

Testing of Basic Characteristics of Pepper Fresh Fruits and Optimization of Mechanical Parameters

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Abstract: By measuring the physical properties of fresh green peppers and measuring the mechanical properties of the epidermis, the crushed and damaged data of the peel and the nucleus under different working conditions were analyzed. The results showed that using 3% 7.0, soaking in heated waters within 24h with the pretreatment of broken machine and peeler peeling peel fruit of the process steps. Obtained the base of the working clearance of 5.5-6.5mm, the cavity is three times the size of the gradual change model and the mechanical properties of the control in the 5 ~ 40N, you can get better peeling effect and the core is not damaged basic conclusions, Which provided theoretical basis for upgrading and processing of pepper initial processing machinery.

1 INTRODUCTION

Pepper fresh fruit is picked after sterilization, peeling, washing, drying, and vested white pepper. white pepper products as one of the most popular products, it needs to remove the peel, pulp and drying the pepper seed process, peeling is the most crucial step.

Pepper fresh fruit peeling methods are the traditional water immersion method, mechanical peeling method, chemical peeling method and biological enzyme method. The traditional method of soaking for a long time (the shortest 5-7d), resulting in a long processing cycle, covers large area, But wastes a lot of water during the processing, labor-intensive production of white pepper has a serious odor. Processing quality is not stable, the cost is higher and higher. Chemical peeling pepper will consume large amounts of chemical raw materials, high cost, resulting in waste water pollution of the environment, while the chemical reagents used in food processing makes the law difficult to promote (Li Mingfu, 2015; Wu Huasong, 2006; Wang Xiulan, 2004). Although enzymatic peeling process shorter, less pollution, but also can play a role in water conservation to some extent, but

the cost of enzyme preparation is too high, the cultivation of enzymes for shorter cycles peeling pepper is also more complex, related research work also remain in the laboratory stage, it is difficult to promote; mechanical peeling method mainly by means of mechanical working principle, the use of peeling parts and pepper fruit friction, collision, hitting the role of peeling. At present, many domestic and foreign researchers have reported on the development of peeling machine and washing machine, but the process should be in accordance with threshing (artificial or mechanical), fan to stems, green ripe fruit sorting, soaking pool or river immersion, machinery Rinsing, natural drying or drying, cleaning, grading and other implementation in order to get better quality finished products. The process involves more equipment, complex conditions, the cost is higher, while friction or hit peeling machine also exists incomplete peeling, high nuclear damage rate and waste more serious issues such as the entire peeling process and ancillary equipment Improve the optimization of space is still larger.

Throughout the status of pepper processing, enzymatic, biological and water immersion, etc., aside processing costs, cycles, product quality and

other factors, the final peeling still need to be manually assisted. However, with the gradual lack of rural labor force in recent years, no one is willing to continue to engage in first-line agricultural production, and the rural areas are facing the situation of having no labor force. As a result, people become the biggest bottleneck in the development of agriculture (Vaidyanatha Lyer Thankamani, 2004; Li Mingfu, 2015; Du Zhihao, 2011; MR. BINU, 2013). Although the mechanical peeling method can alleviate the shortage of rural labor force to a certain extent, it has some help, but the huge unit or the product quality, waste and other factors still restrict the pace of its mechanized production.

Based on the requirement of scale and industrialization of pepper processing, the key technologies of peel peeling of peppers are still difficult to meet the relevant international standards. The lack of adequate market competitiveness of peppers has not yet been fundamentally solved, which limits the sustainable development of peppers industry to a large extent development of. Therefore, by measuring the physical properties of pepper fresh fruit, the mechanical properties of the test, will help strengthen pepper peel peeling key technology research, to focus on carrying out efficient, high quality, non-polluting, low-cost processing technology research and ancillary equipment research Provide basic reference indicators.

2 OVERALL RESEARCH METHOD

The overall method for the study is as follows: First, the pretreated pepper fruits are pretreated with a pretreatment machine to damage most of the pericarp, but the damage is not damaged. Then, the pretreated pepper fruits are treated with a biological enzyme for a certain period of time, Machine peeling, and finally washed and dried to get white pepper (P.K Ravi, 2013).

