ABSTRACT

Thesis entitled: Contributions in defining manufacturing technologies of muesli type products, has 240 pages, with 138 pages of references, is divided into 6 chapters, supported by 266 figures, 47 tables, 134 references, it was conducted within the project "Ph.D. Studies, research training (FOR-CE) 'HRD / 107/1.5/S/80127 for a period of 3 years (2010-2013).

In Chapter 1 (Introduction, Problem presentation) appropriateness of the research is based on national and European context.

The cereals crops were in ancient times an important source of food. Their contents are rich in carbohydrates, proteins, lipids, minerals (K, Ca, Mg, Si, Na, Cu, Nb, Mn) and vitamins (B1, B2, B5, B6, PP), which provides much of the human body energy and the substances that it needs to survive.

The possibility of obtaining valuable quality extruded cereals from unconventional plants, which until recently were considered waste, in combination with other plants commonly used in baking, by modifying the non-destructive factors of extrusion technology is studied in this thesis.

In Romania many plants are grown: grain legumes and oilseeds of which have little value as food for humans. A real technological possibility to obtain products from a nutritional standpoint valuable at the standards and requirements is with the extrusion technology.

Research was conducted during a century and it presented the comparative evolution of extrusion techniques (reception, storage, storing, wrapping, extruding, and drying and so on).

The earliest studies of literature are from 1930 when the first food extruders appeared. Researches on extrusion are numerous but can become a research topic of news and perspective. In Romania and worldwide, grain production and products are growing steadily and people are constantly seeking new competitive technologies. Annual market is bombarded with new products, highly valued by the expanding population. By-products from milling are commonly used in animal feed industry not food. We have developed strategies and methods for fully harnessing the cereal grains, in order to obtain valuable products from a nutritional perspective, which would increase profits in this industry. Key areas in recovery of bran and cotyledons, the main components of waste, are getting extruded feed wholemeal 100% natural without additives. The equipment used in the extrusion of cereals has known throughout history continuous development and improvement. Buhler Company currently has the latest technology in the

production of cereal flakes.

In Chapter 2 (Technologies manufacturing bakery muesli type) presents stages of extrusion technology.

Research was conducted over a period of almost a century and presented the comparative evolution of extrusion techniques; (reception, storage, storing, wrapping, extruding, drying, etc.) and the most advanced facilities owned by the company today Buhler.

The earliest studies of literature about extruded used in the food industry are from 1930. Researches on extrusion are numerous but can become a topical research, news and perspective. In Romania and worldwide grain production and products are growing steadily, expanded and are constantly seeking new competitive technologies. Annual market is bombarded with new products, highly valued by the expanding population. After milling by-products are commonly used in animal feed industry not food. We have developed strategies and methods for fully harnessing the cereals, in order to obtain valuable products from a nutritional perspective, which would increase profits in this industry. The main directions in recovery of bran and cotyledons, the main components of waste, is getting extruded feed whole meal 100% natural without additives. Machinery used in extrusion experienced a continuous development and improvement. Buhler Company currently has the latest technology in the production of cereal flakes.

In Chapter 3 (Cereals used in extrusion technology) are presented subjects cereal, legumes and proposed oleoalginoase extrusion plants. Research on these plants species are numerous but can become a topical research news and perspective. From the cereals were selected for making rods wheat, millet, chickpeas, rice, barley, oats, because they all have a relatively high gluten content, protein content, fat and fibber is relatively average, an excessive amount of plants deficit is compensated by another. From the vegetable there was selected for making rods, soy because it contains the highest amount of protein registered in all the studied plants, in this project and contains a relatively good amount of gluten. From the oilseed plant there were not selected any for making rods, as none of these plants has gluten and the amount of fat and vegetable oil is very high and it makes them difficult to extrude.

In Chapter 4 (Objectives) is presented the main aim of this thesis which is to obtain and characterize the baker's muesli. For this we developed a protocol of experimental studies, pursuing different degrees of filling (different manufacturing methods).

I also proposed a study on the optimal proportions of plant materials to improve the quality of extruded cereal flakes. Research has imposed the following objectives and associated activities:

- Study on cereal plants and physio – chemical properties;
- Study on grain legumes and physio – chemical properties;
- Study on oilseed plant and physio – chemical properties;
- Establishment of raw materials and physio - chemical properties;
- Develop recipes and physio-chemical characterization of the mixtures obtained;
- Obtaining of flakes with varying degrees of filling;
- Physical characterization of the products obtained and their size;
- Determination of moisture;
- Determination of acidity;
- Determination of lipid content;
- Determination of ash and metal;
- Determination of the amino acid;
- Determination of protein.

Chapter 5 (Experimental part) presents the materials, equipment and reagents, methods, techniques and methods used in the evaluation and characterization to achieve the objectives proposed in this thesis.

The materials used were: whole wheat flour, millet, chickpeas, rice, barley, oats and soya plant purchased from the company Solaris.

Evaluation and characterization methods were appropriate objectives. It also presents comments on the preliminary results of this thesis.

