



A De-Seeding Machine Designed for The Fruit Structure of Pseudo-Acid Pulp

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Abstract: As a characteristic economic crop, false acid pulp has high medicinal value, as well as certain edible and ornamental value. Because of the strong stress resistance of the plant and the simple planting, the price of the seeds of the pseudo-acid pulp has remained high in recent years, so the planting area has increased. However, due to the special fruit structure, the de-seeding of the pseudo-acid pulp is difficult and mainly relies on manual work. This project plans to design a small de-seeding machine for the fruit structure of pseudo-acid pulp. The de-seeding work of pseudo-acid pulp is completed by extrusion, kneading and vibration screening, which has a good application prospect.

Keywords: false acid pulp, deseeding machine, vibration screening

1 INTRODUCTION

Nicandra physalodes L.(Solanaceae) is a one-year-old herbaceous plant, also known as blue flower fairy, whipping hydrangea and so on [1]. In recent years, with the growth of science and technology, many characteristic economic crops have been developed and utilized, and pseudoacid pulp is one of them. In terms of medicinal use, the whole plant of false acid pulp is used as a medicinal drug in southern and northern China. It is sweet and sour, slightly bitter and flat in taste, and has the effects of expectorant, sedative, heat-clearing and detoxifying [2]. In terms of food processing, the seed of false acid pulp is covered with a layer of edible resin, which can be used to make ice powder [3], and the gel ball of false acid pulp can also be used as a special additive [3]. Therefore, in recent years, the seed price of false acid pulp is high, and the planting of false acid pulp is simple, drought-resistant and barren-resistant. It can be planted in front of the house, behind the house, in the roadside village, in the newly reclaimed land and between the rows of forest land [4]. It has strong stress resistance. In recent years, the planting scale in Guizhou has been expanding, so the artificial consumption of false acid pulp harvesting and processing is also increasing.

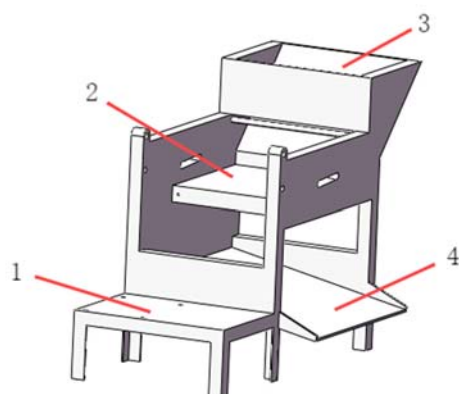
At present, the research on pseudo-acid pulp at home and abroad mainly focuses on medicinal and edible aspects, and lacks research on processing such as deseeding. There is no processing machine suitable for deseeding of pseudo-acid pulp. The fruit of false acid pulp is capsule spherical, with a diameter of about 2cm. It is outsourced by 5 persistent sepals, such as false acid pulp. The seeds are small and flat, with a diameter of

about 1.5mm [5].In the process of deseeding, the seeds should be separated from the sepals. Because the seeds are small and there is a layer of mucus on the surface of the seeds that are not completely dried, the deseeding work of false acid pulp is troublesome. Generally, this work can only be done by people, which is inefficient and laborious. The existing deseeding machine is difficult to complete the deseeding work of false acid pulp, and there is no design in the deseeding of false acid pulp. This project designs a small pseudo-acid pulp deseeding machine for the problem of difficult deseeding of pseudo-acid pulp. This de-seeding machine imitates the process of manual rubbing and screening through crank mechanism and vibration mechanism, which ensures the de-seeding efficiency and avoids seed damage. It can be used to replace people to complete the de-seeding work of false acid pulp.

2 DESIGN OF DESEEDING MACHINE

2.1 FRAME DESIGN

As shown in Fig.1, the three-dimensional model of the frame is shown. The frame 1 is set below the frame, and the motor is installed on it to reduce the center of gravity and increase the stability of the deseeding machine. The frame 2 is used to install the kneading mechanism and the shaking sieve mechanism. The fruit enters the deseeding machine from the feed port. After the shell is separated, the seed is discharged from the discharge port.