The chemical constituents of pepper epidermis were tested by phytochemical pretreatment system. The chemical constituents of pepper fresh fruits were studied qualitatively by water extraction, ethanol extraction and petroleum ether extraction. According to their chemical composition and related experiments The corresponding enzyme preparation is screened; pepper physical properties of the measurement of the use of electronic scales, vernier caliper, respectively, hundred-weight and two-axis size measurement, multiple sets of data to determine

the average to determine the mechanical properties of fresh pepper test using electronic universal testing machine The anti-stress of pepper fruit was measured many times, the value of anti-stress was recorded, and the average value of multiple measurements was taken. The friction test method was used to conduct several tests to record the peel adhesion strength of pepper and the average value of multiple experiments. After analyzing its physical characteristics And mechanical properties, based on the design of mechanical pretreatment equipment to provide a theoretical basis.

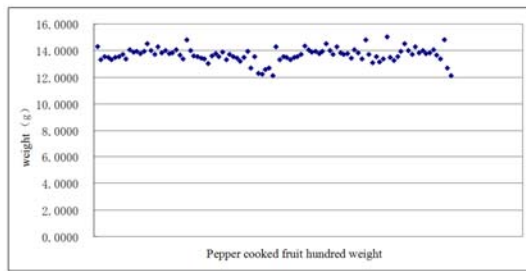
Pepper fresh fruit peeling best enzyme preparation screening and peeling process to the peeling effect as an indicator, the use of single factor test results comparison analysis, screening of suitable enzyme preparation, the use of response surface analysis of enzymatic peeling process conditions further Analysis and optimization, to determine the best process parameters for the design of peeling machine provide a reference.

3 PHYSICAL PROPERTY MEASUREMENT AND MECHANICAL PROPERTIES TESTING

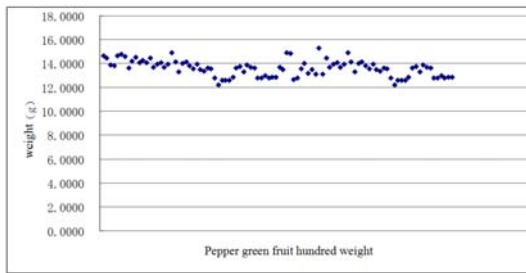
3.1 Physical property measurement

Pepper ear harvest picking string yellow ear or more than four cooked fruit, this method is the traditional practices and experiences of farmers, but also recognized by the market, so the pepper grains have green, ripe fruit points, understand the pepper fruit hundred-grain weight, two-axis size of the indicators help to quickly complete the mechanical method of pepper fruit epidermal premature damage. It has a direct guiding significance for the design, working principle and shaping of key components of pepper fresh fruit pretreatment machine (Piper nigrum L, 2013; Piper nigrum L, 2013; V.Thirupathi., 2009; Li Mingfu, 2012).

Hundred-weight measurement of electronic balance as the main tool, points green ripe fruit, artificial selection of hundred weighing and recording, each sub-100 were weighed separately. Pepper fruit mass distribution shown in Figure 1 (a, b).



(a)

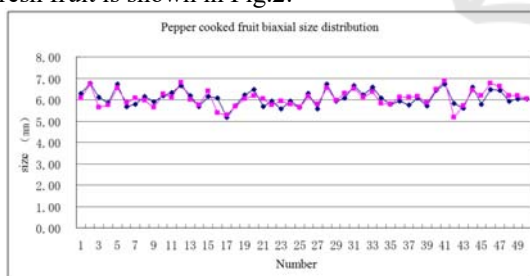


(b)

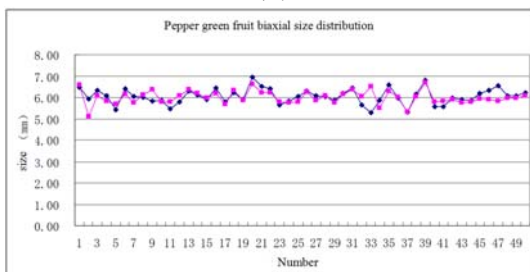
Figure 1 Pepper green ripe fruit hundred redistribution map

As can be seen from Figure 1, pepper ripe fruit hundred gravimetric distribution of the relative law, the ripe fruit hundred weight in 13-14g; green fruit is still in the growth stage, and the growth rate varies, the distribution of hundred weight more Wide range, between 12-15g.

