УДК 631.3

COMPARATIVE TEST OF THREE-STAGE POTATO SOIL SEPARATION DEVICE BASED ON FLUCTUATION EQUATION

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Summary. *The potato screening device of the current potato harvester has the problem of large potato damage. To this end, a three-stage low-loss potato soil separation device was designed and tested. The results show that the three-stage low-loss potato soil separation device can reduce potato damage.*

The common potato harvester lifting chain has greater damage to tubers. In view of this problem, this paper uses the fluctuation equation theory to derive the forced vibration differential equation of the rod-type potato lifting chain. The equation is shown in equation (1), and a three-stage potato soil separation device is designed accordingly [1]. In order to test the working effect of the device, simulation tests were carried out at a harvest speed of 1m/s, a lifting chain speed of 1.2 m/s, a rocking wheel frequency of 7 HZ, and an amplitude of 32 mm, and a control group was designed.

$$y(x,t)=\sum_{k=1}^{\infty}\frac{2T\sin\frac{k\pi x_1}{l}}{\rho A_c l(\omega^2-{\omega_{nk}}^2)}\sin\frac{k\pi x}{l}(cos(\omega_{nk}t)-cos(\omega t)) \quad (1)$$

Experimental results：1. Control group: As can be seen in figure 1, the vibration displacement in the first half of the lift chain is small, roughly around –20 to 25 mm, while the vibration displacement in the middle and rear of the lift chain is large, and the vibration amplitude is about –40 to 60 mm. It can be seen that the lift chain in the control group still has a large amount of vibration at the rear, which makes it more stressed.

2. Optimization group: The image of the optimization group can be obtained as shown in figure 2. In the central vibration crushing section, the vibration displacement is near –25 mm to 25 mm, and the displacement in the sieved soil removal section is low, roughly –12 mm to 17 mm. The three-stage potato soil low-loss separation device of the optimization group can reduce the impact received by the potato.

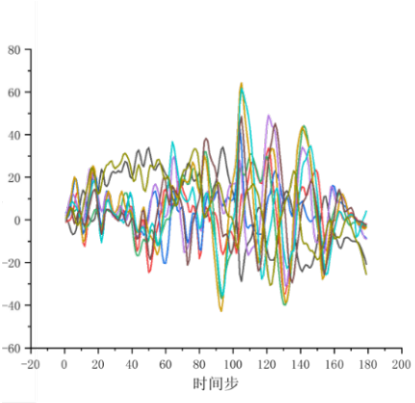

Figure 1 – Chain link normal displacement curve (control)

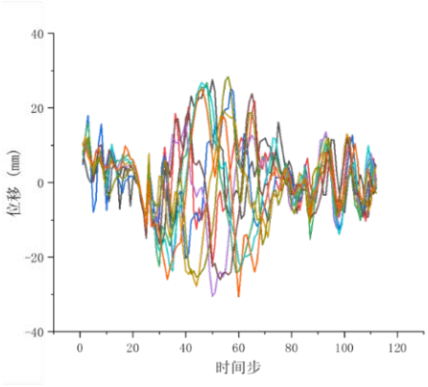

Figure 2 – Chain link normal displacement curve (optimized)

References

1. Liu, Z X.[et al]. OPTIMISATION BY COUPLED RECURDYN-EDEM SIMULATION: OPTIMISATION TESTS OF A THREE-STAGE LOW-LOSS SEPARATION DEVICE FOR POTATO SOIL. – INMATEH Agricultural Engineering. – 2024.