Advanced Materials Research
ISSN: 1662-8985, Vols. 1033-1034, pp 753-757
doi:10.4028/www.scientific.net/AMR.1033-1034.753

Submitted: 2014-06-11
Accepted: 2014-07-01
Online: 2014-10-01

Study on processing technology of ready-to-eat oyster retort pouch

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Keywords: oyster, ready-to-eat, seasoning

Abstract. The instant ready-to-eat oyster was prepared through hot water cooking, seasoned, dried, vacuum packed and sterilized. The optimal seasoning formula was as follows: sauce 10.0%, sugar 9.0%，vinegar 10.0%，rice wine 4.0%. The product has rich nutrition and special seafood flavor, comfortable texture and easy to eat. Ready-to-eat the oyster snack food processing technology research offered a new way to develop high value-added products and technical support.

Introduction

Oyster belongs to the mollusca, oystreidae, and has the most amount farming shellfish in the world, is also one of four major economic farming shellfish in China, others including tegillarca granosa, sinonovacula constricta and ruditapes philippinarum. At present, the annual output of the oyster breeding production of China is the highest in the world, and it reached 3.76 million tons and 3.95 million tons in 2011 and 2012 respectively, nearly accounting for 30% of the total fish breeding in China[1,2]. Oyster meat contains abundant glycogen, protein and essential amino acid, taurine, vitamins, minerals, zinc, selenium as well as trace elements having special physiological functions, also contains polyunsaturated fatty acids and a variety of enzymes, and is a kind of nutrition and delicate flavor quality of aquatic product. So it was listed the first batch dietary food of both medicine and health products by China government[3]. However, due to the oysters with high moisture content, crispness and tissue protease activity higher, the oyster preservation is difficult and length of preservation is shorter, generally no more than 1 week. This situation has greatly limited the sales of fresh oysters and oyster industry[4-7]. With the improvement of people's living standard and life rhythm speeding up, convenient instant recreational products were more and more popularity in the customers. Therefore, the oysters farmed in Zhejiang Sanmen county as raw materials were used to process instant recreational oyster food, in order to overcome the difficulties, provide consumers with sufficient, edible convenience of oyster products, and expand sales of oysters, make whole oyster industry on the benign track of healthy and sustainable development, and will be of significant economic value and social benefits.

Materials and methods

Materials

Oysters: bought in Taizhou city, Zhejiang province, aquatic product market
Other ingrdients: soy sauce, vinegar, sugar, rice wine, ginger

Equipments

Induction cooker, hot air dryer, water activity plan, vacuum packaging machine, high pressure sterilization pot

Main technological steps[3,8]

(1) Raw material pretreatment: The flowing clean water was used to wash the fresh oyster meat in order to get rid of the sediment and broken shells as well as other impurities in the oyster meat.
(2) Blanching treatment: The oyster meat was cooked in boiling water, added 3-5% of the salt and a moderate amount of ginger, it was ok when the oyster meat floated up.

(3)Determination of flavoring ingredients: The orthogonal experiment method was used to determine the flavor formula according color, aroma and taste of the products as the study object, and the soy sauce (A), sugar (B), vinegar(C), rice wine (D) were chosen as four factors, and each factor chosen three levels. The orthogonal experiment was proceeded by L9 (3^4) designed nine experimental group (Table 1). The amount of the main flavoring was screened to determine the appropriate proportion of each seasoning in order to make decisions about the composition of the product flavor formula.

Table 1 Flavoring ingredients orthogonal test factors and levels

Level	Factor			
	soy sauce(A)	sugar(B)	vinegar(C)	rice wine(D)
1	5.0	3.0	5.0	2.0
2	10.0	6.0	10.0	4.0
3	15.0	9.0	15.0	6.0

Drying

The product was dried in hot air dryer until the moisture content was around 40 ~ 50%.

Bagging and vacuum sealing

The each bag was 80 ~ 90 g product, sealed with vacuum sealing machine, and the vacuum degree of each bag was below 0.06 MPa for convenient to inspect and storage.

Sterilization

The product was sterilized in the boiling water of 100˚C for 30 minutes.

Product evaluation method[9]

The evaluation panel composed of five professional team was chosen to overall assessment the taste and color, aroma and odor of the product to conduct a comprehensive evaluation, the evaluation results were divided into four levels: poor, common, better, best, or with 1, 2, 3, 4 respectively ratings said.

Results and discussion

Formula to determine

The flavor of food in addition to odor, color, aroma and taste were also important factors to measure the quality of the product. In order to determine the best flavoring ingredients, the orthogonal test by L9 (3^4) shown in table 2, the main flavoring dosage screening, to determine the appropriate proportion of each seasoning, so as to determine the formula of seasoning.

Table 2 Determine the formula of ready-to-eat seasoning oysters

No.	soy sauce (A)	sugar (B)	vinegar (C)	rice wine (D)	evaluation			total score
					color	aroma	taste	
1	1	1	1	1	1	1	2	4
2	1	2	2	2	2	2	1	5
3	1	3	3	3	3	2	4	9
4	2	1	2	3	1	3	2	6
5	2	2	3	1	2	2	3	7
6	2	3	1	2	4	4	4	12
7	3	1	3	2	2	3	2	8
8	3	2	1	3	3	4	3	10
9	3	3	2	1	2	2	2	6
K1	18	18	26	17	6	5	7	18
K2	25	22	17	25	7	9	9	25
K3	24	27	24	25	7	9	7	24
R	7	9	9	8				

According the results showed in table 2, No. 6 test has the highest comprehensive score and the best effect. According to color, aroma, odor and comprehensive evaluation index calculated K1, K2, K3, and range R, listed in table 3.

