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Amaranth is a Natural Dye Source

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ABSTRACT

This article provides information on the chemical composition and extraction of natural and synthetic dyes, as well as some nutritional dyes, used in coloring products in food production.

In the production of food products, in order to increase their demand, food additives are used, which give a special smell, taste and taste, and provide the possibility of long-term storage without deterioration. Many people are interested in the speed, severity, and dangerousness of diseases caused by food additives. Since most food additives are made of synthetic substances, it is necessary not to ignore the fact that an excess of chemical substances in their content can have a harmful effect [1; 24-26 b, 2; 1-19 b].

Currently, natural and synthetic dyes are used to color products in the food industry. Foods that have lost their color as a result of processing or dyes are added to food products in order to increase the marketability of the product. Colorless products are also given a shine. For example, soft drinks, ice creams and confectionery can be colored to make them look attractive to customers.

Dyes used in the food industry are classified into natural and synthetic dyes according to their origin. Representatives of these two classes, in turn, are divided into organic and inorganic dyes. Paints can be soluble in water or oil and insoluble in both (pigment) [3; 57-58 b, 4; 20-24 b].

The color of food products is the main quality indicator that is first noticed by the consumer. Therefore, in order to increase the attractiveness of food products, manufacturers add various synthetic and natural nutritional dyes to their composition.

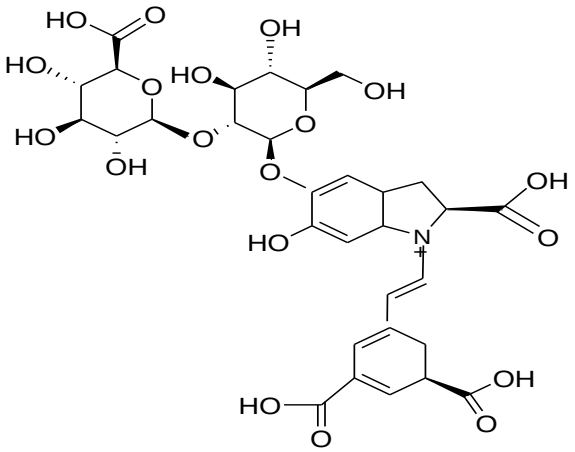
Also, in turn, natural nutritional dyes can be individual or their mixture. The origin of synthetic nutritional dyes is composed of organic and inorganic compounds [5; 256 b, 6; 10-15 b].

Synthetic compounds cause damage to the kidneys and liver, as well as allergic conditions. Also, both products cause defects in the development of the fetus.

In recent years, the trend of replacing synthetic dyes with natural pigments that are beneficial for safety and health in the food industry has been growing worldwide [7; 720-722 b].

Amaranth contains the alkaloid amaranthine, which is unique to this plant, and this compound gives the plant's flowers and leaves a red color.

The amount of this biologically active compound varies depending on the varieties of amaranth and the region where it is grown and is important in increasing the healing properties of the plant.



Amaranthine

Amaranthine pigment is obtained by extracting amaranth and is widely used in the production of confectionery products as a natural food coloring [8; 92-95 b].

Extraction processes form the basis of the production technology of natural food dyes. The choice of one or another method of extracting paint from natural raw materials depends on the nature of the raw material, the properties of the extracted pigment, the tasks and directions of its application for painting. Various parts of wild and cultivated plants, waste from processing of wine, beverage and canning enterprises serve as raw materials for the production of paints. In addition, some of them are obtained by chemical or microbiological synthesis.

Natural food dyes are often extracted from natural raw materials in the form of juice or extract with a suitable solvent. Water or ethanol is used to extract water-soluble pigments (anthocyanins). Lipophilic pigments (chlorophylls, carotenoids) are extracted using non-polar solvents and vegetable oils. The amount of dyes in primary raw materials is often small (1-4%), so special methods are used for their purification and concentration. Certain technological schemes with adjustable production parameters are given in the technological instructions for each manufactured paint. At the same time, there are general sanitary and hygienic requirements for the production of feed dyes, which ensure their quality and safety for the consumer.

