International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

VEGETABLE CLEANING MACHINE FOR AGRICULTURE USE AND IT'S DESIGN ASPECT.

Ms. Supriya Gajbhiye[1] Dr. R. R. Gawande[2]

1Mtech student[1], 2Associate Professor[2]
Department of Mechanical Engineering,
Bapurao Deshmukh College of Engineering, Sewagram. India

ARTICLE INFO

Article history:
Received 00 December 00
Received in revised form 00 January 00
Accepted 00 February 00

Keywords:
Rotating Veg. cleaner
Root crops cleaning machine

ABSTRACT

Green roots such as radishes, carrots, potatoes, etc. should be removed from the soil and clay residues after harvest, and then transported from the plants to the market. Usually, when peeling carrots and radishes, Indian farmers use the traditional method of washing the roots with fingers and feet. This seems to take a long time and requires more tasks. In this company, the CAD version of the vegetable washing system is converted into generated calculations and completed designs. After creating the CAD version, model the finite element and the finite element. The analysis has been completed and the impact has been mentioned in order to complete the green body smoothing project at an economical cost.

1. Introduction:

Washing vegetables is a key step in any process that provides attractive and chemically free-flowing vegetables. Potatoes, tomatoes, cabbage, carrots, radishes and other vegetables must be cleaned of soil and clay residues after harvest. Transport them from the factory to the market.

Figure 1.1 Traditional method of vegetable cleaning

Usually, many Indian farmers use traditional methods of peeling carrots and radishes, including washing the roots with hands and feet. There is a need to develop a rotary vegetable cleaner that is affordable to all farmers in India. This is a key process before bringing vegetation to the market. It will reduce the microbial load in the soil while removing industrial soil, dirt and even pesticide residues, thereby bringing additional crops to the farm. grade.

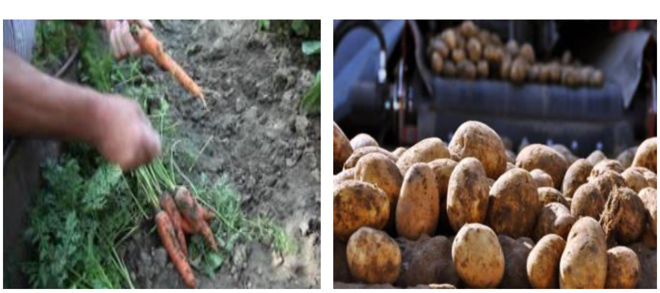


Figure 1.2 Unwashed root crops

Vegetable pollution is usually caused by unhealthy planting, advertising and marketing. Food-borne microorganisms and pesticides, if not disinfected, are of vital importance to the public interest because they can endanger health.

1.1 Objectives:

- Create the concept of a vegetable peeler..
- Calculate the structure of the peeler..
- Perform CAD modeling of creative layouts.
- Reduce the labor and time required to harvest vegetables..
- It helps vegetables well and removes unwanted particles.
- Bring vegetables to the market as soon as possible.
- Reduce water consumption compared to more modern methods.
- Used to sterilize vegetables of different sizes.

1.2 Problem Formulation:

Usually, when peeling vegetables carrots and radishes, Indian farmers use the traditional method of washing the roots with fingers and toes. Time is wasted, farmers sell vegetables, they do not peel well, there are many

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

unwanted residues on the surface, food may also be harmful to health. For this, you need to use vegetable cleaners.

2. Methodology

The following techniques can be used to create cheap peeler designs: A deep understanding of previous agricultural research points you in the right direction. As small as possible. Download, CAD model, design and production optimization.

3. Designing

3.1 Design Calculations:

The following dimensional requirements assume that the casting specifications of the cleaning equipment are used in the calculation. Yield = 18mm diameter, the distance between two adjacent holes is 13mm.

Shower casting technical data Ø = 3 mm

roller length-1 meter

roller Diameter = 40 cm

Table height = 5 feet

Vegetable capacity = 10 kg

Vegetables over time-tomatoes, potatoes, carriers, chicken legs, bunches, peppers,

fruits 5 kg-volume-15 liters (very) maximum.

Clean up to 50 kg/h. Single load = 10 kg.

Vegetable density = 1080 cubic meters.

Unit load = weight of one load / density of vegetables.

The volume of the load = 10/1080
= 0.00925 m ^ 3.