Table 3 The corresponding factors of K1, K2 K3 and R

	Color				Flavor				Taste				Total score			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Ⅰ	6	4	8	5	5	7	9	5	7	6	9	7	18	18	26	17
II	7	7	5	8	9	8	7	9	9	7	5	7	25	22	17	25
III	7	9	9	7	9	8	7	7	7	10	9	9	24	27	24	25
R	1	5	4	3	4	1	2	2	2	4	4	2	7	9	9	8

*Soy sauce(A),sugar(B),vinegar(C),Rice wine(D)

It can be seen from table 3 that the A2B3C1D2 has the highest comprehensive evaluation. The best combination of various factors and experiment 6 A2B3C1D2 same, shows that direct comparison of the results are consistent with the calculation results. The proportion of various seasonings in No.6 test should be a better recipe. In addition, from a single color, aroma, odor evaluation calculation by K1, K2, K3, R, can be found that sugar on the color of the range biggest (R = 5, R = 4), the seasoning of color plays a decisive role, soy sauce is the key of the aroma components in seasoning (R = 4), while the sugar and vinegar (R = 4) play an important role in flavor formation. Synthesis of various factors, the ratio of ready-to-eat oyster seasoning mode is (100 with seasoning sauce, seasoning percentage, the rest to cooked sauce added).

Table 4 The optimal flavoring ingredients

Soy sauce	sugar	vinegar	Rice wine
10.0	9.0	10.0	4.0

Determination of drying temperature and drying time

The oyster meat seasoning for 4hrs was put in the oven to dry, 5 groups of different temperature and time to bake. Products by the evaluation team for its taste, color and flavor quality evaluation, comprehensive results listed in table 5.

Table 5 Influence of toast temperate and time on products quality

	Temperature(℃)	Time(h)	Color	Aroma	Taste
1	50	3	light white	tasteless	soft
2	60	3	light brown	good	harder
3	70	3	dark brown	overweight	hardest
4	50，60	2,1	pale brown	light	softer
5	60，70	2,1	brown	great	great

The results in table 5 showed that different baking temperature and time had enormous implications for the product color, aroma, taste and texture. It was better using two stage temperature baking temperature baking effect than one. Group 1 baking temperature was lower, and the oyster meat tasted softer. Group 3 set of baking temperature is higher, the oyster meat tasted harder, color was deeper. Group 5 by fractal baking temperature, moisture evaporation slowly to the surface and inside the oyster meat not hardening, moderate taste, aromatic flavor. So select group 5 components as a flavor of oyster baking temperature conditions, it can be obtained with color, aroma, taste all to taste the oyster meat product.

According to the drying test, the final drying conditions as fellows: the seasoned oyster meat was dried at 60˚C accompanied by hot air baked 2 h, then storage a night in order to disperse moisture. And then the product was baked at 70˚C for 1 h until the product moisture content reached 40 ~ 50%.

Storage test

In addition to color, aroma, taste, nutrition and other factors, the shelf life of canned food was also an important evaluation index. This process is mainly from the following several aspects: (1) Adding vinegar when seasoning penetration, makes the final product of the pH value of 4.8-5.5, and lower pH value restrained the growth of bacteria after sterilization, other microorganisms of heat resistance were weakened[10,11]. (2) After baking, the water content of the oyster meat was in 40-50%, and the water activity was between 0.90-0.93, so it was beneficial to inhibit the growth of bacteria breeding[12]. (3) Using boiling water sterilization 30 minutes, the yeast, mold, and most of the spore can be killed, at the same time the taste, flavor, color and good texture can be reserved[13] . (4) Using vacuum sealing, on the one hand, the growth of aerobic microorganisms of breeding can be inhibited, on the other hand the fat of oyster meat can also prevent oxidation. The products stored at 37˚C, the total number of colonies were determined, and the results showed that the products reached the standard.

Economic benefit of business accounting

Using oyster meat fat full of raw materials, the price of raw materials was 4 RMBYuan/kg, on the basis of 10 kg, the cost price of 40 RMBYuan, and 1160g oyster meat can be got from the raw materials, the finished product was about 540g, finished product unit price 160 RMBYuan/kg, so the income was 85 RMBYuan, the gross profit margin was 112.5%. It showed that the products had the very good economic benefit, therefore, it also offered a new way for developing and using oysters and way.

Conclusions

In this paper, the oyster meat was used to process ready-to-eat food through blanching, seasoning, drying, vacuum packaging and sterilization. The results showed that the optimal flavoring ingredients for instant oyster leisure soft canned food as fellows: soy sauce 10.0%, sugar 9.0%, vinegar 10.0%, rice wine 4.0%. This product retained the oyster original nutrition composition and its unique seafood flavor, nutritious and comfortable taste, convenient and strong market competitiveness, had good economic benefit and market prospect.

Acknowledgements

Project supported by the Zhejiang province Taizhou City Technology Bureau (20111ky1302).

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