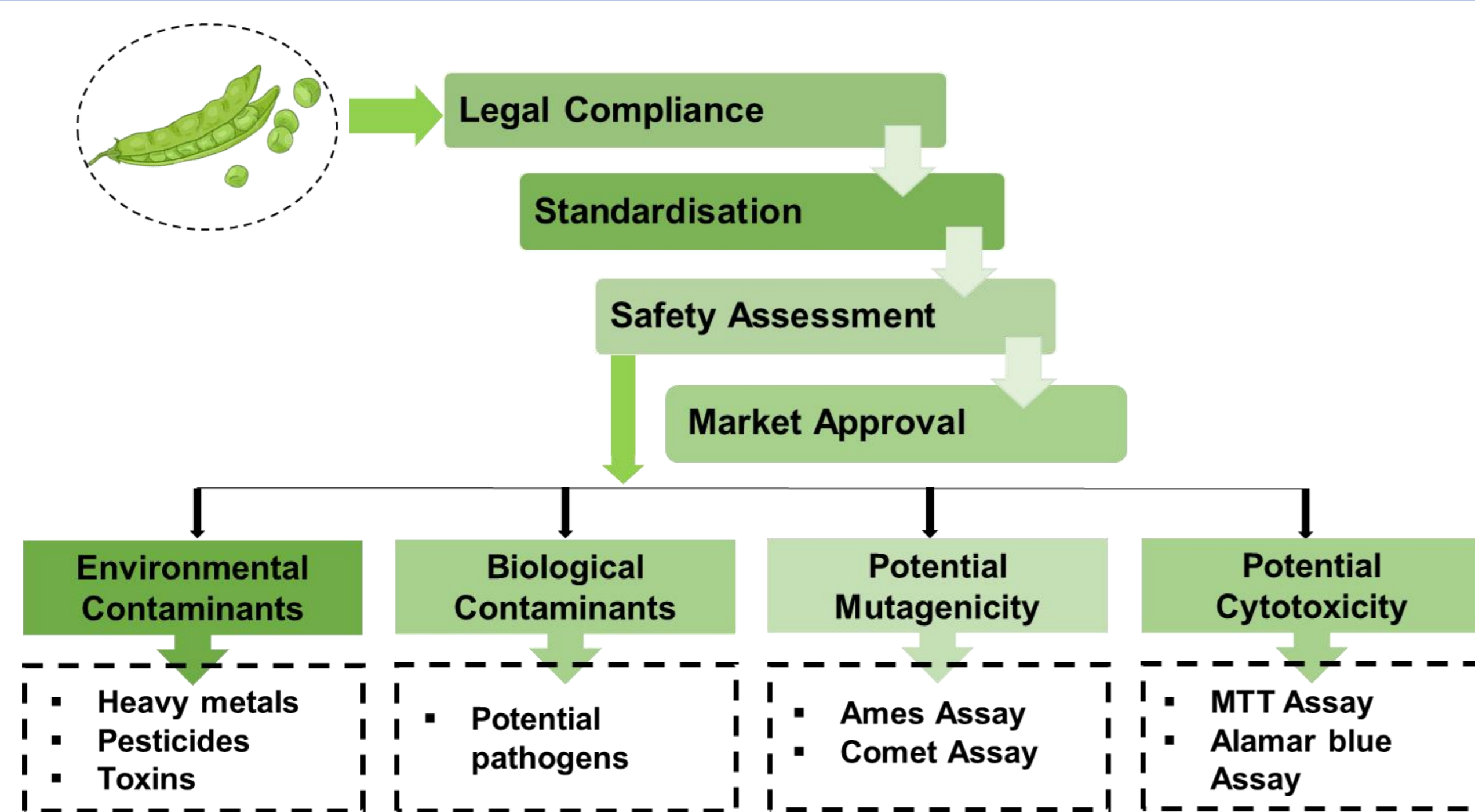


Figure 2: Approaches of safety assessment employed in the ALEHOOP project for the pea by-product extracts

- A detailed inventory of the relevant National and European regulations has been prepared to assess the **legal requirements** from the raw material acquisition, processing, production, and commercialisation.
- The **proximate analysis** of the pea by-product sample was carried out to determine the protein, moisture and ash content.
- Sample has been assessed for **potential pathogens** like *Coliform*, *Salmonella*, *E. coli*, *S. aureus*, Enterobacteriaceae, Yeast and Mould, Anaerobic Thermophiles.
- The presence of **heavy metals** (Cu, Cd, Pb, Hg, As) have been determined by ICP-MS.