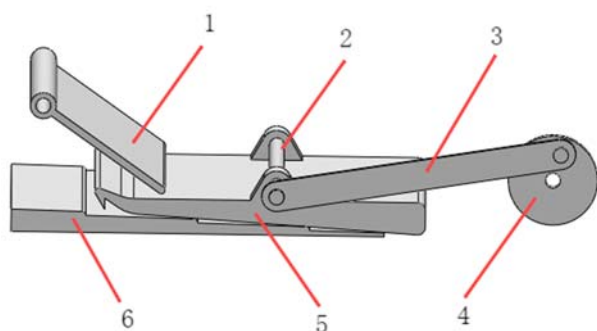


1 - STENT 1 ; 2 - STENT 2 ; 3 - FEED INLET ; 4 - OUTLET

FIG. 1 RACK

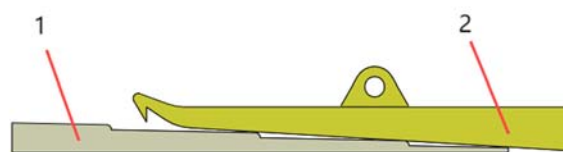
2.2 KNEADING MECHANISM

The kneading mechanism is composed of baffle, upper kneading plate, lower kneading plate, connecting shaft, connecting rod and crank, as shown in Fig.2. The lower kneading plate is fixed, and the upper kneading plate forms a crank slider mechanism through the connecting rod, connecting rod and crank. The sliding groove on the frame limits the range of motion of the connecting shaft, so that the upper kneading plate performs linear reciprocating motion. The motion diagram is shown in Fig. 4. The gap between the upper and lower kneading plates is less than 1cm (the diameter of the picked false acid pulp fruit is about 2cm). When the false acid pulp fruit enters the gap, the upper and lower plates squeeze and knead the fruit to break the peel, and the seeds are initially separated from the sepals. There is a barb at one end of the upper kneading plate, and the lower kneading plate is a stepped type, as shown in Fig. 3, so that the fruit moves to the right as a whole during the back and forth kneading process and enters the next mechanism.



1-BAFFLE ; 2-CONNECTING SHAFT ; 3 - CONNECTING ROD ;
4-CRANK ; 5-UP KNEADING BOARD ; 6 - LOWER KNEADING BOARD

FIG. 2 KNEADING MECHANISM



1-UP KNEADING VERSION : 2-DOWN KNEADING VERSION

FIG. 3 DESIGN OF RUBBING PLATE

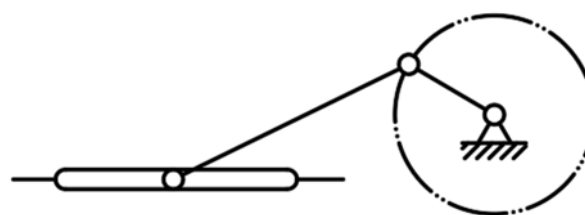
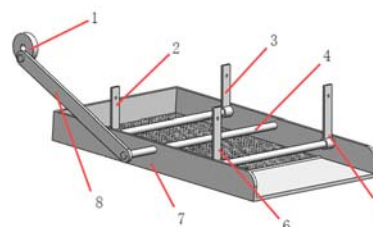


FIG. 4 MOTION DIAGRAM OF KNEADING MECHANISM

2.3 SHAKING SIEVE MECHANISM

The mass of single seed of false acid pulp is much smaller than that of its shell. It needs to go through the process of shaking sieve during separation. Referring to the research of Xiao et al. [6], the shaking sieve mechanism is designed, as shown in Fig.5. The mechanism is composed of a crank, a rocker, a connecting shaft, four spring plates, and a sieve box (baffle, beam, screen mesh). The sieve box is suspended by the spring plate under the bracket 1 (Fig.1). The spring plates 1 and 2 are slightly shorter than the spring plates 3 and 4 (the length of the spring plates 1 and 2 is equal, and the length of the spring plates 3 and 4 is equal). Therefore, the opening of the sieve box is inclined downward, and the crank rocker drives the sieve box to vibrate. The motion diagram is shown in Fig. 6. The broken fruit is reciprocating and jumping on the sieve surface. Due to the inclination of the sieve surface, the seed falls from the sieve hole, and the shell is discharged from the opening of the sieve box.



1-CRANK ; 2-SPRING 1 ; 3 - SPRING PLATE 2 ; 4-CONNECTING SHAFT ; 5-SPRING 3 ; 6 - SPRING LEAF 4 ; 7-SIEVE BOX ; 8-YAO POLE

FIG.5 SHAKE SIEVE MECHANISM

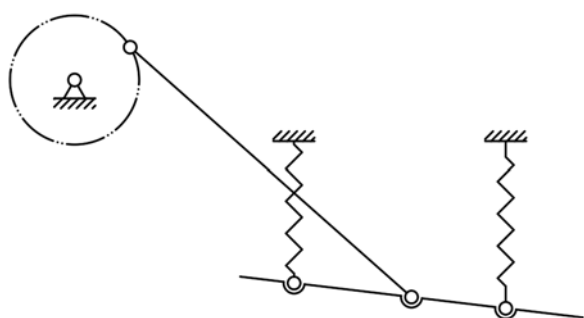


FIG. 6 MOTION DIAGRAM OF SHAKER MECHANISM

2.4 OVERALL ASSEMBLY AND WORKING PRINCIPLE

Fig.7 is the overall assembly diagram of the three-dimensional model of the deseeding machine. The upper part is provided with an opening and closing cover for convenient maintenance. The motor is installed on the bracket 1 (Fig. 1), and the kneading mechanism is installed above the bracket 2 (Fig. 1). The shaker mechanism is installed below. The sieve box mouth extends out of the frame to facilitate the discharge of the shell. The seeds falling from the sieve hole are collected through the discharge port (Fig. 1).