0.00925 = π / 4 d ^ 2 × 0.5

d= 0.375 ≅0.38 m

Cylinder diameter 0.38 m (380 mm)

3.2 Speed of motor roller

N1 = 30 rpm drum speed
N2 = drum speed
D1 = drum diameter 350 mm
D2 = drum diameter 110 mm

N1D1 = N2D2
N2 = (30 × 350) / 110 = 96 rpm

drum directly connected to the motor shaft

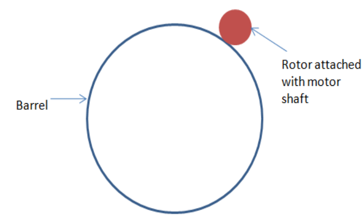
3.3 Torque calculation

When you consider that the total weight of the swing is 80 kg.

$$80 \times 9.81 = 784.8 \text{ N}$$

$$T = F \times r$$

$$T = 784.8 \times 0.02 = 15.696 \text{ N.m}$$



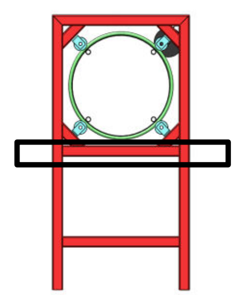
3.4 Power calculation

$$P = \frac{2\pi NT}{60}$$

$$P = \frac{2 \times \pi \times 96 \times 15.696}{60} = 158watt$$

3.5 Frame Calculations

Strain calculation



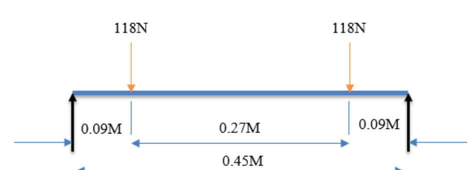
i) There are 2 horizontal members carrying total load at 4 points

Total load = charge + barrel + others

Total load = 15 kg + 13 Kg + 20 Kg = 48Kg / 4 = 12 Kg

Force = mass x acceleration

Force = 12 Kg x 9.81 m/sec2 = 117.72 N = 118 N



RA + RB = 236N

RB x 0.45 – 118 x 0.36 – 118 x 0.09 = 0

RB = 118N

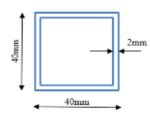
International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

RA = RB = 118N

Maximum bending moment at centre of spam

B.M = 118 x 0.225 – 118 x 0.135

B.M = 10.62 N.M = 10620 N.mm



$$Y = \frac{40}{2} = 20mm$$

$$I = \frac{BD^3 - bd^3}{12}$$

$$I = \frac{40 \times 40^3 - 36 \times 36^3}{12}$$

$$I = 73365.4mm^4$$

$$\sigma = \frac{M}{I} \times Y$$

$$\sigma = \frac{10620 \times 20}{73365.34} = 2.89mpa$$

The frame material is low carbon steel, and the yield strength is 215-250MPa.

When the frame is fully loaded, the stress generated is much lower than the yield point, which makes the construction safe.

3.6 CAD Modeling:

Solidworks is used to create CAD models. Through engineering calculations

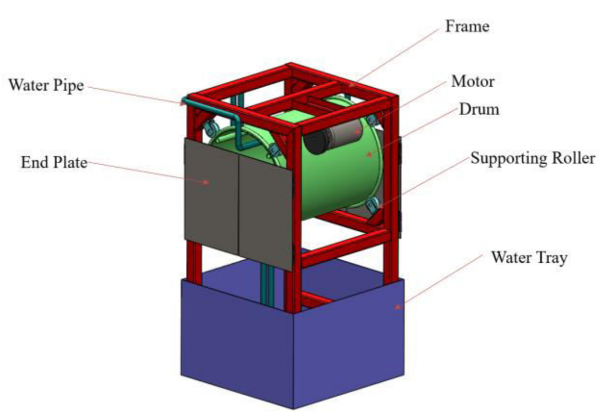


Figure 3.1 Isometric view of CAD model

The barrel is made of 2 mm perforated steel plate. Barrel diameter-380 mm, length-500 mm. One end of the roller is carried by a bearing, and the other end is open. The flat MC 25x3 mm is framed in the form of a drum inside. The Barrel is powered by a 0.5 HP electric motor.

A 40x40x2 mm M.S square tube support frame, supporting the entire device, including the water tank below. The open end of the bucket has a support in the frame to prevent vegetables from falling out during washing. The installation height is 1030 mm.

4. Design Validation:

4.1 Pre-processing:

In finite element analysis, the stability of the structure/machine is observed under given load conditions, in which all structural elements that represent stability or load sources are taken into account to reduce the number of equations to be solved. Apply loads and constraints to the FEM model as shown below. The bottom of the frame is fixed to the floor, as shown by the red triangle.

