Amaranth Seed Extraction by Propan-2-ol after Enzymatic Treatment

M. VESELÁ

Faculty of Chemistry, Brno University of Technology, Brno, Czech Republic,
E-mail: vesela@fch.vutbr.cz

Abstract: A process of amaranth seed grinding followed by extraction was studied. For fat emulsion stability impairment the enzyme G-Zyme®G999 was used. Using this process the improved fat separation was achieved.

Keywords: Amaranth seeds; enzymatic treatment

INTRODUCTION

Amaranth is a dietetically important plant. It has a specific significance for children, sportsmen and elder people. Amaranth guarantees a balanced diet thanks to the high content of quality digestible protein (17.9%) [1], valuable vegetal fats (7.7%), mineral substances and the content of vitamins B, C and E [3]. Starch makes the main structural component of amaranth seeds. It represents 50–60% of its solid part. It does not contain gluten. The application of amaranth in food industry is based on processing of seeds (especially into flour, extruded products, oil) and leaves which can be consumed in the same way as spinach.

In the process of Amaranth seed laboratory treatment, the main concern was given to: fat (oil), protein, starch and the determination of fiber. Experimentally the four-stage extraction of ground material using anhydrous propan-2-ol (IPA) was tested. After using enzymatic preparation of G-Zyme®999 (Ekozym, Ltd.) each fraction was centrifuged. Thanks to the enzyme activity the stability of fat emulsions is affected and the fat phase is sharply separated which is utilized in the initial separation of the fat phase of amaranth seeds [2].

EXPERIMENTAL

Amaranth seed had been homogenized by rubbing with sea sand in the relations of 1:1, 1:2 and in the mixer. Two analytical methods were used to determine the crude protein: total nitrogen determination using the Kjeldahl method with the conversion into the crude protein content and the biuret method. Mineralization of the sample of the homogenized amaranth seed was carried out using Hach Digesdahl mineralizer (USA). The amaranth protein extract in an alkali medium at pH of 9.5 was used for the biuret method.

The ground amaranth seed and anhydrous IPA were mixed in the mass ratio of 1:2. After the addition of 0.2 ml of enzyme G-Zyme®999 lysolecithinphospholipase, diluted in the ratio of 1 + 9, the suspension was tempered at 75°C for 10 minutes. Then the suspension was mixed and centrifuged at 4000 rpm. Anhydrous IPA was added to the sediment in such quantity so that the total mass of the suspension was the same as the initial one. The second centrifugation followed the tempering at 75°C without the addition of enzyme. This was repeated four times. The fat content was determined gravimetrically [4].

RESULTS AND DISCUSSION

When determining the content of fat in the *Amaranthus cruentus* seed, the impacts of homogenization of the sample and the seed grinding time on fat yield were observed. When rubbing seeds with sea sand in the ratio of 1:1 and 1:2, the fat amount of 6.1% and 4.6% was determined. During mixer

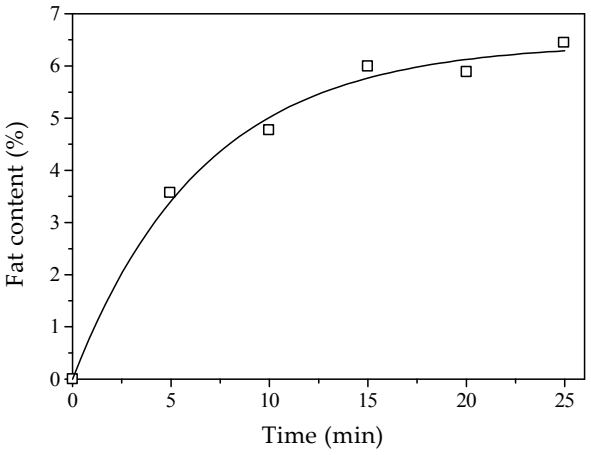

Figure 1. Fat content as function of amaranth seed grinding time

homogenization the fat yield of 7% was achieved after 25 minutes, the impact of seed grinding time on fat yield were observed.

The seed contained 15.8% of crude protein determined by the Kjeldahl method, 16% of total protein determined by the biuret method and 2.9% of fiber determined by the methods according to Henneberg and Stohmann [4]. Starch determination was carried out polarimetrically. An average starch content of the samples made 53.6%.

Experimentally the efficiency of the four-stage extraction of amaranth seed fat using anhydrous IPA was tested. The experiment was based on the centrifuging of the fat containing alcohol phase from the sediment of the ground material. The evaluation of the extraction based on the use of centrifuging to separate the phases was carried out by the mass ratios of the input and output phase and by comparing with analytical determination of fat content. The fat yield was 6.6% after the extraction using enzyme and 7% without enzyme but the fat phase was sharply separated in the presence of enzyme.

CONCLUSION

The main aim of the work was the laboratory testing of the efficiency of the amaranth fat extraction using anhydrous IPA namely by the four-stage extraction of fat and centrifuging both the fat containing alcohol fraction and fat free sediment. The fat yield was 94.8% comparing when using this technology with the analytically determined fat content. This procedure can be recommended not only for the completing of the pilot plant direct procedure of the extraction of quality oils from the low oil raw material, but also from the rape foods, soya flour, sunflower seed and other material in which the remaining oil concentration after the extracting the main oil share reaches approximately double value than the ground amaranth seed.

References

[1] Jarošová J., Michalová A., Vavreinová A., Moudrý J. (1997): Pěstování a využití amarantu. Metodiky pro zemědělskou praxi 13/1977. ÚZPI, Praha.

[2] Vaněk P. (2002): Získávání oleje z řepky olejky novými metodami. [Diploma Thesis.] University of Technology, Brno.

[3] AMR Amaranth, a. s. (2002): Co je to amarant [online]. <http://www.amaranth.cz/pages/whatis/index.htm>.

[4] Davídek J. *et al*. (1977): Laboratorní příručka analýzy potravin. SNTL, Praha.