УНИВЕРСИТЕТ ПО ХРАНИТЕЛНИ ТЕХНОЛОГИИ - ПЛОВДИВ

UNIVERSITY OF FOOD TECHNOLOGIES - PLOVDIV


SCIENTIFIC WORKS
Volume LV, Issue 1
Plovdiv, October 24-25, 2008

НАУЧНА КОНФЕРЕНЦИЯ С МЕЖДУНАРОДНО УЧАСТИЕ

# "ХРАНИТЕЛНА НАУКА, ТЕХНИКА И ТЕХНОЛОГИИ 2008"

# 'FOOD SCIENCE, ENGINEERING AND TECHNOLOGIES 2008'

## НАУЧНИ ТРУДОВЕ

Том LV, Свитък 1

Пловдив, 24 - 25 октомври 2008

# Innovation in use of food fibers as components of biologically active additives

**Natalya Cherno, Galina Krusir**

*Biologically active additives worked out with the help of methods of immobilization are designed to be used when different infringements of digestion accompanied by enzymatic insufficiency or superfluous quantity of enzymes take place. Compositions of such a kind are new physiologically active preparations of food fibers of the second generation.*

In a list of urgent steps to optimize food working out and introduction of foodstuffs of directed action in its sphere occupy an important position. These working out and introduction enable to correct rations correspondingly to individual features of a human being organism, take into account and soften influence of anthropogenic factors. They are different radio protectors, antioxidants, vegetative protein enriches, food fibers. The last ones reduce the risk of various diseases of the century, including diabetes, cholecystitis, colitis, cancer of thick intestine etc.

Food fibers are the complex of biopolymers of vegetative cell walls: hemicelluloses, cellulose, pectin matter, lignin which are steady to the action of alimentary enzymes of a human being organism [1]. Nowadays it`s obvious that use of refined products doesn`t correspond to physiological process or reprocessing and digestion of food which was formed within evolution process [2]. Lack of food fibers in food results in infringement of exchange of substances and is the factor of a risk, which may result in development of various diseases [3].

Physiological effects of food fibers of a food allowance are various and include: suppression of appetite and acquisition of a saturation feeling, decrease of energy consumption, increase of excretion of bilious acids and decrease of a cholesterol level in blood, increase of mass and thinning out of contents of a thick intestine, acceleration of intestinal passage, change of metabolism of micro flora, change of adsorption of nutrilits etc [4].

As it became obvious after researches traditional rations of food can`t ensure use of food fibers on the level of normative standards ( 40 ... 70 g per day). It`s quite necessary to enrich food additionally by this component, whose deficit is on average 50%. It corresponds to 20 ... 35 g of food fibers daily. Nevertheless it's impossible to ensure this way optimal quantity of food fibers in the ration without substantial increase of caloric content of the ration [5].

The technology of acquisition of concentrates of food fibers from different traditional and non-traditional sources of raw material was developed in Odessa National Academy of Food Technologies [6]. High adsorption characteristics of the concentrates of the food fibers, developed surface plus sufficient penetrability for enzymes and substrates, biological inactivity of the concentrates of the food fibers enable to consider perspectives of the food fibers use to be matrixes to immobilize enzymes and other biologically active substances, particularly speaking, hydrolytic enzymes and their inhibitory agents of vegetable origin.

Because of insufficient quantity of organic raw material and possible pathogenicity of microbic producer of biologically active substances, vegetable raw material deprived of above – mentioned defects becomes more and more necessary as a source of enzymes. Besides this vegetable enzymes don't lead to oppression while creating its own enzymes by the organism. They are also capable to function in an acidic environment of the stomach. Concerning the level of enzymatic activity vegetable ferments sometimes exceed organic and microbes analogue, have less toxicity, allergenic potential, consist of a number of useful corresponding biologically active components of polysaccharide, lipide, pigmental and other nature.

Nevertheless there is a problem of activation and stabilization of enzymatic activity. Immobilization of enzymes on the natural carrier is the effective method of it.

Taking into account experience of many years in the field of studying enzymes of microbes organic and vegetable origin, researches take place to explain theoretically appropriateness of creation of series biologically active additives in combination with enzymatic systems in ONAFT. Biologically active additives also combine inhibitors of proteolytic amylolytic and lipolytic enzymes, solvable and unsolvable food fibers used as carriers to immobilize biologically active substances. The researches of their physical – chemical, biochemical characteristics and introduction of working outs in practical manufacturing also take place here.

Biologically active additives worked out with the help of methods of immobilization are designed to be used when different infringements of digestion accompanied by enzymatic insufficiency or superfluous quantity of enzymes take place.

Compositions of such a kind are new physiologically active preparations of food fibers of the second generation.

