



DEVELOPMENT OF NEW VALUE ADDED PRODUTS

LIQUID SMOKED OCTOPUS

WP6. MARKET OPPORTUNITIES

ACTION 1. NEW PRODUCTS

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DEVELOPMENT OF LIQUID SMOKED OCTOPUS (*Octopus vulgaris*)

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Abstract

The common octopus (*Octopus vulgaris*) is an excellent source of high biological value proteins, rich in vitamins A and C, as well as mineral salts. On the other hand, it is low in fat but rich in omega-3 fatty acids, which brings benefits to the cardiovascular system. This study focused on the development of a high added-value utilization of octopus, using an alternative smoking process, which involved the application of liquid smoke. Main features studied comprised, among others, the optimization of the brine concentration, conditions of immersion in liquid smoke and the optimum drying-time and temperature, as well as the evaluation of the sensory characteristics of the prepared products. The cooked octopus immersed in liquid smoke 648 BH (beech/oak) at 10 % (v/v) for 30 seconds and dried at 55 °C with 60 % humidity for 45 minutes, was shown to correspond at the desired product, achieving higher acceptability by the sensory panelist.

Introduction

Octopus (*pulpo* in Spanish and *tako* in Japanese), a staple of Mediterranean and East Asian cuisine, is now a delicacy worldwide driven by the popularity of sushi, tapas, and a desire for high-quality proteins.

According to FAO fisheries reports, much of the global catch of all octopus species (family Octopodidae) - which is around 420,000 metric tons per year - goes to large consumers in South Korea, Japan, Spain, Italy, Portugal, and, more recently, in the United States¹.

Octopus is generally sold both fresh and frozen. However, there are available in the market several types of processed / ready-to-eat products in the form of preserves. For example, octopus with garlic, octopus in olive oil, octopus in olive oil and garlic, octopus stew, octopus smoked in olive oil), lagareiro octopus² and cooked octopus. The availability of these different types of processed products is part of a generalized tendency in the food sector to diversify the offer, also responding to market trends that increasingly seek new products ready to consume, with quality and high nutritional value. Accordingly, the preparation of smoked octopus has been selected as a way to contribute to the diversification of the offer of processed products based on the octopus. The consumption of smoked octopus in the national market has no

¹ SFP, 2018. Sustainable Fisheries Partnership, 2018. T75 Sector Report: Octopus.

<https://www.sustainablefish.org/Programs/Improving-Wild-Fisheries/Seafood-Sectors-Supply-Chain-Roundtables/Octopus>

² Typical Portuguese recipe

expression, although its use can. However, in the international market, particularly in Asia, there is a wide variety of this type of product.

The processing of products with liquid smoke is an alternative to the traditional smoking method. The heat treatment applied to products subject to liquid smoke can be cold or hot smoking³. The use of liquid smoke allows the control of the concentration of smoke to be applied to the product. In comparison with the traditional smoking process, it reduces processing time, is more environmentally friendly and eliminates the presence of toxic smoke compounds (PAH compounds), while providing the desired flavors and aromas of traditional smoke. The deposition of the smoke compounds in the product is more uniform, low-cost, and easy to apply⁴.

The objective of this work was the development of a liquid smoke value-added product derived from octopus, that could be innovative in the market, tasty and safer in comparison with a product prepared using the traditional smoking process.

Materials and methods

In the different tests, octopus caught in the Atlantic coast of Portugal and purchased directly from the auction was used. The material was selected for uniformity in size and cleaned with chilled running water. Then, the octopus was steam cooked for 60 min in a steam cooker (Rational Combi-Master, model CM6).

After cooling, the octopus were cut into pieces (\pm 20cm) and proceeded to smoking according to the scheme of figure 1, in a SIMIA S1001 industrial smoker (Simia, Lda, Montijo, Portugal). The samples were smoked with two types of liquid smoke, 648 BH (beech and oak) and AFS 10 Sol (hickory and oak) (Amcan Ingrédients/Dempsey Corporation) at 10% and 20% (v/v) for 30 sec and dried at 55 °C at 60% humidity for 45 min.

Two sensory analyzes of smoked octopus were performed. In one of them by a panel of 5 trained experts and another with 73 untrained consumers, both hedonic tests for the attributes "Appearance", "Succulence", "Texture", "Aroma / Flavor" and "Overall Assessment".

Results and discussion

The results of the sensory analysis, hedonic test, for samples with different concentrations of AFS 10 Sol smoke, are shown in Figure 2.

