

# THE PREPARATION AND QUALITY EVALUATION OF SAUSAGE IN WHICH FAT REPLACED BY LARD MODIFIED DIGLYCERIDE

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**Abstract** – The functional low-fat sausage was prepared by replacing the fat to lard modified diglyceride (DG). After substitution, the quality of the sausage was measured by texture analyzer and the content of the 1, 3 – diglyceride (1, 3 - DG) in the sausage was measured by high performance liquid chromatograph (HPLC). The results showed that, when the substitution amount of the fat was 60%, the hardness of the sausage was moderate, the springiness and chewiness were better, and the 1, 3 - DG content could reach to 30%.

**Key Words** –1, 3 - DG, low-fat sausage, texture.

## I. INTRODUCTION

Sausage mainly produced through the process of knifing, chopping, filling, sterilization, cooling and packaging etc. The main function of fat in sausage products was to provide exquisite taste and strengthen the meat juiciness and water retention. Simply decreased the fat content in food will change the flavor, texture and taste. At present, there had been a lot of low fat sausages prepared with fat replaced by starch, protein, carrageenan etc. But the sausage prepared with fat replaced by functional oil was less reported.

DG had two isomers: 1, 3 - DG and 1, 2 - diglyceride (1, 2 - DG), and mainly existed in the form of 1, 3 - DG in most natural oils and synthetic DG [1]. 1, 3 - DG was generally recognized as safe, and had been used in cake, meat, drink and other foods [2]. 1, 3 - DG had similar color, flavor and taste with triglyceride (TG), but had many functions such as fall hematic fat, control weight and quickly absorbed etc [3]. This experiment was to prepare the sausage with fat replaced by lard modified DG under the condition without changing the fat content, to increase the content of 1, 3 - DG, and to prepare a new type of DG - enriched sausage.

## II. MATERIALS AND METHODS

Lard modified diglyceride was homemade in the laboratory. Pork, casing and other condiments were bought from a local supermarket. All organic reagents were purchased from Thermo Fisher Scientific Co. Ltd.

The fat and lean were cut apart and mixed according to a certain ratio, then soused, chipped, chopped, filled, stewed and cooled to obtain the sausage. The basic formula of the sausage: fat/lean ratio was 1:3, salt 2.5%, sugar 0.5%, monosodium glutamate 0.05% anise powder 0.1%, ginger powder 0.2%, white ground pepper 0.2%, sauce 0.5%, soybean isolated protein 2%, wine 2%, red yeast rice 0.12%, ice water 30%. The DG - enriched sausage was prepared by replace the fat of the basic formula of the sausage to fat modified diglyceride with different substitution amounts (20%, 40%, 60%, 80%, 100%).

The quality of the sausage was measured by TA.XT Plus texture analyzer with TPA pattern. The type of the probe was P-36R. The speed of the probe before test, under test and after test was 2.0 mm/s, 1.0 mm/s and 5.0 mm/s respectively. The compression ratio was 50% and the trigger force was 5 g. The content of the 1, 3 - DG in the sausage was measured by HPLC. The sausage was soaked in petroleum ether overnight, filtered to obtain the filtrate, then boiled away the solvent in the rotary evaporation apparatus, finally dissolved in mobile phase for HPLC analysis. HPLC conditions: Waters system, Waters 2414 detector, Luna silica C18 column (5  $\mu$ m, 250 $\times$ 4.6 mm, Phenomenex), mobile phase (n-hexane: isopropanol = 15:1), flow rate was 1 mL/min, constant – gradient for sample injection, injection volume was 10  $\mu$ L, column temperature was 35  $^{\circ}$ C, sample : mobile phase = 1:9. The content of the 1, 3 – DG was calculated by area normalization method.

### III. RESULTS AND DISCUSSION

The effect of lard modified DG substitution amount on the texture of the sausage was showed in Table 1. As revealed in Table 1, with the increase of substitution amount, the hardness of the sausage was gradually decrease, the springiness, cohesiveness, gumminess, chewiness and resilience of the sausage were first increase and then decrease. When the substitution amount was 60%, the hardness was moderate, the springiness and chewiness were up to the maximum value, the meat was tight, the oil leak was little, and the slice ability was better. Comprehensive consideration, the effect was best when the substitution amount of lard modified DG was 60%.

Table 1 The effect of lard modified DG substitution amount on the texture of the sausage

Indexs	Substitution amounts (%)					
	0 (basic)	20	40	60	80	100
Hardness(g)	4945.31±69.32	4679.182±211.12	4157.773±124.29	3376.433±87.46	3063.77±135.28	2700.907±166.35
Adhesiveness	-6.571±1.062	-11.738±3.136	-2.115±0.137	-3.936±0.618	-0.636±0.024	-8.543±0.857
Springiness	0.801±0.024	0.826±0.013	0.842±0.049	0.876±0.028	0.843±0.047	0.804±0.036
Cohesiveness	0.365±0.011	0.371±0.008	0.552±0.014	0.721±0.009	0.475±0.011	0.501±0.012
Gumminess	1897.029±120.773	1736.545±93.281	2296.937±114.526	2432.895±136.491	1456.815±79.734	1352.635±86.295
Chewiness	1519.084±127.125	1434.823±111.764	1933.919±96.864	2132.275±144.460	1124.191±59.364	1087.66±87.357
Resilience	0.133±0.011	0.134±0.006	0.197±0.013	0.327±0.008	0.167±0.019	0.175±0.022

The HPLC results of the basic sausage and the sausage when the substitution amount of lard modified DG was 60% were showed in Figure 1. Basic sausage only contained TG, but the sausage in which fat replaced by lard modified DG contained TG, 1, 3 - DG, 1, 2 - DG and monoglyceride (MG). The content of the 1, 3 - DG in the sausage was about 30%. Although the TG content was still the highest, but the 1, 3 - DG content was greatly increased.

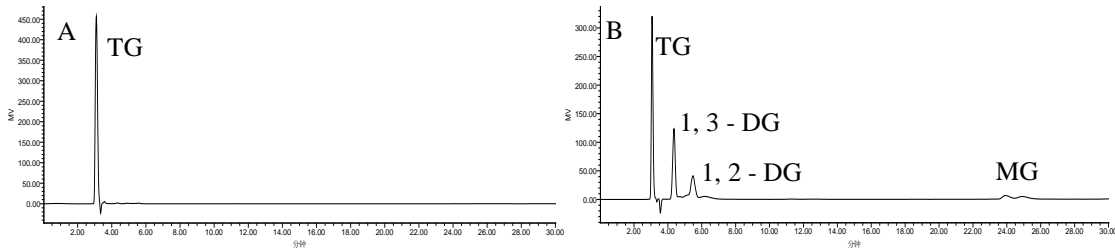


Figure 1. The HPLC figure of basic sausage (A) and 1, 3 - DG-enriched sausage (B)

### IV. CONCLUSION

The sausage which fat was replaced by lard modified DG had moderate hardness, better springiness and chewiness. The 1, 3 - DG content in the sausage could reach to 30%. The 1, 3 - DG -enriched sausage increased the nutrition value and healthy function of the sausage, was meaningful to the production of functional low-fat sausage.

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