Two-axis size using electronic vernier caliper, points green ripe fruit, artificial selection of the 100, were measured. The bifacial distribution of pepper fresh fruit is shown in Fig.2.



(a)



(b)

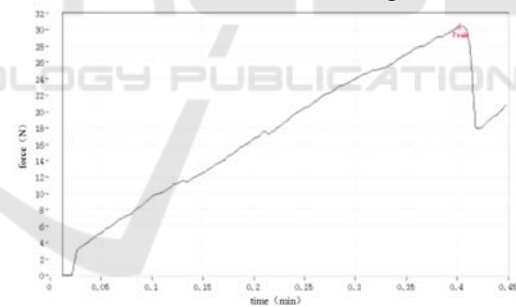
Figure 2 Peppers two-axis size distribution

As can be seen from Fig. 2, the distribution of the biaxial size of the cooked pepper is regular and the size of the biaxial axis is basically the same. The biaxial size of the bred fruit is between 5.5 and 6.5 mm. The green fruit is still in the growth stage. The biaxial size Yet irregular, and basically distributed between 5.5-6.5mm, the shape of green fruit has not yet formed, but the size of the final shape after the formation of ripe fruit basically the same.

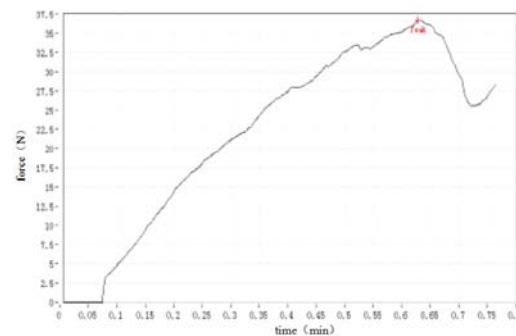
3.2 Mechanical properties test

Pepper fresh fruit mechanical properties of the test can be further understanding of the green peel pepper skin damage, stress resistance of the nuclear, Pepper peel peeling machine design, mechanical properties, peeling principle selection provides a theoretical reference to help peel fruit peel Pre-broken machine and peeling machine model optimization and improve pepper processing quality(Li Mingfu, 2012; Zhang Yuan,2015).

Pepper mechanical properties of fresh fruit, divided into green ripe fruit, artificial thresholding, the selection of maturity, color, shape close to the sample of 100 each, the use of TE-XWW-20 electronic universal testing machine (Shanghai RIXIN data analysis and image processing software) test. Mechanical curve shown in Figure 3.



(a)



(b)

Figure 3 Pepper fresh fruit anti-stress test map

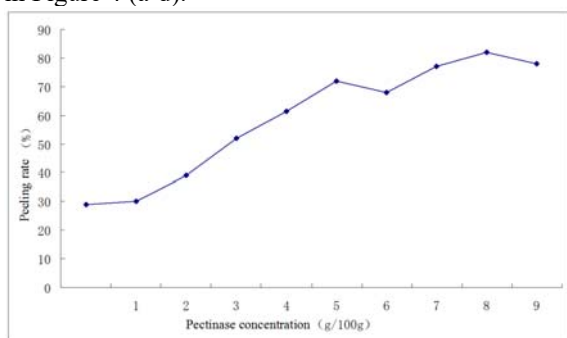
From Fig. 3 (a), we can see that there are two turning points on the strength and time chart of pepper green fruit, the first time the external force reaches 3 ~ 4N and the second time is 31 ~ 32N; (b) There are also two turning points on the time chart, when the external force reaches 3 ~ 5N for the first time, the second time is 36 ~ 37.5N. The above can be expected to damage the epidermis of pepper about 3 ~ 5N external force, while the damage of the nuclear fruit about 30 ~ 40 external force, that pretreatment and peeling machine theoretical hitting force should be controlled below 40N.

