INNOVATIVE DIRECTIONS OF OBTAINING PROTEIN-CONTAINING PRODUCTS FROM THE WASTE OF LEATHER AND FUR PRODUCTION

KERATIN HYDROLYSATES OBTAINED FROM WOOL WASTE

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INTRODUCTION. Wool is a keratinous biological material with structure, mechanical behavior and specific physicochemical properties [1]. Keratin matrix proteins have a high content of cysteine, glycine and tyrosine amino acids. Those with high cysteine content have a molecular weight in the range of 11-26 kDa, and those with a high content of glycine and tyrosine residues have a molecular weight between 6 and 9 kDa. The production of keratin extracts is done using acid hydrolysis [2], hydrolysis in basic medium [3], enzymatic hydrolysis [4] and ionic liquid extraction [5].

MATERIALS AND METHODS. The keratin hydrolysates were obtained from wool waste from the fur industry using the following materials: NH_3 (sol.25%, Na_2CO_3, detergent, CaO, NaOH, H_2SO_4). Three hydrolysis processes were performed in the presence of three different extraction agents: CaO, NaOH and H_2SO_4, each of them at a concentration of 30% in the reaction medium. Three keratin hydrolysates were obtained: KerCa30, KerNa30 and Ker$SO_4$30 following the steps of wool degreasing, hydrolysis, decantation, filtration (Fig.1). In the case of the KerNa30 technological process, no wool residue was obtained.

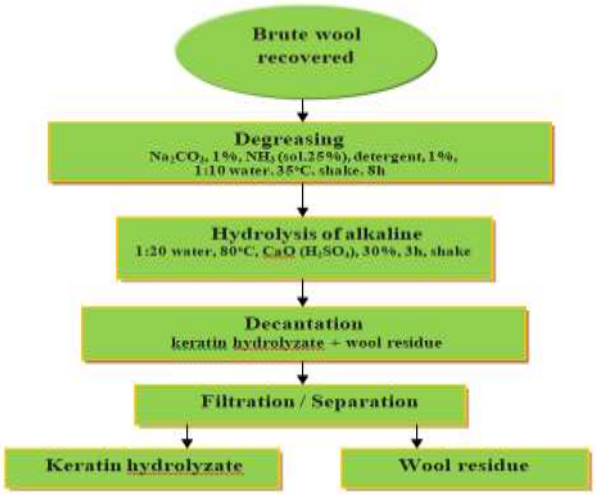

Fig.1.Method for keratin solubilisation with CaO and H_2SO_4

The obtained keratin hydrolysates were physicochemically characterized for: dry matter (EN ISO 4684), ash (EN ISO 4047), total nitrogen (ISO 5397), protein (ISO 5397), aminic nitrogen (ICPI method), particle size and Zeta potential (Zetasizer Nano-NZ, Malvern).

RESULTS AND DISCUSSION. The physicochemical analyses showed different properties depending on the hydrolysis agent used in keratin solubilisation. A maximum of 74.31% of KerCa30 protein was observed, followed by KerNa30, with 61.38% and Ker$SO_4$30, with 22.54%. Aminic nitrogen analyses ranged from 1.40% for KerCa30 to 2.30% for KerNa30 and 2.56% for Ker$SO_4$30, showing increased keratin molecule cleavage in acidic conditions, followed by sodium hydroxide and calcium oxide environment. The protein substance varies from 79.51% for KerCa30 to 74.07% for KerNa30 and 57.23% for Ker$SO_4$30, according to the total nitrogen content ranging from 13.19% for KerCa to 10.93%, for KerNa30 and 4.05% for Ker$SO_4$30. Dynamic light scattering (DLS) analyses of keratin hydrolysate show polydispersions composed from two major populations of different sizes. KerCa30 and KerNa30 have similar populations between 137.6 -107.4 nm, for smaller sizes, and 636 nm for larger majority population. Ker$SO_4$30 presents also two major populations, one at 57.22 nm and one at 2.709 nm. The Zeta potentials of basic keratin hydrolyzates are negative with values of -8.45 mV, for KerCa30 and -23.4 mV, for KerNa30 and for Ker$SO_4$30 the value is 4.71mV. Obtaining keratin in different reaction media at the same concentration resulted in total hydrolysis of the wool in KerNa30, KerCa30 rich in Ca salts and Ker$SO_4$30 with small particle size.

CONCLUSIONS. The different methods of obtaining keratin extracts lead to variations in their composition and properties with the perspective of using them for biodegradable, bioactive smart new material design.

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