Figure 4.1 Constraints

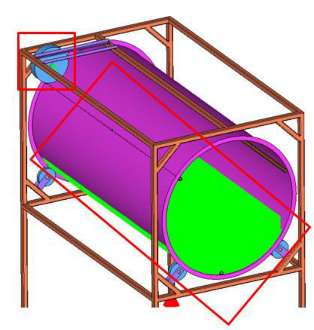


Figure 4.2 Forces and Torque

Forces due to vegetable weight

total weight of single charge = 10 Kg

Force = 10 x 9.81 = 98.1 N

Load on single node = 98.1/42486 = 0.00235N

Motor Torque = 15.696 $N.m$

4.2 Post-processing:

The results of the finite element analysis are shown as displacement, stress and strain.

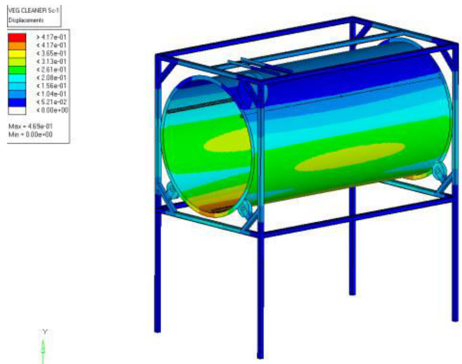


Figure 4.3 Maximum Displacement =0.46 mm

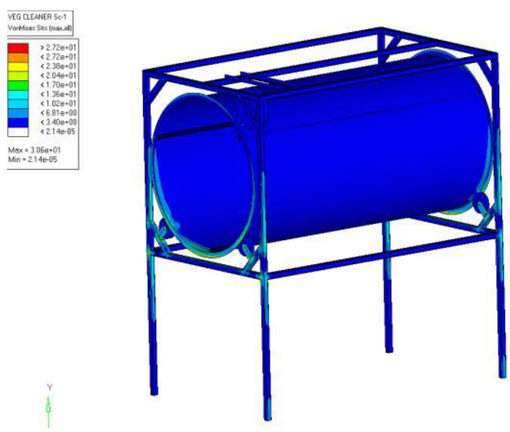


Figure 4.4 Maximum Stresses = 144MPa

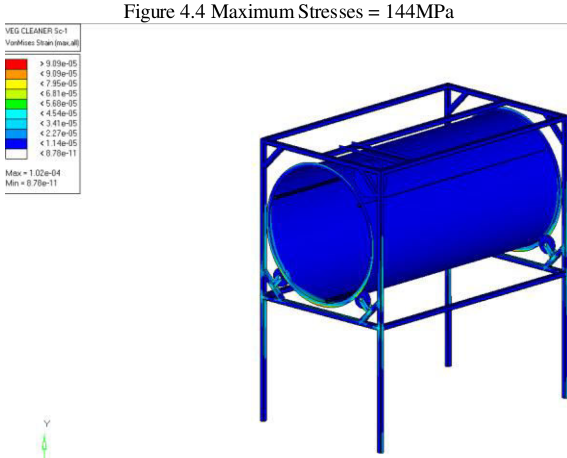


Fig 4.5.: Maximum Strain = 0.000102

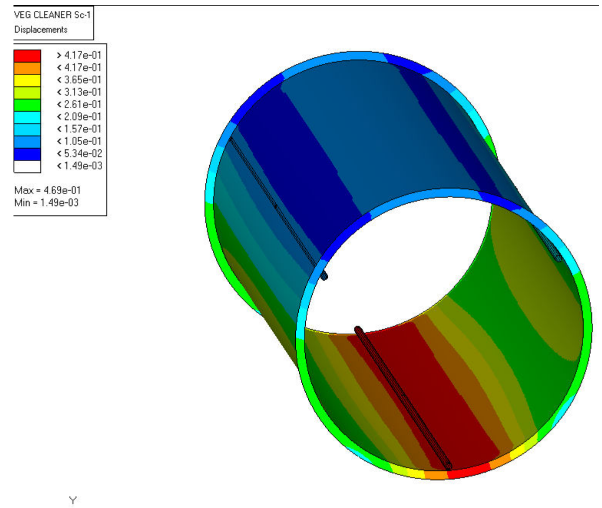


Fig 4.6: Maximum Displacement = 0.46 mm

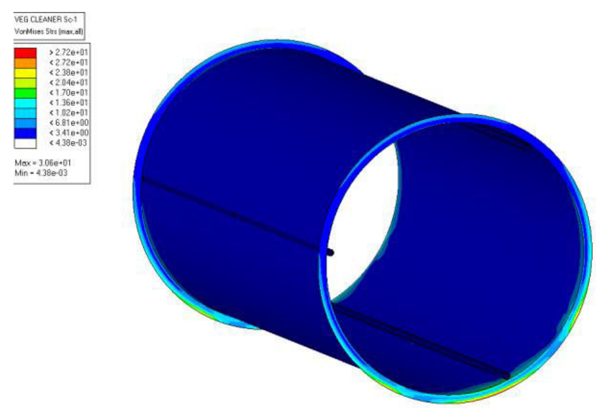


Fig 4.7: Maximum Stresses = 30.6 MPa

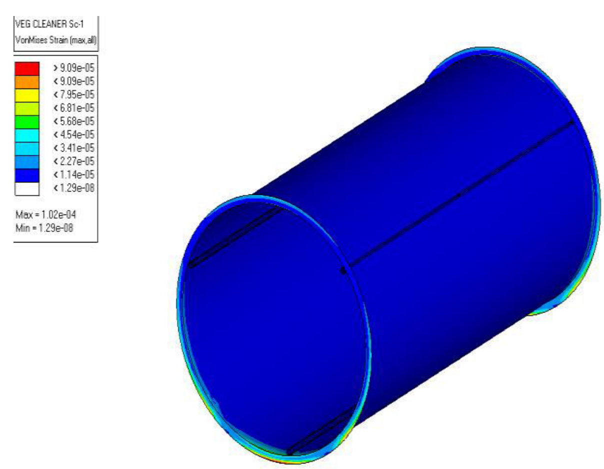


Fig 4.8: Maximum Strain = 0.000102

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

