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## Effect of fermentation on the quality of extruded corn noodles

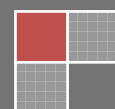
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### ABSTRACT

By determining the water absorption, loss rate, textural property and color index of extruded corn noodles at different fermentation time, the effect of fermentation on the quality of extruded corn noodles was studied. The results indicated that fermentation increased the water absorption from 45.89% to 48.93% and decreased the loss rate from 8.01% to 4.31%. With extending the fermentation time, the hardness, chewiness and cohesiveness of noodles were improved. When the fermentation time was 12 hours, these three indicators reached the maximum, which were 7216.42, 6221.96 and 0.75, respectively. Fermentation had no significant effect on the brightness value, while the redness value was reduced from 9.85 to 4.48 and the yellowness value was enlarged from 38.82 to 49.04, which improved the color of extruded corn noodles.

### KEYWORDS

Fermentation; Extruded corn noodles; Quality.



## INTRODUCTION

Studies had shown that fermentation can change the physical properties and eating quality of corn starch gel<sup>[1]</sup>, increased the content of B vitamins in the cornmeal group<sup>[2]</sup>. Fermentation applied to improve the quality of corn noodles that was rarely reported. In this paper, we fermented corn residue by using plant lactobacillus, made noodles by extrusion molding, and studied the impact of fermentation on the quality of extrusion corn noodles, to provide a new method for improving the quality of corn noodles.

## MATERIALS and METHODS

### Materials and Reagents

Commercial Peeling corn; Lactobacillus P8 sinensis (Number of viable cells:  $1 \times 10^{11}$  CFU/g), Inner Mongolia PuZe Biological Products Co., Ltd.

### Instruments and equipment

CR-400 colorimeter, Japanese KONICA MINOLTA company;  
TA.XT-plus texture analyzer, British Stable Micro Systems company;  
HR-50 multi-functional pasta machine, Wuhan HuaRi Technology Co, Ltd;  
LRH series biochemical incubator, Shanghai Yiheng Technologies Limited.

### Test methods

#### Preparation of fermented Peeling corn

Put 300g samp in a conical flask that had sterilized, then add 300ml of deionized water fully soaked for 4 hours. With 200 ml deionized water activating 0.5 g plant lactobacillus P8 bacteria powder. Let the activated bacterium liquid mix with Peeling corn evenly and then sealed and fermented in a constant temperature of 37 °C. Removed the Peeling corn which fermented for some time, filtered the fermented liquid, rinsed with distilled water, got fermentation Peeling corn, set aside.

#### The preparation of extruded corn noodles

Add fermentation Peeling corn into the pasta machine hopper, crushed corn noodles at room temperature (20±2°C) for 24 hours to make noodles moisture consistently, made the noodles segmentation for 15 ~ 20 cm in length to determine the quality.

#### Determination of cooking time<sup>[3]</sup>

Put 20 roots noodles in 500 ml boiling water, timing, keep boiling state, after 2 minutes get 1 root noodles every 30 s, use two pieces of glass plate to squeeze, look inside whether the noodles have hard in his heart, the hard heart disappearing time is the cooking time.

#### The determination of water absorption of dry materials<sup>[4]</sup>

Put 20 roots noodles at 500 ml boiling water to the cooking time, remove and let it stand for 5 minutes on the screen, count the water absorption of dry material after weighing.  
The water absorption of dry materials (%)

$$= \frac{G_1 - G}{G} \times 100\%$$

$G_1$ -----Cooked noodles weight,  $G$ -----The weight before cooking

#### The determination of loss rate of dry materials

Let the rest of the noodles soup of 1.3.4 boil to 50 ml and then drying it to constant weight in 105 °C, after that we can calculate the loss rate of noodles.

$$\text{The loss rate of materials (\%)} = \frac{M_1 - M_2}{G} \times 100\%$$

$M_1$ -----weight of the beaker and soup after Constant weight

$M_2$ ----weight of the beaker

$G$ ----- weight of the noodles for the former

### The determination of noodles TPA<sup>[5-6]</sup>

Remove noodles at the cooking time and then let it stand for 5 minutes after drop on the screen, then test the TPA. Every time take three roots of noodles parallel and equally spaced and then placed in the slide on the stage, each sample for six parallel test. The experiment with the probe: P/50. Parameter setting: Pre-test speed 2.0mm/s, Test speed 0.8 mm/s, Post-test speed 0.8mm/s, Strain 70%.