³ Alçiçek, Z., Zencir, Ö., Çakiroğullari, G.C. and Atar, H.H., 2010. The effect of liquid smoking of anchovy (*Engraulis encrasicolus*, L. 1758) fillets on sensory, meat yield, polycyclic aromatic hydrocarbon (PAH) content, and chemical changes. *Journal of Aquatic Food Product Technology*, 19:264–273.

⁴ Lingbeck, J.M, Cordero, P., O'Bryan, C.A., Johnson, M.G., Ricke, S.C. and Crandall, P.G., 2014. Functionality of liquid smoke as an all-natural antimicrobial in food preservation. *Meat Science* 97:197–206.

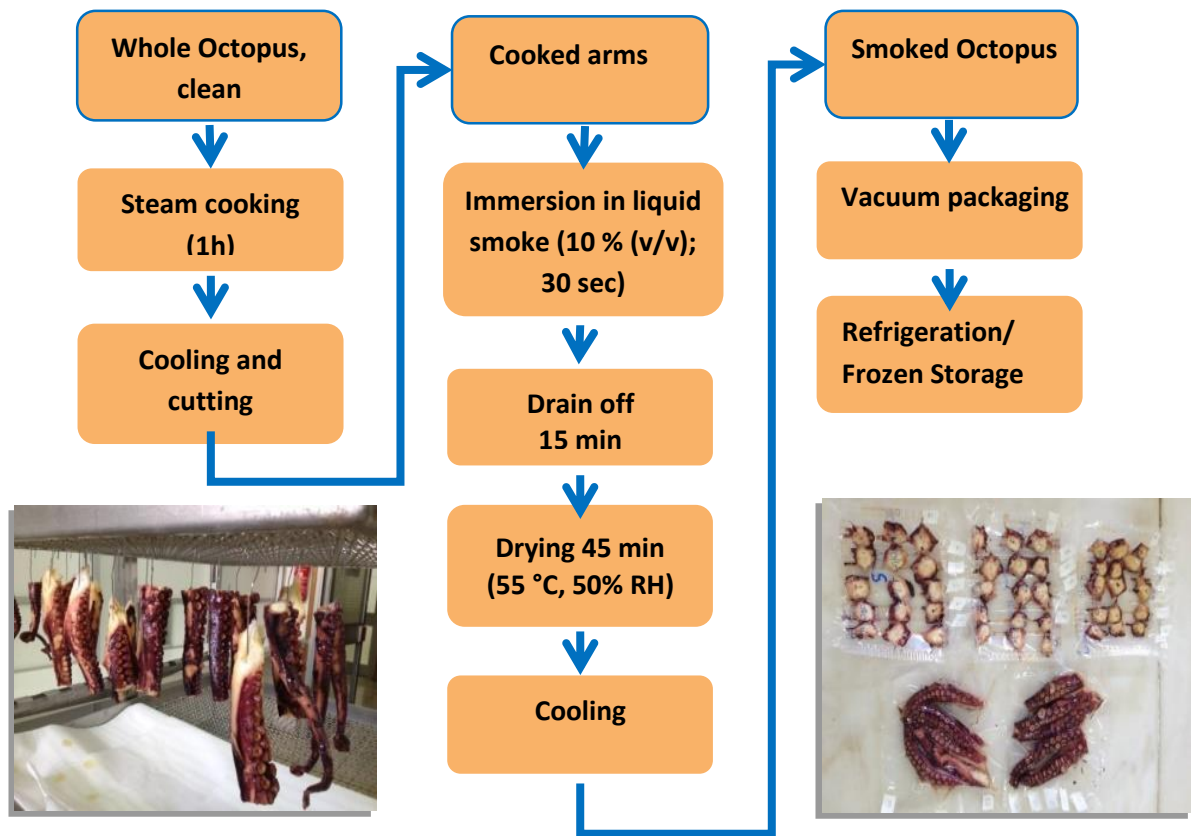


Figure 1: Smoked octopus' procedure with liquid smoke solution.

According to the panelists, the samples with the most concentrated solution (20%) had a more intense smoke smell and flavor and less overall appreciation.

