

TO THE PROBLEM OF MECHANISM OF SUNFLOWER SEED MOIST AND HEAT TREATMENT IN ACID AND ALKALINE MEDIA.

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Abstract

Selectionists in different countries are engaged in creating new varieties of sunflower seeds with high lipid content and at the same time stable to different kinds of diseases and having high productivity. However, modern varieties and hybrids can be characterized as hard for hulling. The present investigation was undertaken with the aim of studying the mechanism of preparing sunflower seeds by pretreating them with acid and alkline electrolyte solutions prior to hulling. The objective was to work out the technique of pre-treating seeds for oil expelling out of oil-bearing material with minimum of hull content. key Words : SEEDS, HULL, TREATMENT, TECHNIQUE, OIL.

Introduction

Production of high quality vegetable oil depends on a number of factors, in particular, at the stage of seed treatment, on the extent of their hulling. At the Fat Technology Department there has been worked out a new technique of sunflower seed moist and heat treatment (1) which has enabled to improve the extent of hulling as well as to get a higher yield of sunflower oil of good quality.

In literature there are references to sunflower moist and heat treatment in water, acid and alkaline media, the mechanism of this process, however, is not considered.

The present investigation was carried out with the aim of studying the mechanism of sunflower seed treatment in neutral, acid and alkaline media at the optimal values of moist and heat treatment time and temperature previously found.

Materials and methods.

The materials in the investigation were the following sunflower seed varieties : Peredovik, Pervenetz, Start, Fluron. Fundula, NS-27, Sunbread 254.

Hulling was carried out in a laboratory single impact huller. The impact effort is controlled by the shift rotating speed.

The technique of the experiment (3) is the following : 200 g of sunflower seeds are treated with water in the amount of 2,5 % of the total mass, allowed to stay in the exicator for 6 hours after which they were heat-treated for 40 min. in the drying cabinet at 130 C. Similarly the samples were treated with HCl solution at pH of 1, 3, 4 and 5 with KOH solution at pH of 8, 9, 10, 11 and 12. The pH constancy was attained by means of buffer mix. All the experiments was attained by means of buffer mix. All the experiments were repeated three times. The sunflower seed hulling was carried out in the unit with constant rotor revolution of 4.000 RPM. The hulled material fractioning was conducted out of 25 g of the sample selected according to the method of diagonal division.

Results, discussion and conclusion.

Tables 1 and 2 present the experiment data on the fractioning of the hulled material.

To be more visual, the plot of yield of underhulled and whole seeds as a function of the medium pH was constructed on the bases of Table 2 data. As it follows from Curve 1 of Figs 1,2 the least amount of unhulled seeds corresponds to pH of 4, in alkaline medium to pH of 11-12, the fraction of total mass of unhulled seeds in alkaline medium being can be explained in the following way. Sunflower seed hull is composed mostly of cellulose as well as of non-cellulose admixtures : nitrogen bearing substances, pectine, mineral salts, wax and others. It is known that cellulose, the main constituent of sunflower seed hull, is polysaccharide built of elementary units of glucose. In the process of treating seeds with water solutions of acids and alkali maintaining constant humidity, cellulose swelling occurs, and non-cellulose water soluble components pass into solution to some extent. On the second stage proceeding at 135 C during 40 min. there occurs cellulose hydrolysis which, as a common knowledge, can take place in solid phase as well though much slower than in liquid phase, which leads to sugar formation according to the reaction.

The degree of hydrolysis of cellulose transformed into sugar depends on the medium pH and heat treatment time. The indirect evidence of proceeding cellulose hydrolysis is change in brittleness of sunflower seed hull and thus the quality of hulling. Penetration of water molecules through the pores of sunflower seed hull will depend on hydrogen ions and hydroxil ions mobility in case of hydrolysis proceeding in alkaline medium. Hydrogen ion mobility depending on acid concentration values

Table 1

Fractional Composition of the Hulled Material
after Treating Seeds with Acid Reagent

Hulled Material Fraction	pH							
	1		2		3		4	
	g	%	g	%	g	%	g	%
1. Whole Seeds+ undehulled material	11,0	44,0	12,5	50,0	13,75	55,0	15,0	60,0
2. Kernels	7,75	31,0	7,0	28,0	4,5	18,0	4,25	17,0
3. Chaff	2,0	8,0	1,8	7,2	2,0	8,0	1,65	6,6
4. Oil Dust	1,0	4,0	1,2	4,8	1,0	4,0	1,67	6,68
5. Hull	3,25	13,0	2,5	10,0	3,75	15,0	2,43	9,72

Table 2

Fractional Composition of the Hulled Material
after Treating Seeds with Alkaline Reagent

Hulled Material Fraction	pH							
	8		10		11		12	
	g	%	g	%	g	%	g	%
1. Whole Seeds + Underhulled material	14,0	56,0	10,25	41,0	10,5	42,0	10,0	40,0
2. Kernels	5,6	22,4	8,45	33,8	7,0	28,0	5,5	22,0
3. Chaff	1,0	4,0	1,3	5,2	2,0	8,0	3,0	12,0
4. Oil Dust	0,5	2,0	0,7	2,8	1,0	4,0	2,0	8,0
5. Hull	3,9	15,6	4,3	17,2	4,5	18,0	4,5	18,0

Tables 1 and 2 show that in acid medium at pH of 3-4 in the hulled materials the content of chaff and oil dust increases, while in alkaline medium similar results are seen at pH of 11-12.

are taken from the reference book (4) and presented in Fig. 3. As it follows from the figure, hydrogen ion mobility increases up to the concentration of 0.1 mol/l, in terms of pH 3-4, which agrees with the data of Figs 1,2. From Fig. 2 it also follows that at pH of 11-12 the number of unhulled seeds decreases sharply and thus hydrolysis proceeds more profoundly. It can be accounted by the fact that in alkaline medium with high enough pH value wax in sunflower seed hulls is generally washed out, thus swelling and hydrolysis proceed more intensively.

On the basis of the study conducted one can draw the following conclusions :

1. In the process of moist and heat treatment of sunflower seeds optimal value of the solution pH is 3-4 in acid medium, 11-12 in alkaline medium.
2. Moist and heat treatment in acid medium leads to hydrolysis of hull more brittle.
3. In alkaline medium, alongside with hydrolysis, wash-out of wax in the hulls takes place which leads to better results in comparison to acid solution treatment.

Bibliography

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Fig. 1. Fraction of total mass of underhulled seeds, whole seeds and kernels in the hulled sunflower seed material after its treating with electrolyte solution in alkaline medium 1 - changes in fraction of total mass of whole seeds and underhulled seeds, 2 - changes in fraction of total mass of whole kernels.

Fig. 2. Fraction of total mass of underhulled seeds, whole seeds and kernels in hulled sunflower seed material after its treating with electrolyte solution in acid medium 1 - changes in fraction of total mass of whole seeds and underhulled seeds ; 2 - changes in fraction of total mass of whole kernels.

Fig. 3. Relation between hydrogen ion mobility and HCl solution concentration.