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CONSIDERATION OF POSSIBILITY TO PURIFY USED BRINE ON TUBULAR CERAMIC MEMBRANE ELEMENTS

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Processing of secondary raw material resources resulting from making fish products, namely, used brine after salting fish is a live issue nowadays. Annual overall volume of used fish brine is 432700 m^3 and the losses of drinking water and boiled salt from that brine comprise 480500 m^3 and 77000 ton respectively. Its purification with the aim of recycling will increase efficiency of processing secondary raw material resources, cut manufacturing expenses and at the same time will allow to reduce anthropogenic pollution of the environment by cutting dumping of used brine.

Technology for purification of used fish brines was developed in the 1980-s. It is based on pressure driven membrane separation process i.e. ultrafiltration using fluoroplastic membranes F 1 Nowadays, since the advent of inorganic membrane elements characterized by length of service and higher capacity in terms of filtrate, compared to polymeric membranes, further development of brine membrane purification is becoming more feasible.

In 2009 VNIRO has studied a possibility in principle to purify used fish brine after salting herring using ultrafiltering tubular ceramic membrane elements CeRAM INSIDE® which have MWCO equal to 300 and 15 kD. Filtration is performed in a crossflow mode at following parameters: temperature of used brine is 20 – 25 ºC, flow-rate in membrane channel is 5 m/sec at different values of operational pressure. During the tests we defined specific capacity and average capacity of membrane elements with respect to filtrate, as well as peak duration of purification. Moreover, selectivity of membrane elements was studied in terms of solids including lipids, proteins and ashes.

Initially, an optimal membrane element for purification of used brines was selected and after that preliminary parameters of purification process were defined. At that, as results of experiments with used brine, samples of concentrates and filtrates were obtained; besides, the latter were homogeneous transparent light-yellow liquids with characteristic fish odor. During selection it was discovered that application of membrane element with MWCO value 15 kD is inexpedient due to small yield of purified brine (19.8%), insignificant average capacity (24.7 l/m^2 h) and duration of purification process that comprised 2 hours. Technological characteristics of membrane elements with MWCO value 300 kD are favourably compared with the above mentioned: average capacity with respect to filtrate has comprised 75.9 $1/m^2$ h at process duration 3 hours and 91% yield. It was established that it has low selectivity in terms of boiled salt (55%) and overall concentration of salt in purified brine is 12.7% from 13.7% of total

concentration of solids. Considering harmless microbiological index of the obtained brine, use of membrane element with MWCO value 300 kD was accepted expedient for purification of used brine.

During selection of purification mode the experiments on ultrafiltration of brine were conducted at different values of average capacity of the selected membranes in terms of filtrate. The following approximate parameters of used brine purification were established from the experiments: constant average capacity with respect to filtrate is 60 l/m^2 h, variation of operation pressure is from 0.05 MPa to 0.55 MPa at temperature 22 – 25 ºC and flow rate 5m/sec. They ensure expansion of purification cycle from 3 to 3.5 hours with 84% yield value. At that, the purified brine remains with high concentration of salt (11.5%) and it meets the requirements of sanitary regulations and SanPiN 2.3.2.1078-01 in terms of safety microbiological index and can be reused.

Based on the conducted experiments, the production procedures were developed for purification of brine using ultrafiltration at salters.

DEVELOPMENT OF BIOLOGICALLY ACTIVE FOOD ADDITIVE TECHNOLOGY "CRAB OIL"

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Commercial crab is principally a source of raw material for obtaining valuable crab meat. The yield of meat amounts to 25% of the total crab weight; firm wastes (carapace containing residues) and liquid ones, i. e liver (hepatopancreas) reach 75%.

Liquid wastes are proved to be valuable raw material for obtaining crab oil which is a rich source of unique compounds of lipid nature (alkoxyglycerides), polyunsaturated fatty acids (PUFA) – ω^3, fat-soluble vitamins A, D.

For elaborating the method for obtaining crab oil the liver (hepatopancreas) was studied by its chemical composition, microbiological and parasitological indices, as well as by the characteristics of food safety aimed at obtaining crab oil. The result of investigations has shown a high percentage of oil (up to 26%). It was defined by the microbiological, parasitological, toxic indices that the crab liver were in agreement with the requirements SanPiN 2.3.2.1078-01 imposed upon the liver of hydrobionts and can be used for obtaining crab oil.

A method for obtaining crab oil from commercial crab frozen liver (hepatopancreas) was developed at VNIRO in two stages (Patent Nr. 2390274).

At the first stage some 60% of oil from the initial oil content into the raw material is released. Frozen liver is crushed, adding 3% of salt, mixed and heated up to 55 ºC. Two hours later the mixture is cooled and settled, the upper layer of oil is decanted and the left bulk is centrifuged, while the oil is poured out.

At the second stage the remainder matter, where there is some 40% of oil left, is extracted by means of isopropyl alcohol in the ratio of 1:3, respectively, at thorough mixing for an hour and is settled and the resulting extract is filtered. It is liberated from isopropyl alcohol. After both stages the oil is mixed and cleared.

After being separated the oil is to meet the SanPiN requirements 2.3.2.1078-01 imposed upon the oil used for obtaining biologically active food additives. The resultant crab oil was studied for fatty acid and fraction composition which showed that the crab liver lipids were rich in biologically active substances and contain PFA ω^3 content up to 20.0 mg/g; alkoxyglycerides up to 160 mg/g; vitamin A up to 0.16 mg/g and vitamin D up to 1.6 mcg/g.

Thus, the crab oil obtained from crab liver is proved to be valuable and unique raw material for the production of biologically active food additive "Crab meat". Scientific and technical documentation was worked out for this additive and a certificate was obtained on the state registration of this additive, as well as a sanitary and epidemiological conclusion on the documentation.