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THE EXPERIMENT ON EXTENDING SHELF-LIFE OF WESTERN STYLE MILD HEATED MEAT PRODUCTS BY IRRADIATING ADDITIVES

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Background:

Extending shelf life is an problem demanding prompt solution, because the spoilage of meat products induce food poisoning and waste for factories and customers. Normally western style mild heated meat products is more difficult to be preserved than other products, because heating temperature may not exceed 85℃.At lower heating temperature, many microorganisms are survived in the products, so the shelf life is shortened. However, western style mild heated meat products have more tender and delicious texture, so more and more people would like to use them. Therefore,Shelf life is the critical point for developing western style meat products. in order to solve this problem, we do the comparative experiment on this topics by irradiating meat products and additives, respectively.

Objective:

In order to extend shelf life of western style mild heated meat products and solve the practical problems for meat industries and customers.

Methods:

a. Test total plate count: National standard GB4789.2-94
b. Test coliform bacteria: National standard GB4789.3-94
c. Test salmonella: National standard GB4789.4-94
d. Test shigella: National standard GB4789.5-94
e. Test staphylococcus aureus: GB4789.10-94
f. Test clostridium botulinum: GB4789.12-94

Results and Discussion:

1.The experiment on irradiating meat products directly:

Firstly three kinds of meat products (cumin beef ham, sliced ham and turkey sausage)are directly irradiated by Co^{60} γ Ray 8KGY,and then preserve at 25℃ and 37℃ in incubator, respectively. The control samples and above samples are periodic tested at the same time, according to the testing results, we gain linear regression equation. All results demonstrate: No pathogens were tested out, E.coli was negative, linear regression equation of total plate count is in table 1 and table 2.

From National hygiene standard GB 27251.1-94 of meat products, we know following data:

	Before transportation	during sales
Total plate count(cfu/g)	≤ 20000	≤ 50000
E.coli (cfu/100g)	≤ 30	≤ 30
Pathogen	No	No

According to this standard, the shelf life of above mentioned products is list in table 3.From table 3,we may find that the shelflife of meats products is longer than control. It was extended two to eight times. From these, we know that irradiation is an effective method to extend the shelf life of western style meat products.

2.The experiment on irradiating additives of meat products:

After additives of meat products are irradiated by 10KGY Co^{60} γ ray, the hygiene level of additives are lowered to total plate count less than 10 cfu/g, E.coli was negative, no pathogens are tested out .This additives are used to produce co-extrusion sausage with HACCP or GMP control in workshop, final products are incubated at 25℃ and 37℃,periodic test them. Total results demonstrate: E.coli was negative, no pathogen are tested out. Linear regression equation of total plate count are listed in table 4.Because microbiological level of control sample already exceed standard level, which are tested in second day, we can not get the equation. According to national standard, shelflife of this products is listed in table 5.Although from microbiological view and by mathematics method ,the shelf-life of this three kinds of products may exceed two years, we should consider chemical-physical property, palatability and package material moisture transmission rate of products. So the exact time should be decided by further test.

In 1997,National standard GB14891.1-1997 for meat products and National hygiene standard GB14891.4-1997 for spices are made public. The average maximum doses for meat products is defined at 8KGY,for spices is at 10KGY.All the doses used in our

experiment do not exceed this standard.
From above two experiments, we know not only irradiating meat products, but also irradiating additives may be used to extend shelf life from 6 days to two years. Compare to this two methods, second one is better than first one, from psychological idea, customer is easy to use second one, because the volume for irradiating is much lower. From the point of serviceability, irradiating meat products need much higher technology. From economic, the volume and weight of final products is smaller and lighter,.So, transportation and irradiation fee is lower. However, the control level of factory should be high enough.

Conclusion:

Irradiating additives by Co^{60} γ ray to extend the shelflife of mild heated meat products is an effective and practical way. Maximum doses is 10 KGY.

Pertinent literature:

1.Food design by hurdle technology and HACCP 1994 L.Leistner
2.Food preservation by combined processes 1994 L.Leistner
3.Further development in the utilization of hurdle technology for food preservation 1994 L.Leistner

Data:

Table1 Total plate count linear regression equation for three kinds of irradiated meat products kept in 37℃

Meat products	Methods	Linear regression equation	Interrelation coefficient	Free degree	$T_{0.01}$ test
Cumin beef ham	irradiation	Y=-0.812+0.66x	92.88%	8	$T=7.088>t_{(1.8)}=3.359$
	control	Y =-5.116+0.59x	96.25%	3	$T=13.077>t_{(1.3)}=5.841$
Sliced ham	irradiation	Y=-0.741+0.63x	92.24%	8	$T=6.755>t_{(1.8)}=3.359$
	control	Y =3.970+0.64x	98.22%	4	$T=39.366>t_{(1.4)}=4.604$
Turkey sausage	irradiation	Y=-0.847+0.65x	95.95%	8	$T=9.636>t_{(1.8)}=3.359$
	control	Y=2.610+0.53x	97.10%	6	$T=29.5>t_{(1.8)}=4.032$

Table2 Total plate count linear regression equation for three kinds of irradiated meat products kept in 25℃

Meat products	Methods	Linear regression equation	Interrelation coefficient	Free degree	$T_{0.01}$ test
Cumin beef ham	irradiation	Y=-0.21+0.51x	99.00%	6	$T=99.497>t_{(1.6)}=3.707$
	control	Y =5.14+0.15x	96.31%	6	$T=26.605>t_{(1.6)}=3.707$
Sliced ham	irradiation	Y=-0.25+0.46x	97.49%	6	$T=39.334>t_{(1.6)}=3.707$
	control	Y =4.23+0.17x	99.44%	6	$T=177.571>t_{(1.6)}=3.707$
Turkey sausage	irradiation	Y=-0.29+0.47x	97.90%	6	$T=47.113>t_{(1.6)}=3.707$
	control	Y=2.93+0.24x	99.45%	6	$T=181.313>t_{(1.6)}=3.707$

Table3 the shelf life of three kinds of meat products kept in 37℃ and 25℃ (days)

T℃ \ samples	Cumin beef ham		Sliced ham		Turkey sausage	
	irradiation	control	irradiation	control	irradiation	control
37℃	8	1	9	2	9	3
25℃	10	2	12	2	12	6

Table4 Total plate count linear regression equation for co-extrusion sausage kept in 25℃ and 37 ℃

Temperature	Linear regression equation	Interrelation coefficient	Free degree	$T_{0.01}$ test
37℃	Y=-90.45+2.50x	96.29%	11	$T=39.6800>t_{(1.11)}=3.106$
25℃	Y=-43.23+0.95x	90.00%	11	$T=14.2100>t_{(1.11)}=3.106$

Table5 The shelf life of co-extrusion sausage added in irradiated additives (days)

T℃ \ Samples	Samples (additives are irradiated)	Control
37℃	730	20
25℃	730	20