### Determination of color<sup>[7]</sup>

Determine the color immediately after the extruded noodles cooling, in order to avoid the influence of moisture loss of color. Use the L\* a\* b\* color space method, said on behalf of the brightness values of L\*, a\* on behalf of the red and green value, b\* on behalf of yellow and blue value. The larger the L\*, the higher the brightness. a\* > 0, the greater the a\* value, the higher the degree of red; b\* > 0, the greater the b\* value, the greater the degree of yellow.

## THE RESULTS and ANALYSIS

### The effect of fermentation on the water absorption rate of extruded corn noodles

Water absorption is a reflection of the degree of hydration noodles indicators, and have influential of noodles' taste<sup>[8]</sup>. We can see the water absorption decreased with time when it was 3 hours before fermentation from Figure 1, the water absorption reach the minimum of 45.89% at the fermentation time is 3 hours, water absorption gradually increased after 3 hours, it get the maximum of 48.93% after 24 hours. That do not agree with Wang Xiaohui and others research results<sup>[4]</sup>, the reason may be that different ways to make the fermentation corn noodles. Method of this paper based on the fermentation corn residue directly squeezed into noodles and have a short fermentation time, so the extrusion noodles surface is rough and easy to form microporous, which are beneficial to the improvement of the noodles water holding capacity. Studies have shown that water absorption of dry materials was negatively correlated with the straight-chain starch content<sup>[9]</sup>, fermentation make the content of amylose increased, but the fermentation time is too long so that amylose content will decline. Therefore, in this article, the extruded corn noodles' water absorption rate is a trend of increase with the decrease of the first.

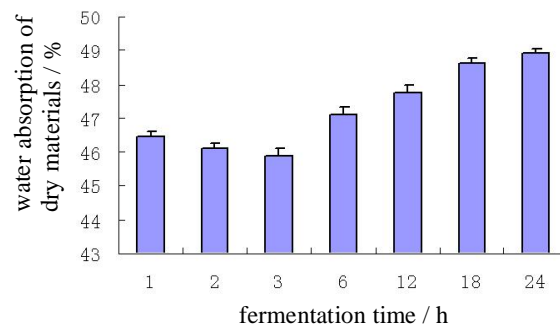


Figure 1 : Influence of fermentation time on the water absorption of extruded corn noodles

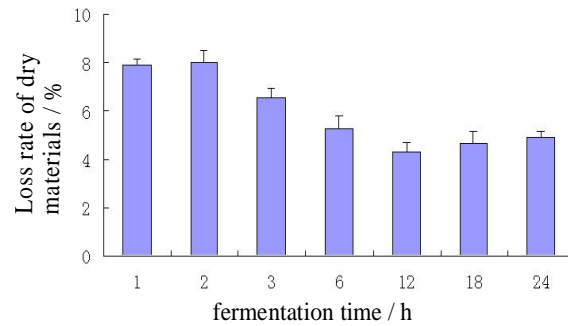
### The effect of fermentation time on loss rate of dry materials of extruded corn noodles

By the figure 2 shows, the loss rate of dry materials of extruded corn noodle is higher when the fermentation time is 1-2 hours. After that, lower the loss rate. The loss rate of dry materials catch the minimum when fermented extruded corn noodles for 12 hours, and rate slightly increased with continue fermenting. There are some research show that fermentation can increase the amylose content in corn, enhance straight-chain starch gel network. Amylose form heat irreversible aging gel network and is difficult pasting when is cooked, and helpful to maintain the shape of the noodles so that can make it pliable and tough with boiling fastness<sup>[10]</sup>, reduce the loss rate of dry materials. The loss rate of dry materials increased after 12 hours' fermentation, this may be because the lactic acid fermentation made the content of corn protein, fat and ash decrease, released the combined starch particles, enhanced its gelatinization of swelling. And when fermentation time is too long, the lactobacillus metabolites is further increase to help amylose to hydrolysis for small molecule dissolution, lead to the content of amylose decrease, make the noodles easy to be boiled, loss rate rise<sup>[11]</sup>.