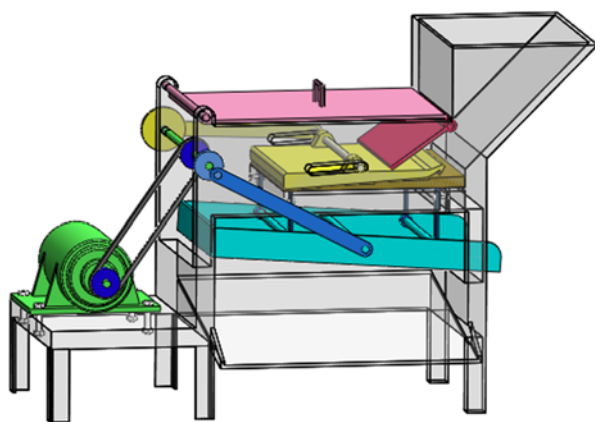


FIG. 7 OVERALL ASSEMBLY DRAWING

The cranks of the kneading mechanism and the shaking sieve mechanism are coaxial, and the pulley is installed on the shaft, which is driven by the belt between the motor. The two mechanisms of the starting motor operate simultaneously, and the material (pseudo-acid pulp fruit) is input from the inlet port. Under the action of the baffle, the material fully enters the upper and lower kneading plate gaps, so that the shell and the seed are initially separated, and then enter the shaking sieve mechanism. Under the vibration of the sieve box, the shell is discharged from the sieve box mouth, and the seed is discharged from the outlet port. The overall movement route of the material is shown in Fig.8, and the workflow is shown in Fig.9.

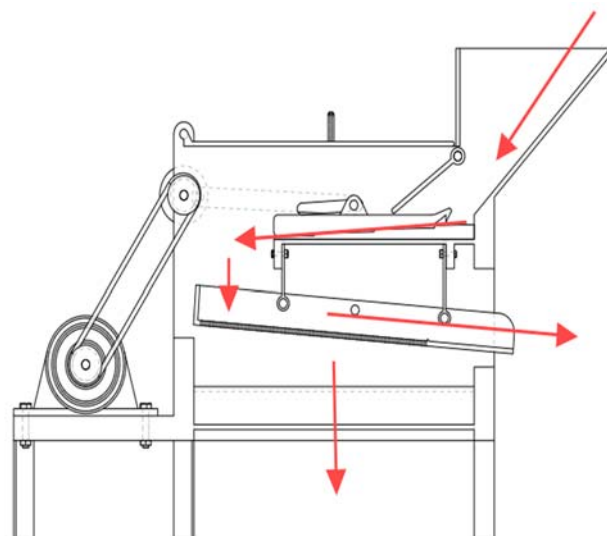


FIG.8 THE OVERALL MOVEMENT ROUTE OF THE MATERIAL

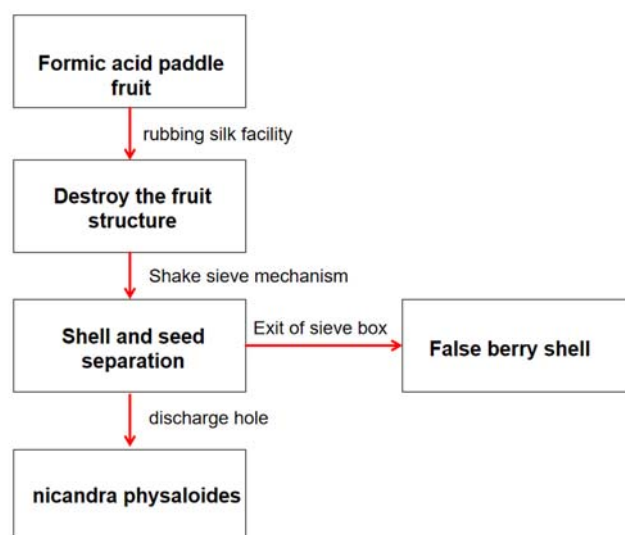


FIG.9 WORKFLOW

3 CONCLUSIONS

In view of the fruit structure of false acid pulp, the deseeding machine first breaks the fruit shell and sepal by squeezing and rubbing, so that the seeds in the sepal gap are separated from the sepals, and then the fruit shell is separated from the seeds by vibration, which can better complete the deseeding work of false acid pulp. At present, there is no machine for de-seeding of false acid pulp at home and abroad, and the research on de-seeding of false acid pulp is almost in the blank stage. Therefore, with the increasing planting scale of false acid pulp, the research and design of de-seeding machine of false acid pulp has a good development prospect.



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