3.3 Chemical Analysis

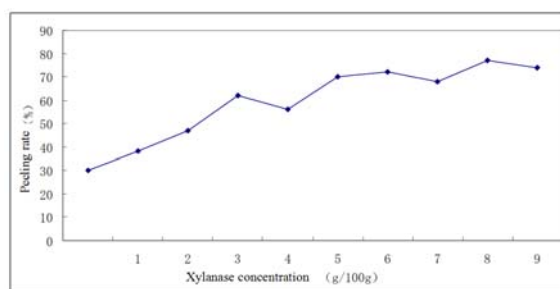
A clear chemical composition of fresh peel peel for rapid and safe screening of enzymes suitable for biological peeling process is of crucial significance, but also the enzymatic and mechanical methods combined with the peeling process theory basis. The test and analysis of the chemical constituents in the peel The chemical composition of the pepper fresh fruit was qualitatively and quantitatively analyzed by the method of phytochemical composition system pre-test, the extraction method of water extraction, ethanol extraction and petroleum ether extraction.

According to the results of the test and analysis, it was found that the peel of pepper fruit contains chemical components such as carbohydrate, flavone, organic acid, saponin, lactone, alkaloid and coumarin and does not contain cardiac glycoside, amino acid, anthraquinone, protein, Volatile oil, may contain phenolic substances.

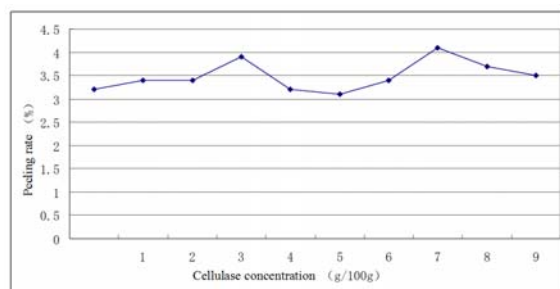
Based on the above chemical composition analysis, the choice of enzyme preparation mainly selected pectinase, xylanase, cellulase, enzyme solution four kinds of specific peeling effect shown in Figure 4 (a-d).



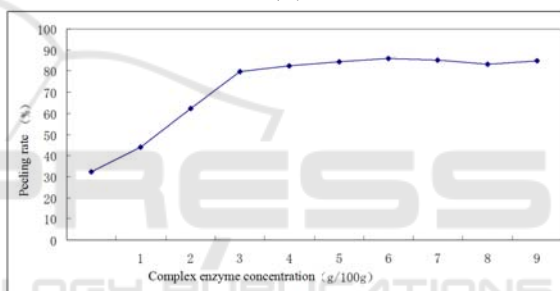
(a)



(b)



(c)



(d)

Figure 4 Different enzyme concentrations lead to peeling effect map

Analysis of Figure 4 (ad) shows that the peeling effect of pectinase and xylanase can reach more than 75%, and pectinase and xylanase dosage of 5% or more to achieve better results, while the fiber Enzymes do not affect pepper peel peeling the main enzyme preparation. Figure d complex enzyme solution, the concentration of 3% or more to achieve the effect of the above single enzyme effect, showing a good economic value.

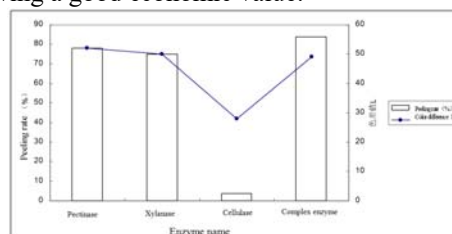


Figure 5 Different enzyme conditions under the effect of comparison

As can be seen from Fig. 5, the optimal peeling effect of different enzyme preparations is compared with the color difference value L, the peeling effect of the composite enzyme solution is best, and the color difference value L is close to that of pectinase and xylanase, Chromatic aberration value L of recognition, at the same time, in the amount, cost, peeling time, etc. have shown better economy, preferably pepper fruit pretreatment after the enzyme preparation.

4 CONCLUSIONS

a. According to the principle of ball dynamics and the rules of contact between the friction surface and the solid body, the working gap of the pre-treated damage machine is 1 to 3 times the biaxial size (5.5-6.5mm) according to the physical characteristics measurement. The peeling machine is from top to bottom The taper gap range is 3 times the cardinal taper of the biaxial size.

b. According to the principle of friction mechanics, the mechanical properties of peeling parts in the working chamber of the peeling machine should be controlled at 5 ~ 40N to ensure the peeling of the fresh fruits of the pepper and the kernels are not damaged.

c. Using complex enzyme preparation. The whole peeling process according to the screening of the composite enzyme solution concentration of 3%, PH value 7.0, heated water immersion within 24h with the pretreatment damage machine and peeling machine to achieve the optimal process steps.

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