The color of the food product is of great importance for the consumer: it is not only an indicator of the freshness and quality of the product, but also a necessary description of its recognition. They can be added to the product in a natural way (beets, carrots, egg yolk, etc.) or during processing. Dyes restore the natural color lost during processing and storage, increase the intensity of the natural color, color colorless products, such as soft drinks, give them appearance and shine of various colors. When evaluating the quality of natural dyes, their compliance with the requirements of technical and regulatory documents is checked. Taking into account the characteristics of this group of food concentrates, the main attention is paid to sanitary-hygienic issues of quality and safety during product examination. Usually, natural dyes are not toxic, but for most of them, permissible daily doses have been established. Modified natural dyes obtained from non-food raw materials are subject to mandatory toxicological examination. It is not allowed to hide the color change caused by product deterioration, violation of the technological regime and the use of unsuitable raw materials with food dyes.

For extraction, the leaves were collected directly from 3 weeks before amaranth flowering to 1 week after flowering, and the inflorescences were collected after the seeds ripened and the collected mass was dried until 10-12% moisture remained.

In order to study the factors influencing the process of extracting amaranth from the dried mass, the optical density was chosen as an indicator of process performance [9; 1-4 b].

It is known that the extraction process depends on several factors:

- ✓ extraction temperature (increasing the temperature leads to acceleration of the extraction process);
- ✓ granulometric content (the finer the raw material, the higher the extractability);
- ✓ hydromodulus factor;
- ✓ the nature of the extractant and other factors

When choosing process indicators, attention was paid to the following processes:

- ✓ when extracting biologically active extract from raw materials, the extraction temperature must not exceed 50oC;
- ✓ water or water-alcohol solutions were taken as extractants because of the prospect of using amaranth extract for nutritional purposes. Preliminary experiments have shown that the hydromodule ratio is 1:10.

In the first series of experiments, the process of obtaining an aqueous extract was studied. The dried mass was crushed to particles smaller than 7 mm to 3 mm, 3 mm to 1 mm, 1 mm to 0.3 mm, and less than 0.3 mm. The optical density was measured in 1:10 diluted solutions of the extract.

The obtained results showed that the decrease in the granulometry of amaranth dried mass led to an increase in the optical density of the extract, which ultimately led to an increase in the efficiency of the process.

The duration of the extraction process also depends on the granulometry of the dry mass. The optical density value of the extract of 3 mm to 7 mm particles and 1 mm to 3 mm particles does not change after 50-55 min of the process, and for smaller particles it remains unchanged after 40 min.

Due to the need to preserve the biologically active substances of amaranth and the need to reduce the energy consumption of the process, the effect of extraction temperature on the optical density of aqueous extract obtained from amaranth pulp was studied.

"Andijan" grade amaranth extraction indicators

Extraction temperature, °C	***Granularity,mm***	***Hydro module***	***Nature of extractant***	***Time, min***	**Yutilish maksimumi, nm**
30-50	7-3	1:10	*Water*	50-55	532-535
30-50	3-1	1:10	*Water*	50-55	532-535
30-50	1-0,3	1:10	*Water*	50-55	532-535
30-50	<0,3	1:10	*Water*	40	535-542

In the researches, amaranth's dried leaf and flower mass was crushed to a size smaller than 0.3 mm. The temperature increased from 30 °C to 50 °C. It was found that the value of the optical density changed to a very small extent with the increase in temperature. The final results were not significantly different.

Therefore, in order to preserve biologically active substances, it is advisable to carry out the extraction at a lower temperature, that is, at 30 °C.

From a technological point of view, increasing the temperature makes it possible to preserve the obtained extract. Inhibition of the development of microflora at the temperature limits of the conducted studies is unlikely.

From the perspective of using amaranth extract as a dye in food industry technologies, the change of

its color depending on pH was studied.

The active acidity of aqueous extract of amaranth was changed between 12.0 and 2.0. Color change was observed visually. Studies have shown that the aqueous extract of amaranth leaf and flower mass does not change color in the range of pH 2 to 12.

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