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Review paper

Soy Bran Separation Process for Application of Product in the Food Industry

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Abstract: Change of lifestyle, also as contemporary dietary habits of people, requires innovations in the food processing technology and implementation of new ingredients. Fat replacers are well known as ingredients which has been used in the production of low energy products. Furthermore, in the combination with sugar substitutes it is possible to obtain serious energy reduction, while the sensorial properties remains unaffected. A certain lightweight fractions of soy bran separation and milling process could be applied as fat replacers in the food industry, especially in cookie production. Soy bran milled fractions with dietary fibers content (cellulose, hemicellulose, lignin, inulin, pentosans etc.) have been selected for this work. Technological process of soy bran separation and milling starts with a cleaning of the external part of the soy grain, further it is necessary to adjust the moisture content for the efficient mechanical grinding process. New age milling and separation equipment (air separator, cascade classifier, dryer, hammer mill, roller mill) was used for the purposes of experiment. Results obtained with the analyze of microbiological and chemical properties of soy products, along with a probe sieving analysis, indicates a strong potential for use as fat substitutes in bakery, cookie and confectionery production.

Key words: soy bran, milling products, chemical composition

Introduction

Bread, pastry and other cereal products belongs to the very important food group, which is also known as staple food. These products could be different in various characteristics, but their production has one technological process in common. It is a grain milling process, whereas the final products are: flour, grits, bran and other co-products.

Nowadays, the dietary habits of consumers has been change, therefore it is important to satisfy increasing demands for a healthy food on the market. Wheat and rice are already present in human nutrition in the large extent, while the use of soy, spelt, buckwheat and rye is offering some opportunities for more versatility in daily nutrition.

The surface of grain is perfect habitat for various microorganisms (Žeželj, 1995). Among them, molds, yeasts and bacteria are the most frequent species could be found in cereals, moreover the microorganism contamination is possible during the milling process. The initial contamination of the grain starts early in the vegetation and ripening period of the plant growing.

The most important characteristics of fat replacers are similar textural properties, furthermore fat replacers posses physical, chemical and sensorial abilities (especially after taste) of typical fats (Owisu-Apenten, 2005), likewise products with fat replacers have a lower energy value in compare to conventional products.

Carbohydrate based fat replacers could be found these days on the market, especially those on the starch base (maltodextrin) or modified starches. Beside there are some fat replacers on the fiber base, protein base fat replacers and fat substitutes (Shaltout and Youssef, 2007).

Fiber based fat replacers are suitable for bakery and confectionery industry, due to required chemical composition and suggested health benefits. Some of the commercial available fiber based fat replacers are microcrystal cellulose, methylcellulose gums (methyl cellulose and hydroxymethyl propyl cellulose), pectin and hydrocolloid gums (Shaltout and Youssef, 2007).

The additional value of fiber based fat replacers is a high dietary fiber content, which could increase functionality of the final product, especially in the category of non-gluten products with relatively weak nutritional and functional profile (Thompson et al., 2005).

The aim of this study was chemical and microbiological analysis of soy bran, after the milling and separation process. The final application of soy bran light fractions could be as fat replacers in the food industry.

Materials and methods

The separating and milling equipment that was in use for the purpose of soy bran processing, consisted of: air separator, cascade classificator, chamber dryer, milling rollers and hammer mills. Examinated samples were soy bran and side fraction of the soy milling from „Soja protein“ A.D. Bečej.

Standard ICC methods (2008) were used to evaluate all samples in duplicate for moisture (No. 110/1), ash (No. 104/1), crude protein (No. 105/2), total fat content (No. 136), crude fibre value (No. 113), starch content (No. 122/1).

Microbiologycal analysis was obtained by the isolation of molds and determination of their total number. The total number of yeasts and moulds were determined according to the SRPS ISO 21527-2.

Results and the discusion

Milled soy bran posses a potential to become a future fat replacers on the fiber base. The first phase of the process was fractionating of the soy grain, followed by refining, trough aspiration channels and precipitator during the cleaning and hulling of soy grain. Figure 1 presents a Multi-plex zigzag air classifier 1-40MZM.

