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Design, Modelling Andanalysis Ofvegetaable Cleaningmachine Foragriculture Use.

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A B S T R A C T: The root greens like radish, carrot and potatoes, etc., after harvesting need to be wiped clean off the soil and clay debrisearlier than transporting them from discipline to market. Normally Indian farmers comply with a conventionalapproach of cleansing the carrots, radish wherein the roots are washed manually via way of means offingers and feet. which appears to be very time ingesting and calls forgreaterwide variety of labours to process. In this venture the CAD version of vegetable cleansingsystemturned into generated and layout calculations turned intofinished. After the CAD version generation, Finite Element Modelling and Finite Element Analysis turned intofinished and the consequenceshavebeenmentionedwith a purpose to finalize the layout for fabrication of bodilyversionwith a purpose tosmoothgreens at inexpensive rate.

Keywords:Rotating Veg. cleaner
Root crops cleaning machine

I. INTRODUCTION

Washing of greens is critical step in any processing operation, which offersappealing and chemical loosegreens. The greens like potatoes, tomatoes, cabbage, carrots, radish, etc., after harvesting had to be wiped clean off the soil and clay debrisearlier than transporting them from subject to the market.

Figure 1.1 Traditional method of vegetable cleaning

Normally many Indian farmers observe a conventionalapproach of cleansing the carrots, radish wherein the roots are washed manually with the aid of usingarms and feet. There is want to layout a rotary kind vegetable cleanser which each farmer in India can afford. Washing of root vegetationearlierthanpromoting it into the market, is an vital process, which reduces the floor microbial load, at the same time aseliminatingthe sector soil, dirtor even residual pesticides, which ends up in the fee addition of the produce on the farm level.

Figure 1.2 Unwashed root crops

Contamination of veggies is typicallybecause of unsanitary cultivation and advertising and marketing practices. The microorganisms and insecticidesconcerned with the meals if remained un-sanitized, may bevital from a public fitnessfactor of view, due to the facttheycouldresultinfitness hazard.

1.1Objectives:

- To conceptualize a layout for vegetable cleansing machine.
- To carry out layout calculations of vegetable cleansing machine.
- To carry out CAD modeling of the idealayout.
- To lessenlabour requirement and time for vegetable cleansing.
- To easy the vegetable very well and eliminateundesirable particles.
- To supply the vegetable to the marketplace as rapid as possible
- To lessenintake of water aidin comparison to cutting-edge methods
- To sanitize the veggies of diverse sizes

1.2 Problem Formulation:

Normally Indian farmers comply with a conventionalapproach of cleansing the vegetable carrots, radish wherein the roots are washed manually with the aid of usingfingers and feet. Manually washing to be very time eating and calls for a morerange of labors to process. Due to loss of time farmers, at oncecarry the greens to the marketplace for promoting and do not the wellsmoothgreens, a hugeamount of undesirabledebris are connectedat the surface, whilefedoncan also additionallyreasonfitness hazards. So, to triumph over this hassle Vegetable purifier is required.

II. PRAPOSEDMETHODOLOGY:

The following methods can be used to achieve a cheap peeler design: In-depthresearchon previous agricultural research will guide you in the right direction. Analysisof existing needs andimplementationof design and experimental design analysis methods will optimize the solution design with the leastamount Possible loads, CADmodels, design optimization and manufacturing.

III. DESIGNING:

3.1 Design Calculations:

Accordingto the following size requirements, it is assumed that the cleaning device casting technical data used to calculate the required.
performance = 18 mm in diameter, andthe distance between two adjacent holes is 13 mm.

Showercastingtechnical dataØ = 3 mm

roller length-1 meter

roller Diameter = 40 cm

Table height = 5 feet

Vegetablecapacity = 10 kg

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

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

Clean up to 50 kg/h. Singleload = 10 kg.

Vegetabledensity = 1080 cubic meters.

Unit load = weight of oneload / density of vegetables.