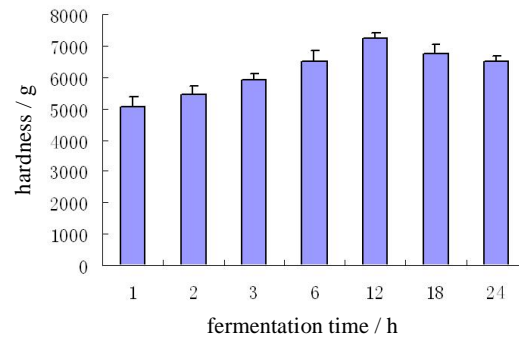
### The influence of fermentation on TPA of extruded corn noodles

According to the research of Lu Qiyu and others, the hardness, chewiness and cohesive performance are better than other indicators of characterization on the quality of fermentation corn noodles. Therefore, this paper chosen these three indicators as represent to reflect the quality of fermentation extruded corn noodles<sup>[12]</sup>. What we can see from figure 3 to 5 is that as the extension of fermentation time, hardness, adhesiveness and chewiness of extruded corn noodles showed a trend of decrease after the increase first, and peaked at 12 hours for fermented, which were 7216.42, 6221.96 and 0.75, respectively. Three indicators numerical began to decline when fermentation time was more than 12 hours. The reason may be that in the process of fermentation, plant lactobacillus metabolic products attacked the amylopectin's amorphous region, short chain in the amorphous district was hydrolyzed or removed by means of chain scission, lead to the long chain and short chain of

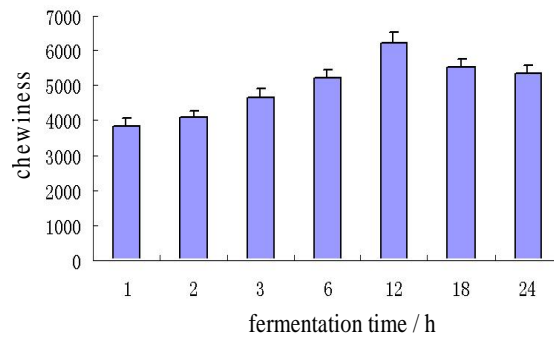
amylopectin rising proportion. In addition, fermentation made the amylose contents increase and reduced the degree of polymerization, which was conducive to amylose cross-linked. These changes between branched chain and amylose are more conducive to form a stronger gel and increase the hardness and chewiness, so that it can help the quality of extruded corn noodles to improve. But if the fermentation time is too long, the starch chain would be degraded deeply, and would make the noodles quality decline<sup>[13]</sup>.



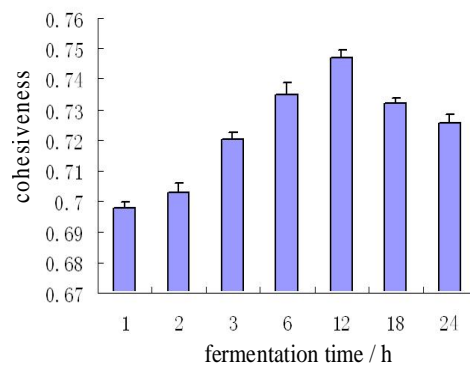
**Figure 2 : Influence of fermentation time on the loss rate of dry materials in extruded corn noodles**