RESULTS

Table 1: The legislations applicable to the extracts from pea by-product

1. General Food Safety and Feed Hygiene
2. Ensure the Protection of Animals, Environment and the Human Health
3. Addition of Vitamins and Minerals or Certain Other Substances to Food and Feed
4. Maximum Level of Contaminants in Food and Feedstuff
5. Foodstuffs for Particular Nutritional Uses
6. Labelling, Presentation and Advertising of Foods and Feed
7. Protection of Data
8. Applicable Financial Rules

Table 2: Proximate composition of extracts from pea product

	Batch A	Batch B	Batch C
Moisture Content (% w/w)	3.9 ± 0.1	3.8 ± 0.1	4.4 ± 0.2
Ash Content (% w/w)	2.0 ± 0.1	2.1 ± 0.1	2.2 ± 0.1
Protein Content (%)	86.7 ± 0.2	86.5 ± 0.4	80.5 ± 2.1

Table 3: Limits of the potential pathogens set for the extracts from pea by-product by the ALEHOOP project

Test	Limit
<i>Coliform</i>	<10 cfu/ g
<i>Salmonella</i>	Absent/ 25g
<i>E. coli</i>	Absent/ g
<i>S. aureus</i>	Absent/ g
Enterobacteriaceae	<10 cfu/ g
Yeast and Mould	<10 cfu/ g
Anaerobic Thermophiles	<10 cfu/ g

The pea by-product extracts tested negative for all of the pathogens.

Table 4: Legal limits of the heavy metals that can be found in pea by-products (As per Codex Alimentarius CXS 193-1995; Undesirable content refers to having only food quality significance but no public health significance; PTWI refers to the Provisional Tolerable Daily Intake of the metals expressed per kg body weight (bw))

Conc. (ng/g)	Copper (Cu)	Cadmium (Cd)	Mercury (Hg)	Arsenic (As)	Lead (Pb)
Batch A	6.6 ± 0.2	0.05 ± 0	0.0	0.01 ± 0	0.04 ± 0
Batch B	1.3 ± 0.1	0.04 ± 0	0.0	0.0	0.02 ± 0
Batch C	7.5 ± 1	0.01 ± 0	0.0	0.01 ± 0	0.06 ± 0
Limit (acc. to CODEX)	Undesirable	100 ng/g	4 ug/kg bw (PTWI)	3 ug/kg bw/day (PTWI)	100 ng/g

The concentration of heavy metals in the pea by-product samples by ICP-MS were found to be very low.

CONCLUSIONS

The pea by-product sample was within the limits of safety and non-toxicity for the parameters tested for food additives. The new protein from pea by-product will be validated in food for consumers with different dietary requirements.

ACKNOWLEDGEMENTS

This project has received funding from the Bio Based Industries Joint Undertaking (JU) under grant agreement No. 887259. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio Based Industries Consortium.

REFERENCES

- Voisin, A.-S., Guéguen, J., Huyghe, C., Jeuffroy, M.-H., Magrini, M.-B., Meynard, J.-M., Mougél, C., Pellerin, S., & Pelzer, E. (2014). Legumes for feed, food, biomaterials and bioenergy in Europe: a review. *Agronomy for Sustainable Development*, 34(2), 361–380.
- García-Vaquero, M., & Hayes, M. (2016). Red and green macroalgae for fish and animal feed and human functional food development. *Food Reviews International*, 32(1), 15–45.
- European Commission. (2014). *European Commission Decision of 18 December 2014 Amending Decision 2000/532/EC on the list of Waste Pursuant to Directive 2008/98/EC of the European Parliament*
- ALEHOOP website: <https://alehoop.eu/>