**Materials and Methods**

Different methods of immobilization of biologically active substances on the food fibers are worked out to create biologically active additives showing considerable enzymatic activities: physical methods of immobilization ( adsorption and method of soaking of the carrier by the solution of biologically active substance ), immobilization by the method of soaking in the solution of polyethylene oxide with the further fixation with the help of gamma – irradiation, microencapsulation of biologically active substance with the use of sodium salt of carboxymethylcellulose, agar-agar, pectin, carrageen extract, hemicelluloses which enable to create preparations with high stability of enzyme component and high amylolytic, proteolytic and lipolytic activities.

Wheaten chop off and food fibers of wheaten chop off, food fibers of husking bran of oat, powders of dried up vegetables, fruits and others were used as matrixes to immobilize biologically active substances.

**Results and Discussion**

Optimal conditions of immobilization are selected: weight ratio a carrier : enzyme, water duty, time of incubation and temperature of environment.

Optimal concerning a level of conservation of proteinase activity of proteinase complex of Lucerne weight ratio of a carrier: enzyme are presented in table 1.

With the help of the results presented it becomes obvious that use, for example, of wheaten chop off as a carrier results in increase of conservation of proteolytic activity.

It is also shown that when there is immobilization on the food fibers a spectrum of

physical – chemical features of enzymes ( pH and thermal precipitator, pH and thermal stability), stability increases connected to contents of the stomach, a prolonged character of actions of the enzymes immobilized on the food fibers during the experiments in vivo and in vitro is defined.

Table 1

Optimal weight ratio of a carrier : enzyme

| carrier | weight ratio of a carrier: proteolytic enzyme | conservation of activity, % from maximum |
|---|---|---|
| wheaten sowing | 1 : 1.5 | 88.4 |
| food fibre of wheaten sowing | 1 : 2 | 70.5 |

Dependence of conservation of initial activities of immobilized preparations on biopolymer contents and structural characteristics of the surface of the food fibers is revealed. This dependence enables to recommend optimal contents of the food fibers to create enzymetic preparations which are characterized by the maximum conservation of the initial enzymetic activities.

Kinetic parameters of hydrolysis of casein by native and immobilized forms of enzymes are studied. Increase of K in case of immobilized preparations is explained by decrease of affinity of an enzyme to the substance. That's natural for immobilized preparations which are characterized by difficult diffusion to the substratum. It's also can be explained by the electro negativity of the matrix.

Increase of K when immobilization takes place, means that to get the necessary speed of reaction much more concentration of the substratum than for the native enzyme is required. Probably that's so because of conformational difference of immobilized preparation compared to the native one.

Decrease of V max explained by terms of heterogenous catalysis of high molecular substratum was watched for immobilized preparations practically in all cases.

Sorption features of immobilized preparations concerning cholic acid, ions of lead are searched. The characteristics of their water – retaining ability is also presented.

It's defined that sorption ability of concentrates of the food fibers isn't reduced while they are being modified with the help of enzymes. It enables to consider perspectives of use of the enzymes as enteroscopes.

Scientific grounds of manufacturing technologies for food fibers modified by the enzymes are worked out. Technological processes and their modes enable to ensure a line character of manufacturing. The technology is approved in industrial conditions.

Biologically active substances worked out and stabilized by fiber carriers are biologically active additives of poly functional action. On the one hand they are enteroscopes and ensure detoxication influence on a human being organism, on the other hand they possess physiological activity with the spectrum of actions similar to the enzymes and their inhibitors of vegetable origin.

REFERENCES


1. Черно Н.К. Пищевые волокна: состав, свойства, технология производства. Дисс... докт. техн. наук, Одесса. 1990.- 506 с.
2. Черно Н.К., Адамовская К.Д., Лобоцкая Л.Л. Полисахарид-лигнинные комплексы нетрадиционного для пищевой промышленности сырья и их свойства // Химия древесины. – 1991. – N 3. – С. 75–78.
3. Дудкин М.С., Казанская И.С., Черно Н.К. Определение содержания пищевых волокон и их компонентов в пшеничных и ржаных отрубях // Вопросы питания. – 1988. – N 1. – С. 66–67.
4. Черно Н.К. Пищевые волокна. Прогнозирование некоторых физиологических эффектов / Тез. докл. респ. науч. конф. «Химия, медико-биологическая оценка и использование пищевых волокон».- Одесса.- 1988.- С. 4–5.
5. Пищевые волокна / М.С. Дудкин, Н.К. Черно, И.С. Казанская и др. – Киев: Урожай, 1988. – 149 с.
6. Черно Н.К., Крусир Г.В. Кислотно – основные и ионообменные свойства пищевых волокон // Прикладная биохимия и микробиология. – 1992.- т. 28, вып. 2, N 3. – С. 297–303.