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## Effect of modified atmosphere packaging on the shelf-life of common carp (*Cyprinus carpio*) steaks

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### Abstract

The effect of modified atmosphere packaging (MAP 1: 40%CO<sub>2</sub>+60%N<sub>2</sub> and MAP 2: 100%CO<sub>2</sub>) on the shelf-life of carp steaks was studied. Carp steaks were stored at +3±0.5°C and on days 1, 3, 6, 9, 13 and 15, microbiological, chemical and sensory testing was performed. Based primarily on odour scores it was observed that carp steaks packaged in MAP1 remained acceptable up to 13 days of storage, while carp steaks packaged in MAP2 remained unchanged until the end of the study. By using MAP, especially 100% CO<sub>2</sub>, products shelf-life can be significantly prolonged.

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### 1. Introduction

The fish and fish products market is growing rapidly worldwide. One of the consumer demands is that fish entering the retail chain is deboned and ready for fast cooking<sup>1</sup>. Shelf-life of fresh chilled fish can be extended by

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packaging in vacuum or in modified atmosphere (MAP). Modified atmosphere packaging is achieved by removing air from the packaging unit and filling with a single gas or mixture of gasses. Gaseous mixtures with high carbon dioxide (CO<sub>2</sub>) and nitrogen (N<sub>2</sub>) concentrations were the most commonly studied by numerous researchers in the field of fish packaging in the last decade. However, modified atmosphere packaging of fish is not present on the Serbian market. The aim of this research was to monitor the changes in microbiological, chemical and sensory parameters in common carp (*Cyprinus carpio*) steaks packed in modified atmosphere during the 15 days of storage.

## 2. Materials and methods

In this study, two year old marketable carp (*Cyprinus carpio*) of average body weight of 2.5 kg were used. Carp originated from a fishpond where semi-intensive farming was used. Carp were transported live to the fish slaughtering and processing facility, where they were stunned, slaughtered, scaled, and carcasses were cut into steaks 2 cm thick. Two sample groups of carp steaks were formed and packaged in modified atmospheres with different gas ratios: MAP1: 40%CO<sub>2</sub>+60%N<sub>2</sub> (I group) and MAP2: 100%CO<sub>2</sub> (II group). The machine used for packaging the carp steaks was Variovac (Variovac Primus, Zarrentin, Germany), and the packaging material was foil OPA/EVOH/PE (oriented polyamide/ethylene vinyl alcohol/polyethylene, Dynopack, Polimoon, Kristiansand, Norway) with low gas permeability (degree of permeability for O<sub>2</sub> – 3.2 cm<sup>3</sup>/m<sup>2</sup>/day at 23°C, for N<sub>2</sub> - 1 cm<sup>3</sup>/m<sup>2</sup>/day at 23°C, for CO<sub>2</sub> – 14 cm<sup>3</sup>/m<sup>2</sup>/day at 23°C and for steam 15 g/m<sup>2</sup>/day at 38°C). The ratio gas : fish steak in the package was 2:1. All samples were stored in the same conditions at 3±0.5°C and on days 1, 3, 6, 9, 13 and 15 of storage, microbiological, chemical and sensory testing was performed.

### 2.1. Microbiological analyses

Total viable count (TVC) was determined according to ISO 4833 -2:2003 (PCA Merck, Germany). Number of bacteria of the family *Enterobacteriaceae* was determined according to ISO 21528 -2:2004 (VRBD Merck, Germany). All plates were examined visually for typical colony types and morphological characteristics associated with each growth medium. Microbiological data were transformed into logarithms of the number of colony-forming units: log<sub>10</sub> cfu/g.

### 2.2. Chemical analysis

Muscle pH was measured by Cyber Scan pH-510 digital pH-meter (EUTECH Instruments, Netherlands). The total volatile basic nitrogen (TVB-N) was determined using official steam distillation method according to Commission Regulation (EC) 2074/2005 and expressed as mg TVB-N/100 g.

### 2.3. Sensory evaluation

The sensory evaluation was performed by six trained panellists prior to the chemical analyses. The samples were evaluated for overall acceptability, with regard to odour, flesh colour and texture using 1-5 intensity scale, with 5 corresponding to the most liked sample and 1 corresponding to the least liked sample. Product was defined as unacceptable if it achieved a score less than 2 points by at least of 50% of the judges.

### 2.4. Statistical evaluation

Results of the analyses were statistically evaluated using one-factor analysis in the ANOVA programme (Microsoft Office Excel 2007).

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