Innovative technologies of grain sorghum processing

N F Kashapov¹, M M Nafikov², A R Nigmatzyanov², R A Mingazov²

¹ Kazan Federal University, 18 Kremlyovskaya street, Kazan, 420008, Russian Federation
² Tatar Institute of agribusiness personnel retraining, Kazan, 420059, Russian Federation
arnig76@yandex.ru

Abstract. The article presents materials for the production of grain sorghum food products that allows you to completely eliminate from the diet foods containing gluten, vegetable oil from germ of grain sorghum, nanocellulose, tannin, amyllopectinosis sorghum starch and glucose-fructose syrup.

In the Russian Federation sorghum although not the basis of the diet of the population, but flour from this culture is widely used in the diet of people suffering from allergies to gluten. Gluten intolerance (celiac disease), has recently become quite widespread in the world. The disease is provoked by the use of gluten - containing foods from wheat and rye. Flour from wheat and rye has improved baking properties, but hydrolysis of a new type of protein can form metabolites that have in certain cases, toxicity or allergenicity due to the lack of enzymes in the body for their digestion. One way to eliminate the symptoms of celiac disease is a diet, that is-complete elimination of gluten-containing products from the diet. Therefore, in some cases, such a substitute can be products using sorghum flour.

The dry sorghum contains up to 55% fat and serves as a raw material for vegetable oil production. It refers to edible vegetable oils, which by its physico-chemical parameters and acid composition is similar to corn [1,2]. Along with other vegetable oils, sorghum oil is used to prepare salads and other dishes.

In medicine tannins are used as a binding drug, as an antidote for poisoning with salts of lead and mercury, Antidiarrhoeal, hemostatic and antihemorrhoidal agent [3, 4]. Tannins can be used as a therapeutic and prophylactic agent to reduce the risk of heart disease and cancer. A large amount of glutamic acid in grain sorghum, as well as the presence of essential amino acids make waste cargotrailer production (and gluten extract) perspective raw material for production of glutamic acid, the amino acid gidrolizatov and pastes, the demand for which in the medical and food industries is increasing [5].

Frozen paste of amyllopectinosis sorghum starch is rapidly and completely dissolves during thawing, almost no phenomenon of syneresis. This property is used in industrial freezing of food products. Amyllopectinosis sorghum starch finds wide application in the textile industry, textile good dressing should be easy and removed from the finished fabric, and pastes amyllopectinosis sorghum starch give a film with a high solubility and at the same time a high capacity dressing. This marked improvement in the quality of the fabric and reducing the amount of strand breaks. Ordinary sorghum starch is used as glue and dressing in the manufacture of paper, cardboard and various paper products, for the enrichment of bauxite ores. Dextrin obtained from amylopectin sorghum starch is better than dextrin from topioc. Pastes, dextrins from waxy sorghum transparent and sustainable, and their films possess high strength, flexibility and instantly re-dissolved. In addition, amylopectin starch is used in...
multi-color printing on fabric and paper. Starch is also used in mining, metallurgy and other industries [6].

Also extracted from grain sorghum tannins are used for tanning of leather and fur, preparation of inks, etching of textile fibers, for giving to various drinks tart and astringent taste and as a food dye.

As dyes in the food industry, isolated pigments from sorghum films are used.

The outer layer of sorghum grain contains wax. By extracting the envelopes of the grain sorghum with hexane to obtain 5-10% of crude wax to the weight of the shell. When applying for extraction of ethanol with crude to remove wax and pigments. The properties of this wax are close to the properties of Carnauba, used in the manufacture of furniture of the highest quality [7].

Sorghum is mostly a technical and fodder crop, the main products of processing are glucose-fructose syrups, sorghum starch and alcohol [8,9]. Sorghum starch is a versatile product free from any anti-nutrient components. Since sorghum endosperm often has a tint color, sorghum starch can also be slightly colored. The color of starch can also be enhanced by pigments of seed shells, which are released in the process of production solutions. In many cases, this is not essential, but white starch is preferred for the manufacture of some products. Therefore, the production of starch for food purposes, I prefer to use as raw material of sorghum varieties with light seed shells and white endosperm. By its physical and chemical properties (viscosity, gelatinization temperature, clear paste) starch sorghum similar to corn. It generally similar ratio of amylose and amylopectin, so the scope of use of these starches also coincide. Sorghum starch is used in the production of sauces, fillings for pies, puddings, desserts based on milk. It is used as an additive for baking bakeries and confectionery products in cases where it is necessary to weaken the action of gluten and give more softness and tenderness to the product while reducing the addition of sugar and fat (biscuit semi-finished product, ice cream cups, biscuits, bakery mixtures, etc.). This starch is used for technical purposes in the paper industry, in the textile and medical industry (figure 1).
Figure 1 - Scheme of Cargo zero
The production process of Adobe Song Kerala Kerala is made from corn. Just like for baking starch, starch from Cargo is a good Serum for the production of shares substances. On its basis produce glucose-fructose crop (GFS) with a sedan is the ratio of the components. Schemes of production of GFS from song and corn Kerala are identical and include the following main stages: Dexter kerala a-Las - > glucose production (Lucille Share) —→ artist glucose solution absorbent —" ISO glucose glucose.

Lower compared to corn cost of grain Cargo and higher content in it kerala provides the best performance of rolling for the production of GFS from Cargo. For the same reasons, production from Cargo Sparta is more rental than corn.

References
[1] Nafikov M M, Yakushkin N M, Fomin V N, Kashapov N F, Fomin D V, and Nigmatzyanov A R 2016 Sugar sorghum: technological and economic aspects of cultivation in the Republic of Tatarstan Kazan: Publishing house "ZnakC" IP Sizikov p 40
[2] SHepel’ N A 1994 Sorghum Volgograd: press Committeeep 448
[3] Bol’shakov A Z, Bondarenko S M, Kadyrov S V and Klepko YU N 2008 Rostov-on-don: ZAO "Rostizdat" p 60
[4] Kadyrov S V, Fedotov V A and Bol’shakov A Z 2008 Sorghum in the Central Chernozem region Rostov - on-Don: ZAO "Rostizdat" p 80
[5] Alabushev A V, Alabusheva O I and Anipenko L N 2004 Recommendations for the preparation of feed from sorghum and use in the diets of farm animals and poultry Zernograd p 32
[6] Kovtunov V V, Gorpinichenko S I 2011 The main areas of use of grain sorghum grain farming No 6 (18) pp 28-32
[7] Amira C D 1992 Small grains in monogastric and ruminant feed formula-tions: Prospects and problems. In: Utilisation of sorghum and millets International Crops Research Institute for the Semi-Arid Tropics, Patancheru, India pp 183-90
[8] Kashapov N F, Nafikov M M, Gazetdinov M H and Nafikova M M 2015 Waste-free production technology of alcohol from sugar sorghum Materials of the International scientific and technical conference " Innovative engineering technologies, equipment and materials – 2015 "(MNTC" IMTOM–2015") p 288-91
[9] Kashapov N F, Nafikov M M, Gazetdinov M. H., Nafikova M M and Nigmatzyanov A R 2016 Innovative technology for the production of ethanol from sweet sorghum IOP conference Series: materials science and Engineering 012012