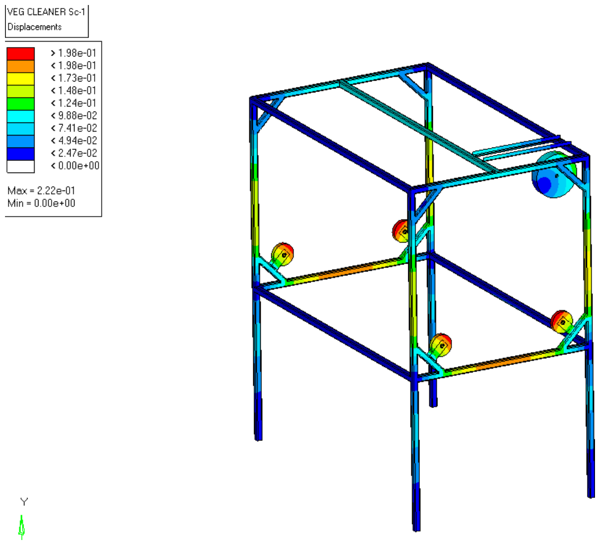


Fig 4.9: Maximum Displacement = 0.2 mm

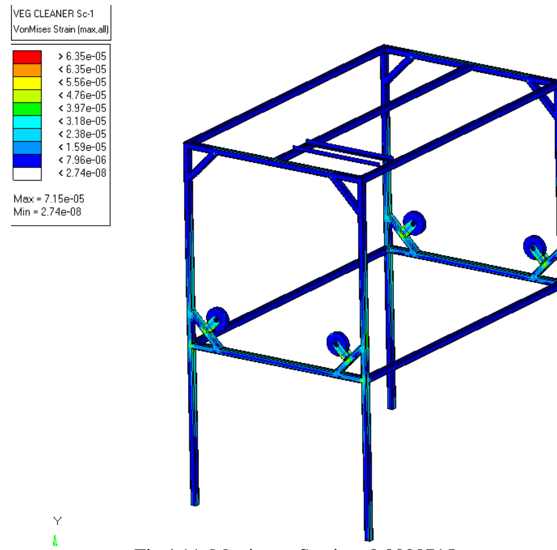


Fig 4.11: Maximum Strain = 0.0000715

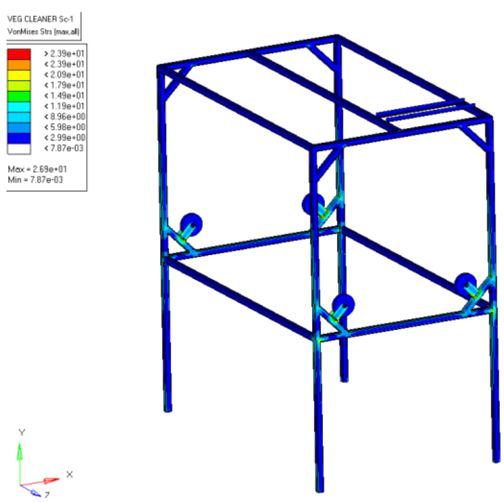


Figure 4.10 Maximum Stresses = 26.9 MPa

5. Result Discussion:

According to the company's requirements, we developed a vegetable peeling machine and analyzed it using the finite element method. With the help of linear static analysis, we determined that the stress in the model was 30 MPa and the elastic limit was 215 MPa. The result of shows that the stress of 30 MPa is much lower than the yield point.
The linear static analysis shows that the displacement of the structure under the maximum load is 0.3mm. The result shows that the displacement is very small compared with the size of the structure and can be ignored. These results indicate that the design is safe for the given load conditions.

