Development of boxthorn root debarker

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[Keyword] Boxthorn, Boxthorn bark, debark, boxthorn root debarker

I. Introduction
A boxthorn root bark is an essential ingredient in herbal medicines for cancer treatment. Debarking the boxthorn root bark is usually done manually with small wooden hammer, and it is a hard and complicated job. Also most of boxthorn barks are imported from China. However, Chinese boxthorn barks are old woody tissues, the medicine efficient is low. Most of herbal medicine consumer wants to use the domestic boxthorn bark. This study was carried out to develop a boxthorn root debarker to reduce labor and cost requirement.

II. Materials and Methods
1. Test materials
The boxthorn roots used for this study were 3 years old boxthorn root, The length of root was 40 ~ 60 cm, moisture content of roots were 60 ~65%.

2. Prototype manufacture
The prototype developed in this study as shown is Fig 1. The prototype consisted of two-disk saws, a belt conveyer, and four-urethane roller.

The two-disk saw cut the boxthorn root for easy transfer, slope belt conveyer carries the boxthorn roots. The four-roller crush debarking of boxthorn root and shaking sieve sorts debarking root.

Fig 1. Schematic diagram of prototype

3. Test method
Working performance was tested with the roller of material, debarking rate of moisture content of root, Ratio of the peripheral velocity difference of roller and debarking rate is defined as;

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\text{Debarking rate} = \frac{\text{Weight of peeled bark}}{\text{Total weight of bark}} \times 100 \, (\%)
\]
III. Result and Discussion

1. Debarking rate by various roller materials

Fig 2 is shown the debarking rate of roller material. Debarking rate of PVC roller is very low as 30.2%, but urethane roller shown is 80.6% because urethane rollers pull of root by elastics of surface as compare with hard and smooth surface of PVC roller.

![Fig 2. Debarking rate of roller material](image)

![Fig 3. Debarking rate of moisture content of root](image)

2. Debarking rate of moisture content of root

The result of moisture content of boxthorn root shows at Fig 4. Most of root consisted of 60%–65% moisture content on digging time but 1 day later could be reduced moisture content of root about 2%, so the best debarking time are 1–2 day after digging.

![Fig 4. Debarking rate by peripheral velocity difference](image)

![Fig 5. Working performance](image)

3. Debarking rate by peripheral velocity difference in roller

Debarking rate of peripheral velocity difference shown Fig 4. 1:2 velocity ratio of roller is 95.1% but another velocity ratio of roller is low. High velocity roller needs of high gear velocity ratio and complicate power transmission. So suitable ratio of peripheral velocity is 1:2. Also working performance as shown in Fig 5. The prototype could be 60 kg/hr debarking, 12 times better than manual debarking, and operating cost decreased by 67% and production of the root bark increased by 19%.

IV. Conclusions

In order to minimize the labor requirement and cost, the boxthorn debarker was developed and tested. The roller material shown be urethane and debarking time are 1–2 day after digging, Roller velocity ratio is 1:2, Also working performance could be 60 kg/hr, 12 times better than manual debarking, and operating cost decreased by 67% and production of the root bark increased by 19%.