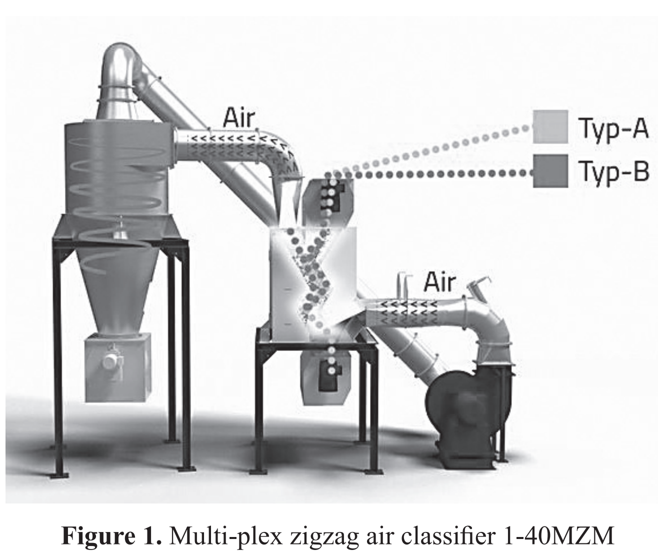


Figure 1. Multi-plex zigzag air classifier 1-40MZM

Lightweight fractions of the wheat milling were used as fat replacers on the fiber base, and examined in certain cookie formulations. Therewith, the examined fractions were the corn bran (Jung, Kim and Chung, 2005), also as soluble fibers from corn and wheat (Warner and Inglett, 1997).

Figure 2. Soy bran milling fractions

Milled soy bran fractions were subjected to chemical and microbiological analysis, and the results are shown in the following tables 1 and 2.

Table 1. Chemical composition of the side milling product light fraction (bran)

Quality parameters	Content, %
Moisture, %	7,90
Ash, % DM	3,55
Crude proteins, % DM	16,1
Total fat, % DM	0,63
Starch, % DM	9,96
Crude fibre, % DM	41,50

According to results obtain trough series of individual physical and chemical analysis, it is obvious that soy light milling fractions contain very high amounts of crude fibers (41,5% DM). Furthermore, soy bran milling products possess a very high content of proteins (16,1% DM). The starch content in these fractions was under 10 % (9,96% DM), and the total fat content was very low (0,63% DM).

Table 2. The total number of molds in the samples of the side milling product light fraction*

Sample	DG18 (cfu/g)
Soy bran	
1	$2,6x10^4$
2	$4,8x10^2$
3	$3,3x10^2$
4	$7,3x10^2$
5	$3,6x10^2$

Legend:* - the result presents an average value of three probes

Results of mycopopulation shows presence of molds in every sample, and the most dominant microorganism contamination was in sample 1. It was not surprise, because these samples were taken from the aspiration pipes and cyclone, therefore the presence of dust particles (inorganic from land and organic from the soy grain fracture) is assumed. Furthermore, bran fracture was mixed with the different particles of different grain parts, weeds and other grains. In accordance with the structure, appearance of the soy grain and the method of silo reception, the grain is transferred to the raw aspiration which exclusively provides the raw cleaning. Fractions which are carried away by the fan, consists of some particles of stems, bran pods and other legumes (wheat seed with pod), which is an adequate surface for the mycopopoulation colonizing, whereas those could be found in other soy flour samples. Following the result of Plavšić et al. (2007) the maximal number of molds in flour samples was 1,5 x 10^3 cfu/g.

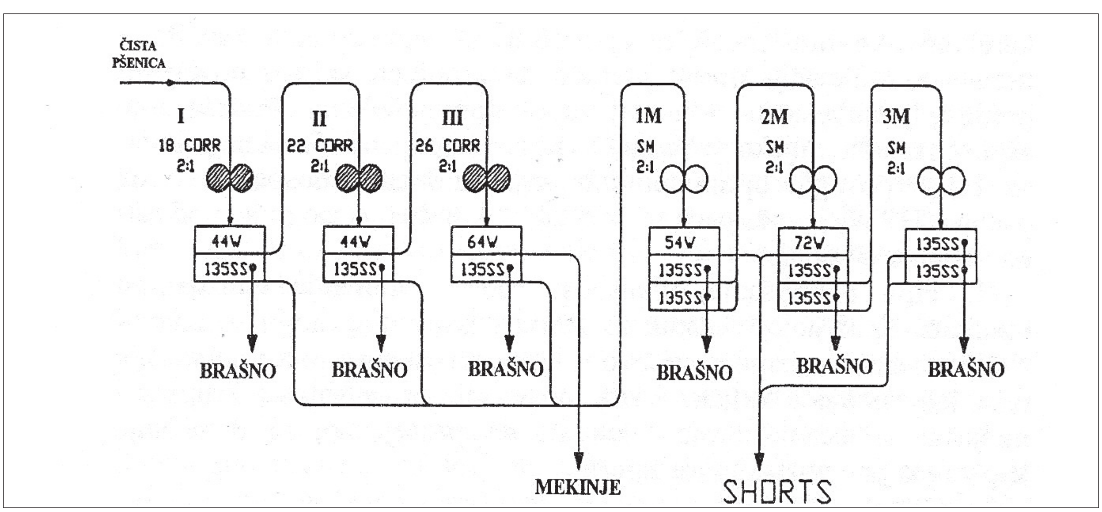
Table 3. Treatments of the milling fraction soy bran processing

