**Project name:** Aflatoxin contamination of various nuts and the development of ways to detoxify them

**Relevance:** The problem of mycotoxicosis began in 1961 in the UK, but until now it has not been completely solved and is a topical issue. Fungi can contaminate nuts during growth, harvesting, and storage in various climates, as well as in agriculture and storage, especially during storage where unfavorable temperatures and relative humidity are present, which contribute to the growth of fungi and the production of toxins. The frequency of occurrence of aflatoxin B<sub>1</sub>, in samples of various nuts around the world is growing significantly. Analyzing the studies of foreign scientists in Turkey, Iran, Pakistan, Brazil, Saudi Arabia, Italy, Algeria, and the United States, it is necessary to regularly conduct more stringent monitoring and food safety systems to control aflatoxin. Since geographical origin can affect the risk of contamination, in order to protect human health, countries should strengthen the monitoring of aflatoxins in nuts coming from countries with a favorable environment for the growth of aflatoxigenic mold fungi or with less strict regulations.

Kazakhstan is one of the producers of nuts in Central Asia. Nut-bearing plantings grow in Almaty and South Kazakhstan regions. In the Almaty region, 52.4 hectares of land or 12.6% is occupied for nut plantations, and in the South Kazakhstan region-353 hectares or 85%. The rest of the relatively small part of the nut plantations falls on the Zhambyl and Kyzylorda regions.

Thus, on this issue, the Republic of Kazakhstan is also no exception. In the Republic of Kazakhstan, Professor B. S. Maikanov and his students were engaged in the problems of food contamination with aflatoxins. The climatic conditions of the Republic of Kazakhstan represent the optimal possibility of contamination of various nuts. As evidenced by the results of our research presented above. It should be noted that there are no systematic regular and reliable studies, they are sporadic, and the issues of detoxification of nuts affected by aflatoxins in the Republic remain open.

The issues of detoxification as relevant are well reflected in foreign sources. In general, to reduce the risk of contamination with aflatoxins, a comprehensive approach is required, in which the control of contamination is provided at all stages of production on the principle of "from field to table". This approach involves targeted breeding, increasing the crop's resistance to the effects of fungi, as well as the use of biological control methods, supplemented by post-harvest measures, such as proper drying and proper storage of crops that are potentially susceptible to contamination. In addition, it is necessary to search for options for safe alternative use of already contaminated crops in order to extract at least part of the economic benefits.

In the Republic of Kazakhstan, we have not found any research on detoxification of plant products in the sources available to us. Therefore, it is extremely important to control and regulate the level of aflatoxin  $B_1$ , in domestic and imported nuts.

In recent years, nuts are a permanent attribute of the table, in addition, nuts are present as fillings and food additives in confectionery (cakes, chocolate, ice cream, etc.). "Kazakh Research Institute of Fruit and Vegetable Growing" has developed a promising program for the development of nut growing in the country. In this context, this project is very relevant and necessary.

The proposed methods of detoxification will be fundamentally different from foreign and domestic analogs in their innovation. It should also be noted that the tests will be carried out both in vivo and with food. A feature of domestic methods of detoxification is its relative cheapness and availability.

The proposed project will make it possible to advance research work in the field of mycotoxicology and food safety to more high-tech positions. The scientific potential involved in the project will acquire completely new skills to work with the problems of aflatoxins and to develop new innovative ways to detoxify them, the university will become one of the competitive scientific organizations when the expected effect is achieved. Economic entities producing nuts in the Republic will be reliably protected from the negative impact of aflatoxins

on the quality and safety of products. Companies that sell imported nuts will also be offered these detoxification methods.

**Goal:** Development of techniques for detoxification of various nuts with aflatoxin B<sub>1</sub> contamination in accordance with the results of their veterinary and sanitary assessment.

**Expected results:** The degree of contamination with aflatoxin in ope, nuts grown in Almaty and Zhambyl regions has been determined:the concentration of aflatoxin B in the samples of nuts from the two regions varied from  $0.0001 \pm 0.0010$  to  $0.0002\pm 0.0011$  mg/kg, which did not exceed the MPC; nuts of all types of the above-mentioned areas are not subject to control in the markets according to regulatory documents on the content of aflatoxin B; an application for the Eurasian patent "Method of extraction of aflatoxins from food and feed" has been prepared, the advantage of this method is the replacement of methanol as an extractant, which belongs to the 1st class of particularly dangerous substances, a PhD, two master's theses and three theses are being carried out within the framework of the project.

When determining the degree of contamination with aflatoxin in1 and the quality indicators of nuts grown in South Kazakhstan and Kyzylorda regions, it was found: samples of walnuts in the shell from the South Kazakhstan (Turkestan) region were contaminated with aflatoxin in<sub>1</sub>: Tulkibas district from 0.014±0.0018 to 0.015±0.0018 mg/kg; Langer from 0.0066±0.0018 to 0.007±0.0012 mg/kg, Sairam from 0.01581±0.0018 to 0.016±0.0015 mg/kg and from the city of Shymkent (market "Kyrgy") from 0.009±0.0012 to 0.010 ±0.0018 mg/kg; samples of walnuts in shells from Kyzylorda region (Kyzylorda, market "Eski bazaar") were contaminated with aflatoxin in in concentrations from  $0.010 \pm 0.009$  mg/kg to  $0.012 \pm 0.0018$ mg/kg, excess in fatty acid content (palmitic – by 44% stearic – by 28%, oleinating – by 34%, by linoleic 36%, by linolenic 38%); the nutritional value of walnut in the shell is reduced in amino acid content (from 2% to 25%, the sum of amino acids - by 6%, the ratio of the sum of essential to interchangeable amino acids - by 16%, the amino acid score was minimal for leucine - 95.5%; methionine -65%; phenylalanine - 96%). When determining the degree of contamination with aflatoxin B<sub>1</sub> and the quality indicators of imported nuts, it was found: nuts from Uzbekistan were contaminated with aflatoxin B<sub>1</sub>: peanuts 0.025±0.0012 mg/kg, dietary supplements 0.018±0.0001 mg/kg, walnut without shell 0.07±0.0012 mg/kg, pistachios 0.007±0.0011 mg/kg, hazelnuts 0.26±0.0009 mg/kg; walnut in shell produced by China, Ukraine and Chili is contaminated from 0.012±0.007 to 0.045±0.004 mg/kg; in Japanese nuts 0.012±0.001 mg/kg and in pistachios of Iranian production 0.04±0.01 mg/kg; imported nuts are not tested for aflatoxin in1, both at the places of the customs zone and at the places of sale, although the MPC for the countries of the Customs Union is 0.005 mg/ kg; when monitoring imports, we found that the main import of nuts is smuggled in small batches, bypassing customs posts (auto, railway and air transport). From imported nuts, due to the large import from China (up to 70%), we have inherited the fatty acid composition of walnuts, in comparison with domestic products: the concentration is reduced by myristic - by 10%, stearic - by 38%, oleinic - by 32%; the nutritional value of walnut in the shell is reduced in terms of amino acid content (from 9% to 39%, the sum of am

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## List of publications and patents published under this project: (with links to them): -

**Information for potential users:** Laboratories for Food Safety of the Committee and the Committee for Veterinary Control and Supervision of the Ministry of Agriculture of the Republic of Kazakhstan, Kazakhstan Association of Producers and Processors of Nuts and Berries.

Additional information: -