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Use of round goby (*Neogobius melanostomus*) processing waste in bioeconomy

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Abstract

Round goby (*Neogobius melanostomus*) in Baltic Sea is an invasive species, which over the past decade spreads rapidly. Round goby was indirectly introduced from Black or Caspian Sea. During these years catch reaches several thousand tons. Fishermans acquire these fish sourcing but appears problems with implementation. The development plan of Latvia establish to use these species of fish for human consumption and that is why in research have been considered possibility of fish processing residue (internal organs, head, bones etc.). In accordance to bioeconomic principles, processing waste is considered to be raw material for the production of high added value products. Evaluating the use of round goby processing waste from the economic and technical viewpoint in the context of Latvia we examine the extraction of fish oil. During the research fish's total amount lipids has been determined while using Bligh/Dyer method. The oil has several quality indicators – amount of free fatty acids, acid value and saponification value. Content of protein, moisture, ashes and carbohydrates in the fish has been determined. Round goby's head consists of 81.18 ± 1.10 % water, 4.24 ± 0.10 % ash 1.00 ± 0.13 % fat, 16.60 ± 0.40 % protein, 0.0 ± 1.00 % carbohydrates. The body consists of 83.68 ± 12.86 % water, 3.75 ± 0.01 % ash, 0.67 ± 0.07 % fat, 16.60 ± 0.40 % protein, and 0 ± 1.00 % carbohydrates. While assessing production capabilities, attempts were made to obtain oil through heat extraction and microwave extraction methods. After numerous applications of centrifugation using the heat extraction method fish gelatin was acquired, there were no findings of oil in the upper part of the liquid layer. Similar results were obtained using the microwave extraction.

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Keywords: fish; extraction; fish oil; bio-products; high–value products

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1. Introduction

Round goby (*Neogobius melanostomus*) is indirectly way introduced from Black or Caspian Sea. Round goby first time in Baltic Sea recognized in Poland, Gdansk by approximately in 1991. First time in Latvia this fish recognized approximately in 2004 in Liepaja coast. Fish prevalence repeatedly investigated in scientific literature. Average fish prevalence speed is about 30 km per year. Currently round goby are in all coast of Latvia. In addition, species spread also provides in fresh-water [1−7].

Exploring the reasons for the spread of fish determined that mostly impact is from human activity. One of the main reason for spread is sailing and human activity near coast. These fish species easily adapts surrounding conditions and in imported place they continue feed and reproduce. Therefore changes the current environment, food cycle and species of fish population. Viewing fresh − water goby prevalence in fresh-water concluded that zander changes food chain becoming aggressive. Bigger zanders eat small ones about 1.2 %−7.7 % often. It is related with lack of traditional feed. Similar tendency expected in result of round goby prevalence. Observed that turbot population in the sea now is decreasing rapidly – even twice. Number of fish and nutrition tendency should continue to research to fully understand the situation [4−11].

Fish processing residues makes approximately 60 % of fish total weight. In the last years researches are trying to understand what kind of high added value product could be made from this processing residues. One of version is obtaining industrial enzymes. They are obtained from fish internal organs which constitute average 5 % from fish total weight. Obtained trypsin from other species of fish keeps activity in alkaline environment at approximately 50 °C−60 °C temperature and catalyze the chemical reaction. This kind of enzyme could be used as washer for clothing, as skin treatment, for food processing, in chemical industry and in many other processes [9−15].

To improve quality of animal food and quantity of valuable essential amino acids can produce fish protein hydrolasate. In that way could significantly improve the nutritional value of fish meal. Amino acids concentration in hydrolasate could double [16].

Biofuel producing from fish oil are known last 20 years but now people are researching to get higher quality material and solving storage and logistics problems. By the fuel processing it is possible to obtain biofuel which accord American Society for Testing and Materials (ASTM) standard requirements [14−19].

Fish processing residues could be raw material for cosmetic products for example for sun tan cream, face cream or serum which accelerates wound healing [17−21].

In non-food industry fish oil can use for lubricant, washing products, pesticides, fungicides, polyurethane foam and many other products production. From bio-economy perspective are researches how to get fish oil from processing residue. In this case main important thing is quality of oil and Omega 3 unsaturated fatty acid composition [21−23].

2. Methodology

2.1. Material preparation

For the laboratorial research round goby is used, caught on April 5, 2017 at 12:00 on the coast of the Baltic Sea (coordinates: 56,516325; 20,946526). Fishing nets where employed. This specific day is considered to be the first day when round goby appeared on the coast of the Baltic Sea. Fishing for the round goby was initiated. The experiment began after approximately 40 h.

The average length of the fish is 19.53 ± 0.05 cm. ¼ of the length of the body is the head. Fish's body weighs 77.46 g ± 2.00 g, however the head weighs 20.83 g ± 2.00 g. For further research the body and the head are used separately. In this experiment the internal organs are removed and discarded.

Homogenisation is done before acquiring the oil. Prior to homogenisation the fish specimen is rinsed under running cold water. Blender is used for the homogenisation process, maximum power output 750 W. The fish heads are diced to fractions of 1– 2.5 mm on average. Before homogenisation the rest of the fish's body is mixed with distilled water (ratio of 1:5) and diced until 0.2–0.7 fraction size.