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

$0.00925 = \pi / 4\ d^2 \times 0.5$

$d = 0.375 \cong 0.38$ m

Cylinder diameter 0.38 m (380 mm)

3.2 Speed of motor roller

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

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

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drum directly connectedto the motor shaft

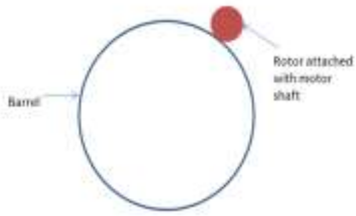
3.3 Torque calculation

When you considerthat the total weight of theswing is 80 kg.

80 × 9.81 = 784.8 N

T = F × r

T = 784.8 × 0.02 = 15.696N.m



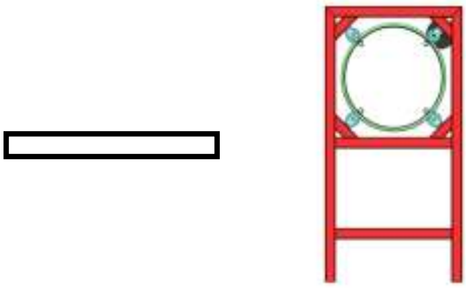
3.4 Power calculation

P = 2πNT / 60

P = (2 × π × 96 × 15.696) / 60 =158watt

3.5Frame Calculations

Deformation calculation



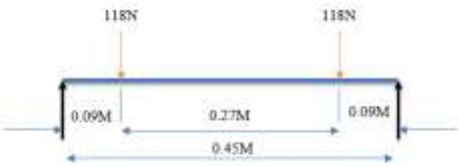
i) There are 2 horizontal elements carrying the total load at 4 points.

Total load = load + drum + other

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

force = mass x acceleration

force = 12 kg x 9.81 m / s2 = 117.72 N = 118 N



RA + RB = 236N
RB X0.45- 118 x 0.36- 118 x 0.09 = 0
RA=118N
RA = RB = 118N
Maximum Biegemomentin spam
M = 118 x 0.225-118 x 0.135
M = 10.62 N.m = 10620 N.mm

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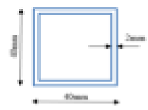

Y = 40/2 = 20M
I = (BD ^ 3 - bd 3) / 12)
I=(⟦40×40⟧^3-⟦36×36⟧^3)/12
I=73365,4⟦мм⟧^4
σ=M/I×Y
σ=(10620×20)/73365.34 =2.89mpa

The frame materialis low carbon steel, andthe yield strength is 215-250MPa.
The stress of the frame underfull load is much lower than the elastic limit,sotheconstruction is safe.

3.6 CAD Modeling:
Solidworksis used to create CAD models. Through engineering calculations

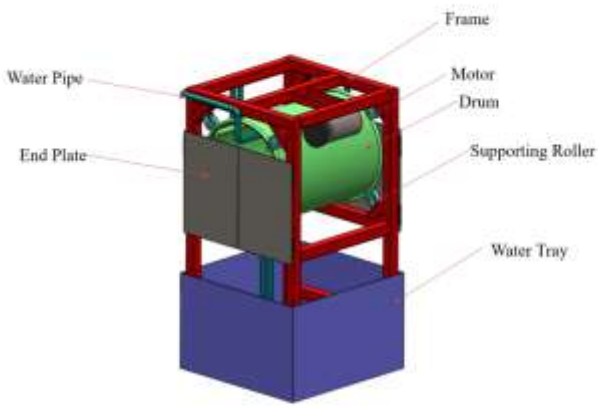

Figure 3.1Isometric view of CAD model

The barrel is madeof 2 mm perforated steel plate. Barreldiameter-380mm, length-500 mm. One end of the roller iscarriedby a bearing, and the other end is open.The flat MC, measuring 25x3 mm, is mounted in the form of a drum from the inside. The high-voltage motor base is madeof MS tube Sq 40x40x2 mm, which supports the entireinstallation, including the water tank below.The open end of the bucket provides framed support sothatthevegetableswillnotfall during harvest.

