DETERMINING THE PARTICLE SIZE OF SKIMMED WALNUT FLOUR

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Summary: This paper shows the experimental results of the particle size analysis of the skimmed walnut flour.

The following was determined: the minimum and maximum particle size of flour, their distribution by size, the average value of particle size.

The analyzed indicators affect the water binding and emulsifying capacity and rheologic properties of nut meal.

Keywords: nut meal, skimmed walnut flour, granulosity, Rosin–Rammler distribution

Introduction

Nuts are a valuable product that can be used in foodstuffs, confectionery, bakery, pharmaceuticals and perfumery, etc. Walnuts have great importance for the national economy, especially the export section, as their proportions increasing on the foreign market.

Walnuts are a particularly valuable product because of their high content of nutrients. It contains very little water 4%, protein 16%, fat 65%, carbohydrate 14% [1].

Walnuts contain high amounts of ω–3 fatty acid, α–linolenic acid, ω–6, dietary fiber, minerals, vitamin B complex (B2, B5, B6), C, D, E, [2,3] .

When walnuts are pressed, walnut oil as primary product and walnut meal as secondary product are obtained.

From walnut meal, skimmed walnut flour can be obtained that can be successfully used in food industry, especially in the production of meat. Knowing the degree of grain size flour is required for it's hydration process, in the preparation of the composition of cooked and halfsmoked sausages. This way the fine flour is hydrated rapidly and binds a greater amount of water than flour with a higher degree of granolosity, because the contact surface of the particles of flour with water is higher.

Particle size analysis is the analysis of the size and size distribution of particles resulting from the process of grinding walnut flour, obtained from mechanical processing of walnuts.

The manufacturing technology of meat products, flour particle size of skimmed walnuts influences the water binding capacity, emulsifying capacity and rheological characteristics of the obtained composition, particularly for boiled sausages [4].

The purpose of this paper is to determine the minimum and maximum particle size of skimmed walnut flour, size distribution and the average size value of particles.

Methods and materials

Obtaining skimmed walnut flour.

As study material was used skimmed walnut flour that has been obtained by cold pressing walnut kernels. After pressing two main products are obtained: walnut oil and

skimmed walnut meal. But to get flour, the skimmed walnut meal is grinded with a colloidal mill, then it needs to go through a sieve, to remove physical hazards, then packed and stored.

The chemical composition of skimmed walnut flour is different compared to the composition of walnuts, because a significant amount of fat (oil) is removed, which will influence the degree of granulosity of the flour, figure 1.

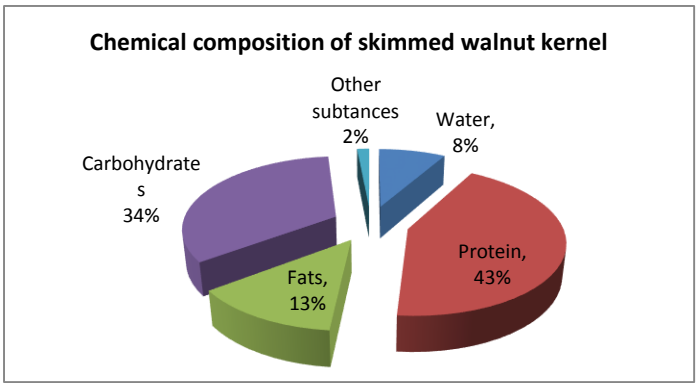

Fig. 1. The chemical composition of skimmed walnut kernel

The organoleptic characteristics of skimmed walnut flour are shown in table 1.

Tabelul 1. The organoleptic characteristics of skimmed walnut flour

Indicators	**Admissibility conditions**
Appearance	Pieces or fine powder, obtained by means of pressing. Obtained from 100% high quality walnut kernel, from which oil was obtained. Doesn't contain foreign particles.
Colour	Colour yellow to light brown.
Taste and smell	Typical taste and smell of nutty products. Contains no added flavor. No foreign taste and smell.

Determining the granulosity degree.

The principle of the method consists in sieving flour through specific sieves, weighing the remaining residue and the sieved flour. The sieves, with holes of different sizes, are mounted one above the other, in order of increasing size of the hole. The flour sample is placed on the upper sieve, which has the largest openings.