Samples	Treatmants of bran refining with the cascade clasificator of the fraction after processing, %			
	0	I	II	III
Soy bran	100	81,75	78,35	69,06
Residue on the sieve 150 μm	0,4	0,4	0,3	0,3

Conditions of material processing were: air flow – 8 m^3/h; dosing material speed 50% from the max value

Table 3 presents results of an application of different treatment during the bran refining with the cascade clasificator (Scheme 1) Air flow and dosing material speed were variables. It is obvious that multiply refining leads to separation of significant amount of waste materials, owing to higher amount of endosperm residue in the corn grain bran particles.

For the purpose of drying, refined brans were subjected to heat treatment and consequently milled with the machine MLU-202 (Stojanović & Psodorov, 2007).



Scheme 1. Buhler milling figure

Conclusion

Soy bran milling products possess an optimal chemical composition and very high content of dietary fibers, therefore they fulfill prerequisites for fat replacers in food industry. Separating of soy bran requires an adequate equipment and optimal adjustment of processing parameters, such as air flow and dosing speed. A subsequent process which consists of drying and milling are also complex, and it is necessary to choose temperature, drying period and proper method of milling.

Soy bran particles smaller than 50 µm are especially interesting as fat replacers, due to textural and sensorial characteristics. Furthermore, they are suitable for a non-gluten formulations, such as non-gluten cookies and cakes.

Soy bran particles possess a desired characteristics to be used as fat replacers in non-gluten product formulations, therefore presents a refreshing innovation on the healthy food market.

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References

Honig, D. H., Rackis, J. J. (1979). Determination of the total pepsin-pancreatin indigestible content (dietary fiber) of soybean products, wheat bran, and corn bran. Journal of Agricultural and Food Chemistry, 27, 6, 1262–1266.

ICC Standard No.104/1 (2008) Determination of ash in cereals and cereal products

ICC Standard No.105/1 (2008) Determination of crude protein in cereals and cereal products for food and feed

ICC Standard No.110/1 (2008) Determination of moisture content of cereals and cereal product

ICC Standard No.113 (2008) Determination of crude fibre value

ICC Standard No.122/1 (2008) Determination of starch content by calcium chloride dissolution

ICC Standard No.136/1 (2008) Cereals and cereal products – determination of total fat content

ISO 21527-2:2011. Microbiology of food and animal feeding stuffs - Horizontal method for the enumeration of yeasts and moulds -Part 2: Colony count technique in products with water activity less than or equal to 0,95, 2011.

Jung, J. Y., Kim, S.-A., Chung, H.-J. (2005). Quality characteristics of low-fat muffin containing corn bran fiber. Journal of the Korean Society of Food Science and Nutrition, 34, 694–699.

Owisu-Apenten, R. (2005). Introduction to food chemistry. CRC Press, Washington, D.C

Plavšić, D., Sakač, M., Čabarkapa, I., Šarić, Lj., Psodorov, Đ**.** 2007. Mikrobiološka ispravnost pšeničnog brašna. Žito-hleb. 34(5-6), 83-90.

Shaltout, O. E., Youssef, M. M. (2007). Fat replacement and their applications in food products: a review. Alexandria Journal of Food Science and Technology, 4, 29–44.

Škrinjar, M. i Tešanović, D. (2007)**.** Hrana u ugostiteljstvu i njeno čuvanje. Prirodno-matematički fakultet, Univerzitet u Novom Sadu.

Stojanović, T. & Psodorov, Đ. (2007)**.** Savremena tehnologija žita, brašna i hleba. 46-118, Prokuplje, Srbija

Thompson, T., Dennis, M., Higgins, L. A., Lee, A. R., Sharrett, M. K. (2005). Gluten-free diet survey: are Americans with celiac disease consuming recommended amounts of fibre, iron, calcium and grain foods? Journal of Human Nutrition Dietetics, 18, 163–169.

Warner, K., Inglett, G. E. (1997). Flavor and texture characteristics of foods containing Z-trim corn and oat fibers as fat and flour replacers. Cereal Foods World, 42, 821–825.

Žeželj, M. (1995). Tehnologija žita i brašna.Tehnološki fakultet Novi Sad.

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