IV. DESIGN VALIDATION:

4.1 Pre-processing:

In finiteelementanalysis,the stability of the structure/machine is observed under given load conditions, inwhich all structural elementsrepresenting stability or load sourcesare taken into accounttoreduce the number of equations to be solved. Applythe loads and constraints to the FEM model as shown below.Thebottomofthe frame is fixed to thefloor and is represented by a red triangle.

Figure 4.1Constraints

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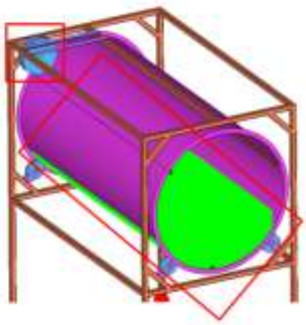

Figure 4.2Forces and Torque

Force throughthe weight of thesystem
Total weight of theload = 10 kg
Force = 10 x 9.81 = 98.1 N
One unit load = 98.1 / 42486 = 0.00235 N
Torque = 15.696 $N.m.$

4.2Post-processing:
The results of the finiteelement analysis are shown as displacement,stress and strain.

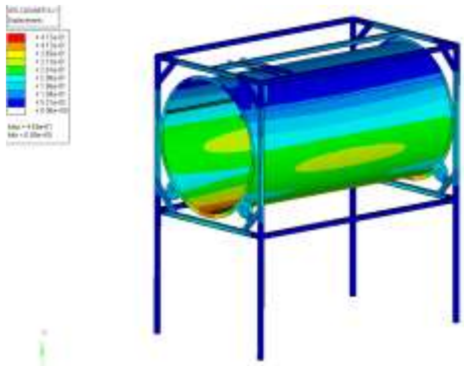

Figure 4.3Maximum Displacement =0.46 mm

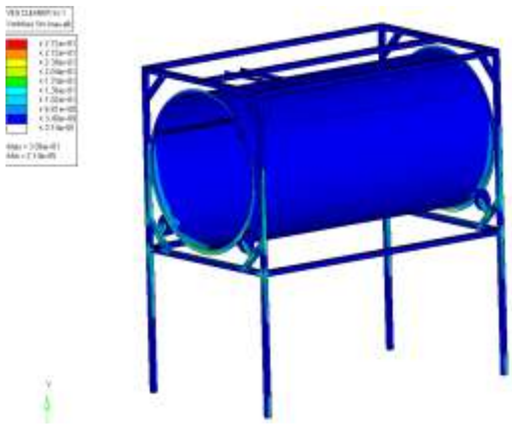

Figure 4.4Maximum Stresses = 144MPa

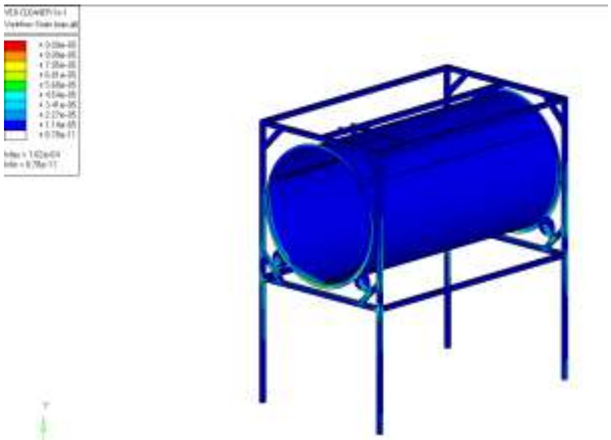

Fig 4.5.: Maximum Strain = 0.000102

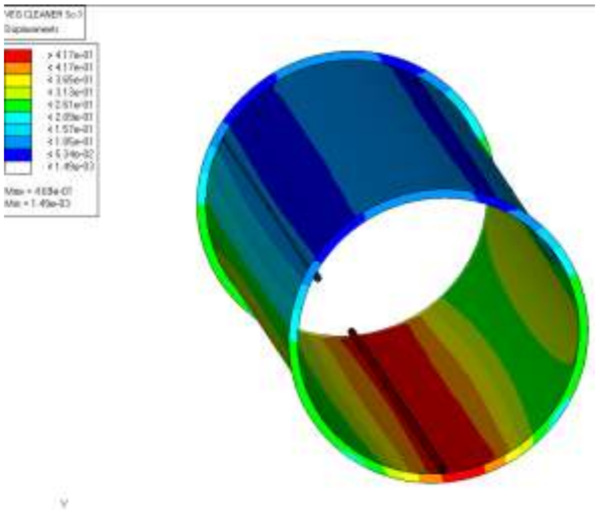

Fig 4.6: Maximum Displacement = 0.46 mm

Fig 4.7: Maximum Stresses = 30.6 MPa

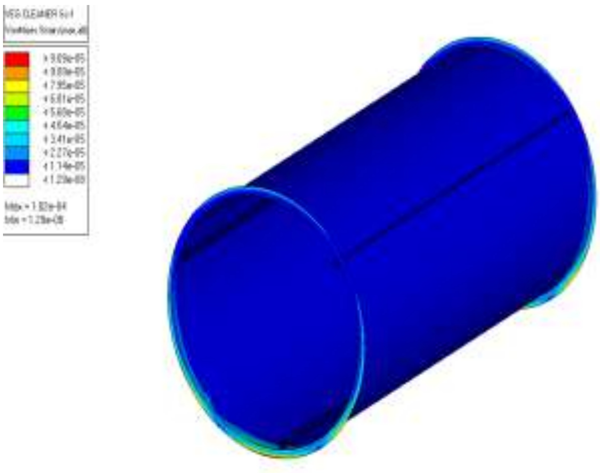

Fig 4.8: Maximum Strain = 0.000102

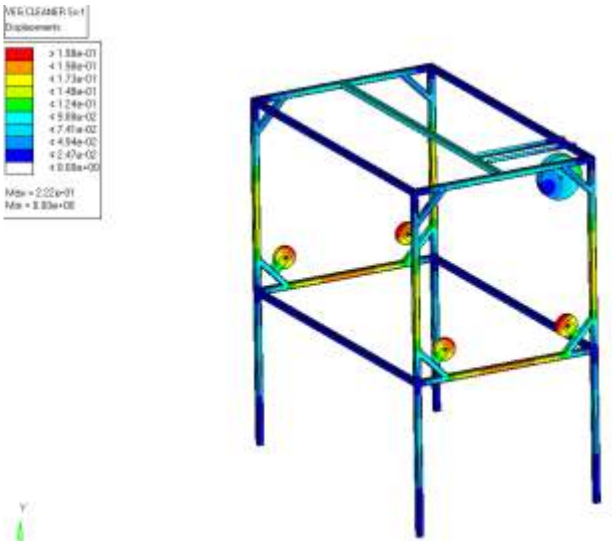