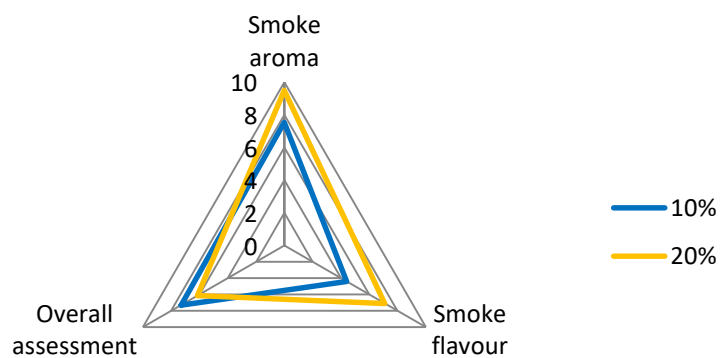


Figure 2: Results of the sensory analysis of the octopus, with an aroma of smoke (AFS 10 Sol) applied at different concentrations (n=5 panelists).

In the test using two different liquid smoke products, it has found that the product prepared with AFS 10 Sol smoke had a more intense smoke flavor and smell, but the overall assessment was similar (Figure 3). Any of the tested liquid smokes was satisfactory, although 648 BH (beech/oak) smoke made it possible to obtain products with a smoother smoke smell and flavor.

The results of the sensory analysis, hedonic test, for the final samples (drying at 55 ° C, t = 45 min and aroma 648 BH), are shown in figures 4 and 5.

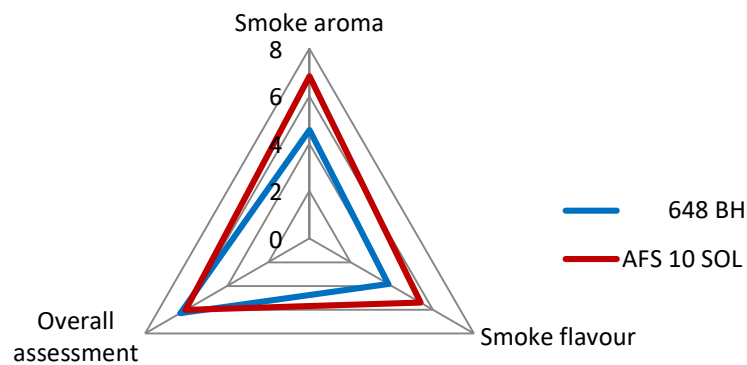


Figure 3: Results of the sensory analysis of the octopus with smoke aromas 648 BH and AFS 10 Sol (n = 5 panelists).

Sensory analysis data (Fig. 4) shows that 87% of the untrained consumers gave positive ratings (Like to Like extremely), while 5% of the answers were negative. However, 8% of panelists express indifference to this innovative product.

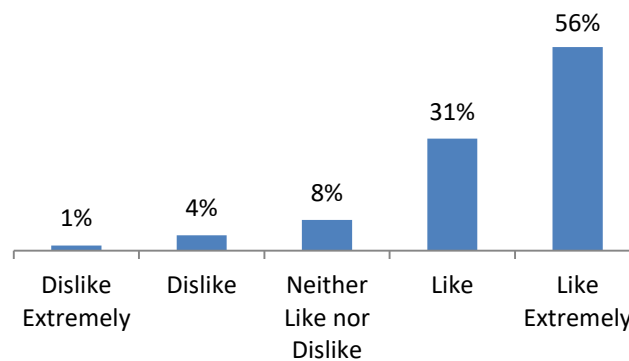


Figure 4: Sensory analysis of the final samples and their overall assessment (n = 73 panelists).

Flavor and tenderness were the most appreciated attributes (Fig. 5), while smell and juiciness were the least appreciated.

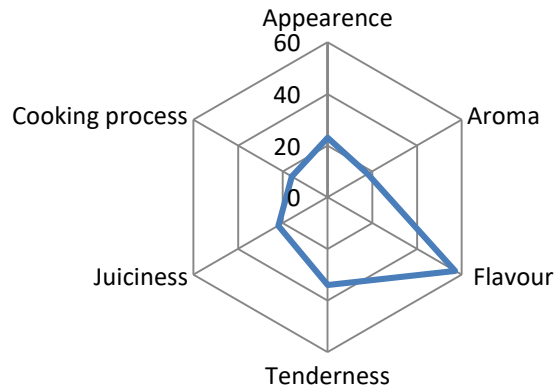


Figure 5: Number of responses to the question “What I Liked most” (n=73 panelists).

Conclusion

This study made it possible to develop a new value-added product on the market and define the optimal conditions for the concentration of smoke aroma and what is the best aroma to use to obtain smoked octopus with a high level of consumer’s acceptability. Thus, the hot smoking of cooked octopus could be an interesting alternative transformation for the development of a new and appetizing product and a suitable way to add value to this fisheries resource.