Type	Value	Remark
Displacement	0.46mm	negligible compared to the size of structure
Stress	144 MPa	144 MPa < 215MPa. well within the Yield stress limits
Stress in frame	26.9 MPa	26.9 MPa < 215MPa. well within the Yield stress limits

Table 5.1 Analysis observations

6. Development:

6.1 Construction:

The barrel is made of 2 mm perforated steel plate. Barrel diameter-380 mm, length-500 mm. One end of the roller is carried by the bearing, and the other end is open. The flat MC, measuring 25x3 mm, is framed in the form of a drum from the inside. The Barrel is powered by a 0.5 HP electric motor.
A 40x40x2mm M.S square tube support frame, supporting the entire installation, including the water tank below. The open end of the bucket has a support in the frame to prevent vegetables from falling out during washing.

6.2 Construction:

Part No.	Parts	Cost
1	Frame [Material + Fabrication]	5300
2	Tray [Material + Fabrication]	1200
3	Rollers	800
4	Water Pump	350
5	Battery 12V	820
6	Motor	5000
	Total	13500

Table 6.1 Cost estimation

7. Conclusion:

After completing this task, the vegetables are thoroughly washed with water, and the pesticides and residues are removed in a short time with a vegetable cleaner. Stacking and washing vegetables in a vegetable peeler is easy and convenient. It takes less time. According to the performance of the vacuum cleaner, a variety of vegetables can be cleaned at the same time..

Acknowledgements:

The authors would like to acknowledge the support provided by faculty of Bapurao Deshmukh College Of Engineering, Sevagram to conduct these research experiments.

REFERENCES

[1] International Journal of Research and Development Trends, Design, Development and Testing of Small Mechanical Fruit Washers, R.N. Kenghe, A. P. Magar and K.R. Kenghe, Department of Agricultural Process Engineering, Mahatma Phule Krishi Vidyapeeth, rahuri, India.

[2] IJRMET automatic root scrubber design Ravdeep Singh Guman, Rachit Khanna, Sidhant Singla, Preetpal Singh, Harvinder Singh, School of Mechanical Engineering, Chitkara University, Punjab, India.

[3] Design of small root vegetable washing machine Michelle Choi, Isabella khan, Kourosh Mohtashami..

[4] Small mechanical carrot cleaning machine for preparing research samples Author: A. Moos, D. D. Steele, DC. Kirkpatrick.

[5] "Development of a manually operated root crop cleaning machine" by Dawn C.P. Ambrose and S.J.K. Annamalai Central Agricultural Engineering Research Institute, Regional Center, Coimbatore 641003, Tamil Nadu, India.

[6] "Design, manufacture and work estimation of small potato machine (Solanum Tuberosum L.)" Glaizalyn B. Batara; Teresito G. Aguinaldo, Francisco D. cuaresma and Helen F. Gavino, School of Engineering, Central Luzon State University, Science City Muñoz, Nueva Ecija

[7] "Design and Development of Fruit Washer" S.A.Adegbite, S.K.Adeyemi, A.O.Komolafe, M.O.Salami, C.F.Nwaeche and A.A. Ogunbiyi, Journal of Research and Reports 21 (6): 111, 2018; no article JSRR.46041 ISSN: 23200227

[8] "Development of Fruit Washing Machine" F.I. Oyeleke, A. M. Olaniyan, M. O. Sunmonu and S. K. Oyeniyi, Department of Agriculture and Biosystems Technology, Faculty of Engineering, Ilorin University, Nigeria.

[9] "Building vegetable washing machines for the food industry", Toby J. Mendenhall, TomBossa D. Negusse, Stanley G. Solomon, JR. And RANDY R. PRICE, Department of Agricultural Engineering, Oklahoma State University, Stillwater, Oklahoma.

[10] "A drum washing machine for cleaning tubers" Mike Emers, 2012 Alaska Agricultural Innovation Funding Report.

[11] "UBC farm cover cleaning vegetable barrel Solomon Fang, Wendy Huang, Callum McGregor, Rocky Tam.