Fig 4.9: Maximum Displacement = 0.2 mm

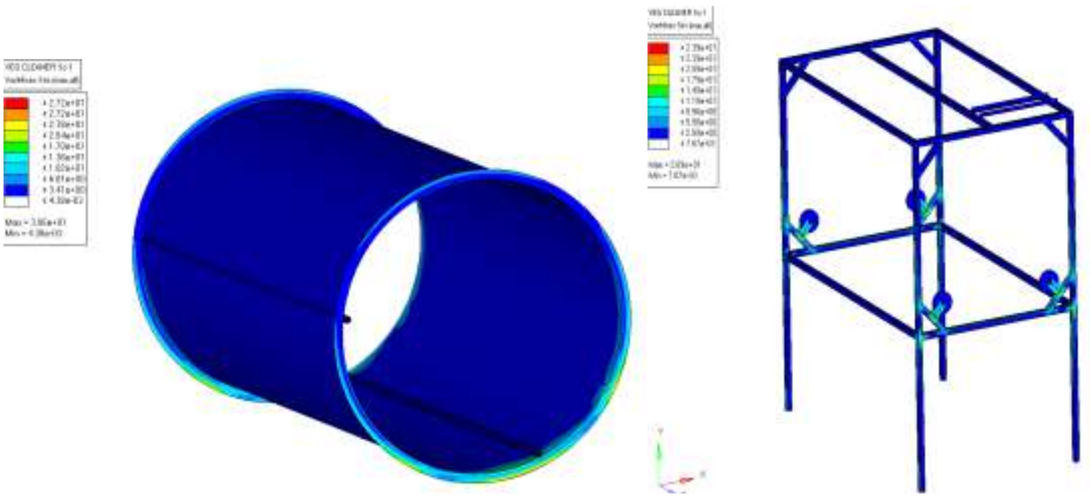

Figure 4.10 Maximum Stresses = 26.9 MPa

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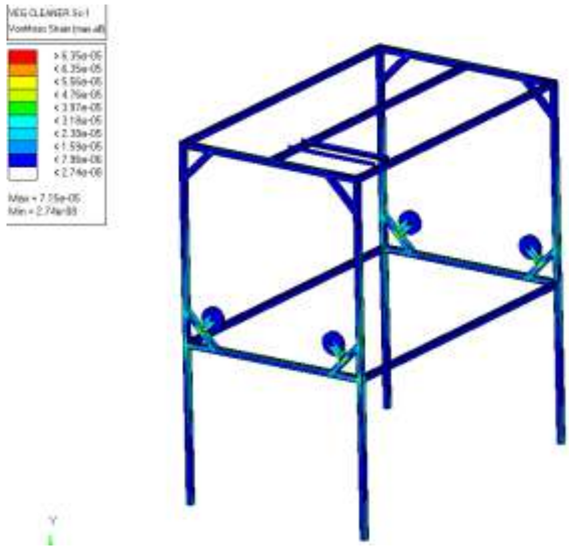

Fig 4.11: Maximum Strain = 0.0000715

V. RESULT DISCUSSION:

According to the company'srequirements, we designed a vegetable peeling machine and analyzed it with the finiteelementmethod.Using linear static analysis, it is found that the stress generatedin the model is 30 MPa, and the elastic limit is 215 MPa. ... It can be seen from the results that the stress of 30 MPa is much lower than the elastic limit. Linear static analysis shows that the displacement in the structure under the maximum load is 0.3 mm. The results show that the displacement is very small and negligible compared to the size of the structure. From these results, it is clear that the structure is safe for the given loading conditions.

Type	Value	Remark
Preload	0.46mm	Insignificant compared to the size of the structure
pressure	144 MPa	144 MPa <215MPa.Withinyieldpoint
Frame tension	26.9 MPa	26.9 MPa <215 MPa, within the yieldpoint

Table 5.1 Analysis observations

VI. DEVELOPMENT:

6.1 Construction:

The barrel is madeof 2 mm perforated steel plate. Barreldiameter-380mm, length-500 mm. One end of the roller iscarriedby a 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 PS motor base is madeof 40x40x2mmMS pipe, which supports the entireinstallation, including the water tank below.Theopenend of the barrel is provided with a bracket with a frame,sothatthevegetableswillnot fall out of the barrel during washing. ...The installation height is 1030 mm.

6.2Construction:

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

ADVANTAGES:

The this machine is portable and can be used for small scale level.

mainetenance cost of this machine is very less

This machine can be handle by unskilled labor

The intial cost of this machine is very less

The production rate of this machine is machine is more as compared to conventional machine.

VII. CONCLUSION

Aftercompleting this task, the vegetables are thoroughlywashedwithwater, and the pesticides and residuesare removed in a short time with a vegetable cleaner. Stacking and washing vegetables in a vegetablepeeler is easy andconvenient.It takes less time. According to the performance of the vacuum cleaner, multiple vegetables can be cleaned at the same time.

Future Work:

- Water sprinkle system can be changed.
- Driving system of the system can be changed to increase the efficiency.
- Capacity and speed of the system can be change according to the requirement.

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