CHARACTERIZATION OF DIFFERENT BY-RPRODUCTS FROM FOOD INDUSTRIES AND ITS POTENTIAL FOR VALORISATION

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Introduction. By-products from different food industries, namely wheat germ and wheat bran (company GÉRMEN); bone, cooked pork blood and hair (CENTRAL CARNES); brewer's spent yeast and grain (UNICER) and fish meal and mammalian meal wastewater (SAVINOR) were collected in 3 consecutive days to evaluate the variability of the by-products in different production days. The aim of this work was the characterization of different by-products and assessment of the potential for further industrial valorisation.

Methods. After collection, the samples were refrigerated until delivery, for a maximum period of 24 hours. The physicochemical (protein, fat, ash, fiber and moisture) and microbiological composition of each by-product was evaluated (3 batches). The methodology used for the determination of each parameter followed the Portuguese standards: determination of total protein by Kjeldahl method (ISO 1871:2009, NP 1612:2006), total fat by Soxhlet method (NP 1613:1979), total ash by incineration at 550 °C (NP 518:1086, NP 1615:2002) and determination of moisture content by drying at 102 ºC (NP 1614-1:2009). Enumeration of total mesophilic bacteria was performed on Plate Count Agar and *Enterobacteriaceae* on VRBGA.

Results. The values for the physicochemical (P:protein, FT:fat, A:ash, M:moisture and F:fibre) and microbiological parameters are listed in Tables 1 and 2.

Table 1. Physicochemical composition of each by-product (g/100g)

By-product	P	FT	A	M	F
Wheat germ	32	9	4	12	19
Wheat bran	13	4	5	14	69
Bone	20	13	27	35	-
Cooked blood	29	<0.1	1	69	-
Hair	27	1	1	72	-
Fish wastewater	8	<0.1	7	85	-
Mammalian wastewater	1	1	1	99	-
Spent yeast	8	0.3	1	82	-
Spent grains	22	7	4	71	59

Table 2. Microbiological composition of each by-product (CFU/g or mL)

By-product	Total counts	*Enterobacteriaceae*
Wheat germ	1.42×10^4	3.33×10^3
Wheat bran	5.35×10^5	8.93×10^4
Bone	6.63×10^3	$<3.0 \times 10^2$
Cooked blood	5.08×10^6	$<3.0 \times 10^2$
Hair	5.23×10^7	3.10×10^5
Fish wastewater	$<3.0 \times 10^3$	$<3.0 \times 10^2$
Mammalian wastewater	1.89×10^5	$<3.0 \times 10^2$
Spent yeast	$<3.0 \times 10^3$	$<3.0 \times 10^2$

The analysis of these results showed that mammalian wastewater had low potential for recovery, while fish wastewater showed interesting protein contents. Moreover, wheat germ was the most complete product from the nutritional point of view with relevant protein, lipid and fiber contents. The remaining products can be grouped in protein-rich byproducts (bone, hair, spent yeast, cooked blood) with potential for protein extraction and peptide production, and in fibre rich products (spent grains and wheat brain) with potential for polysaccharide extraction and oligosaccharide production. Concerning microbial contamination hair present the highest microbial load and Enterobacteriaceae contamination, requiring stabilizing and decontamination processes before valorisation.

Conclusions. Assessment of compositional and microbiological analysis are crucial steps to explore sustainable and integrated solutions for food byproducts valorisation.

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