**Figure 3 : Influence of fermentation time on the hardness of extruded corn noodles**



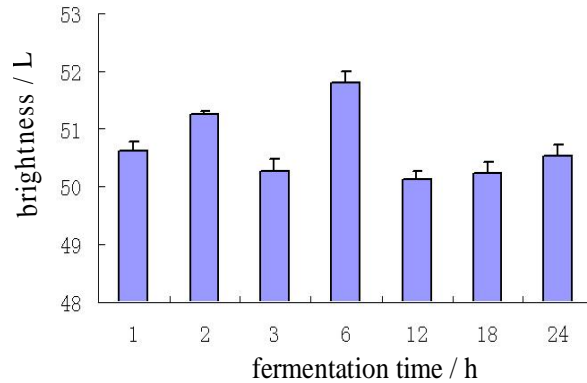
**Figure 4: Influence of fermentation time on the chewiness of extruded corn noodles**



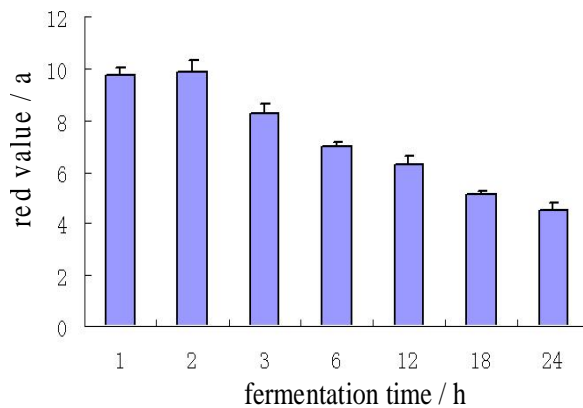
**Figure 5: Influence of fermentation time on the cohesiveness of extruded corn noodles**

**The effect of fermentation on color of extruded corn noodles**

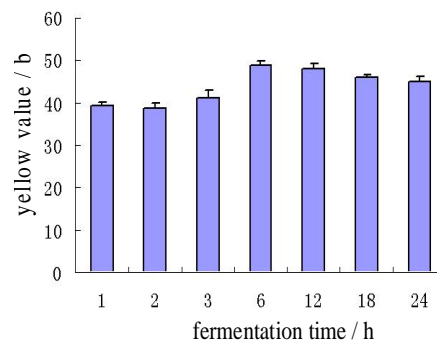
Color is an important sensory evaluation index of noodles, is the first sense impression of noodles, directly affect the quality of noodles quality judgment. From figure 6 to figure 8 shows, as the extension of fermentation time, the brightness values of extruded corn noodles in the range of 50.26 ~ 51.79 and the change is not obvious; Red values decreased from 9.85 to 4.48; The yellow value increased from 38.82 to 49.04 before fermentation 6 hours, and then slightly lower. we can get the greatest brightness value and the greatest yellow value when fermentation time was 6 hours. And the Corn noodles sensory color is the best. Timely fermentation can improve the color and quality of extruded corn noodles.



**Figure 6 : Influence of fermentation time on the brightness of extruded corn noodles**



**Figure 7 : Influence of fermentation time on the redness of extruded corn noodles**



**Figure 8 : Influence of fermentation time on the yellowness of extruded corn noodles**

**CONCLUSION**

1) With the fermentation time extending, the water absorption rate of extruded corn noodles increased from 45.89% to 48.93%, loss rate of dry materials reduced from 8.01% to 4.31%, the cooking quality of noodles has been improved.

2) Fermentation improved the extruded corn noodles' hardness, chewiness and cohesiveness, and these three indicators reached the maximum when fermentation time was 12 hours, which were 7216.42, 6221.96 and 0.75, respectively. That means fermentation enhanced and improved the quality and the taste of extruded corn noodles.

3) Fermentation has little influence on brightness value of extruded corn noodles, but it could reduce the redness value from 9.85 to 4.48 and increase the yellowness value from 38.82 to 49.04, for that case, it can improve the color, enhance the organoleptic quality of noodles.

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