Preparation and characterization of complex physical and chemical working of cereals taken

Determination of protein, fat, fibber, gluten, moisture and ash was determinate on(FT spectrophotometer IFRALUM 10).

Development of manufacturing recipes. Manufacturing recipes were: 100% whole wheat, Soya / Chickpeas - 75/25%; Mei / Chick / Barley - 25/25/50% Wheat / Nut - 75/25% wheat / soy - 75/25% , Soy / my / Chick / Rice - 25/25/25/25% wheat / Millet 75/25%, wheat / Rice 50/50% wheat / soy / Mei - 25/25/50% wheat / Barley 50/50% wheat / oat 50/50%.

There are prepared 23 formulas in order to increase the protein and gluten content so as the obtain higher extrusion. Among them were selected for extrusion 10 recipes that were high in gluten and protein content and the higher wheat as blank.

Extrusion selected recipes:

Processing recipes were made on a production line from China JIANSAIXIN brand and common extrusion occurred on an extruder DS56 - III. Extrusion was performed at constant only variable parameter is the degree of filling of the extruder which is by 5, 10 and 15 equivalent to 30 , 60 and 90 kg per hour.

Determination of physical properties of extrudes:

Was determined and characterized length, width, height, weight, degree of swelling, and organoleptic characteristics for all 11 samples obtained from the three different extrusion parameters. With increasing filler was an increase of dimensions, and improved organoleptic properties.

Determination of the chemical properties of extruded:

- Determination of moisture with thermal balance. All samples were below 8% moisture content in accordance with a manufacturing cereal flakes standards. The filling had no effect on humidity;
- Determination of the acid by titration with sodium hydroxide. In all variants where we used soy flour and oat acidity is relatively high compared with other samples in some cases exceeded 10 degrees. The lowest acidity was recorded in the sample of wheat and millet 75/25 % with values of about four degrees followed by whole wheat puffs sample. It is noted that in all samples in witch was used wheat flour acidity is much lower than the rest. Soybeans and oats cereal flakes acidity increased slightly while wheat and millet diminish it.. The degree of filling has no influence on the acidity of the obtained products;
- Determination of lipids by Sechelt method. The degree of filling does not affect the fat content of the rods, however, higher amounts of fat were recorded for the

variations made at the filling degree of 10;

- Determination of metal content. Metals were determined with a flame absorption spectrophotometer AA CONTR 300. All samples have higher contents of iron and zinc. Manganese is equally in all the samples and the copper is contained in relatively low amounts in all samples. The most significant amounts of copper is in the sample 2 been soy / chickpea 75/25 % at all three variants.

Chapter 6 (Conclusions). By the analysis of the experimental results, presented in the previous chapter, the following conclusions can be summarized:

1. It was noted that the raw materials ideal for extrusion are the products containing more gluten. It expands slightly and gives top quality products. Products low in gluten do not gelled, swell and during extrusion can occur popping and abnormal functioning;
2. The products obtained at high filling degree have superior organoleptic properties, are well aerated and their consistency is similar to the rods. Mastication and crystallization resistance decreases with the increasing filler. The products obtained at high filling degree have the consistency similar to that of rods and melt in your mouth;
3. The colour of these puffs is brighter and the oven and nozzle exit which proves the Maillard reaction did not occur. By thus increasing the filling level is a non-destructive method for obtaining high quality extrusion;
4. Length increases with the degree of filling level;
5. The weight increase with the degree of filling level;
6. The average diameter of the rods increases as the degree of filling level;
7. The expansion of the rods increases with the degree of filling level;
8. Most rods especially with the chips manufactured in small filling level have a higher middle than the ends. Much of the effect it has cutter and humidity output rods. Cutter should be sharp and should have a relatively high speed to make a proper cut. Moisture output rods must be as low as possible. Soft extrudes are sectioned more by press than by cutting which can be seen at the end results. Also, if the output is too low humidity soluble strong flours may occur as over expanding

cases 16, 17, 18, soy, millet, chickpea, barley, 25 % . All of the extruded material obtained was below 8% moisture in the first embodiment except for the extrusion of wheat and soybeans;

9. The degree of filling does not influenced acidity. It was noted, however, that in all variants where we used soy flour and oat acidity is relatively high compared with other samples in some cases exceeded 10 degrees. It was observed that all the samples where used wheat flour is much lower acidity than the rest. Soybeans and oats cereal flakes acidity increased slightly while wheat and millet declined. They can be used as the acid for the correction values are above or below the regulatory limit. The degree of filling has no influence on the acidity of the products obtained;
10. The fat content was not significant changes are observed. Eight of the 11 samples studied samples made of the degree of filling 10 had higher fat content. We can say that the degree of filling extrusion extruded environment offers richer in lipids;
11. The metals especially iron were found slightly higher values than those calculated from the raw material. The highest values were found at small degrees of filling. The remaining metals were unchanged;
12. It was found that extrusion at high filling degree is an alternative non-destructive processing but consumes more energy.