In the case of manual sieving, the sifting takes 6 minutes. With 89–100 circular movements / minute. In the case of mechanical sieving, the sifting takes 3 minutes. with 200–300 circular movements / minute. To intensify the sieving process, balls or rubber rings will be placed on the sieve at the same time with the flour [5].

After finishing sieving, on each sieve will be found a quantity of flour, which represent all particles with sizes larger than the openings of the sieve.

Rezults of the research

Granulometric characteristics of walnut flour determines the quality of the flour, the effective values of economic indicators. Most materials that are subjected to sifting, are polygranular, including walnut flour. Depending on the specific of the operation of the technological process in which they are obtained, they have a certain dispersion of diameters and size distributions of different sizes. Therefore, the degree of particle size uniformity of flour may differ, even if their specific surface or average diameter is the same. It should be noted that grist particles, have mechanical characteristics and different composition.

The size of the used sieves and the share of flour fractions on each sieve for separate materials, are shown in table 2 [6].

Table 2. Particle size analysis of skimmed walnut flour

Nr. Sieve	**Size of orifice, l_i (μm)**	**Particle size fraction, d_i (μm)**	**Flour situated between two adjoining sieves, a_i (%)**	**Passed through the sieve, C_i (%),**	**Residue on the sieve, R_i (%)**
1,2	1200	1200>d	1,7	98,3	1,7
1,0	1000	1200 …1000	4,6	93,7	6,3
0,9	900	1000 ...900	8,0	85,7	14,3
0,8	800	900 ...800	68	17,7	82,3
0,7	700	800 ...700	12	5,7	94,3
0,6	600	700 ...600	2,9	2,8	97,2
0,5	500	600 ...500	1,8	1	99,0
0	0	dℜ500	1	0	–

Sorted and separated on sieves grist fractions are composed of particles with sizes between a minimum and a maximum value, within the mix size distribution is characterized by different distribution laws.

Particle size distribution is best mathematically characterized by the Rosin–Rammler–Sperling–Bennett equation [7].

$$R_x = 100 * e^{-bx^n} \quad (1)$$

where:

R (%) – percentage of residue (particle size bigger than d);

b and ***n*** – constants, that depend on the nature of the material and the fineness of grinding (b=0.003–0.035; n=0.53–0.70);

x (d_i) – h the average size of fraction particles.

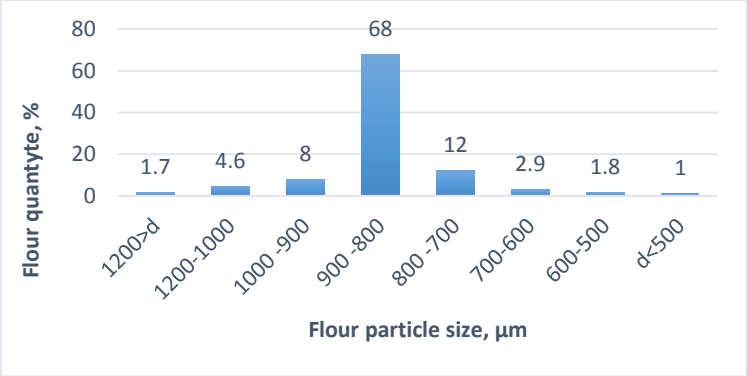

Fig. 3. Granulometric repartition of skimmed walnut flour

Skimmed walnut flour is a polygranulated component, the size of the particles ranging from 500 to 1200 µm. About 86 % of flour particles are around ≤ 1000 µm, 68 % of which are between 800...900 µm. Particles larger than 900 µm represent 14,3% of the total flour.

According to granulometry, if 100% of flour can pass through a sieve with openings of 1 mm in diameter, it can be regarded as flour with average particle size, therefore, skimmed walnut flour, according to the classification in question is of medium quality [8] .

Conclusions

1. Walnut flour is a very valuable product by its high content of nutrients that contain very little water 8%, protein 43%, fat 13%, carbohydrates 34%. Skimmed kernel contains dietary fiber, minerals, vitamin B complex (B2, B5, B6), C, D, E.
2. Skimmed walnut flour is a polygranulated component, particle size ranging from 500 to 1200 µm, and the average particle size is 850 µm.
3. Majoritatea particulelor de făină din miezul de nucă degresată constituie 86 %, cu dimensiunile inferioare de 900 µm. Most skimmed walnut flour particles with sizes smaller than 900 µm, represents approx 86%.

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