

# ***BOTTLE WASHING MACHINE***

*Sudarshan Sahebrao Jagtap [3]*  
*Department Of Mechanical Engineering*  
Guru Gobind Singh Polytechnic, Nashik, India  
[sudarshanjagtap2004@gmail.com](mailto:sudarshanjagtap2004@gmail.com)

*Tanishq Komal Hiray [2]*  
*Department Of Mechanical Engineering*  
Guru Gobind Singh Polytechnic, Nashik, India  
[tanishqhiray@gmail.com](mailto:tanishqhiray@gmail.com)

*Prof. Ganesh Deepakrao Wagh [1]*  
*Department Of Mechanical Engineering*  
Guru Gobind Singh Polytechnic, Nashik, India  
[ganesh.wagh@ggsf.edu.in](mailto:ganesh.wagh@ggsf.edu.in)

**Abstract**—One of the most complicated problems faced in these industries include cleaning of storage or processing containers especially in industries like, tissue culture, beverage, medicinal industries as well as food industries use bottles/containers extensively on a large scale. Before storage of products which may include food, seeds, tissues, preservatives, medicines, beverages the storage element needs to be cleaned thoroughly. For e.g., in tissue culture industry the media prepared is stored in a highly clean and contamination free sanitized storage glass bottle. These bottles are reused many numbers of times and hence cleaning becomes extremely important.

This machine reduces the effort and time required to wash the bottles. Each machine can accommodate 2 workers at the same time which considerably increases the washing rate and reduces the labor required as compared to manual washing. Each machine has 4 brushes and thus it can wash 4 bottles at the same time. The brush has a high rpm rapid spinning action which cleans the bottle inside out and removes any sort of dirt, stains, left over products from the surface efficiently resulting in a very clean surface.

This machine is simple is working and does not have any complex sensors and programmesthus, it does not require skilled worker and can be easily operated by ordinary personnel. moreover, it has very less maintenance and it is very easy to install. it can also be transported easily as the agriculture-based industries are in remote areas. This machine plays a very important and crucial role in the operation of industries and increasing the efficiency and reducing the effort of worker, also improving the quality of cleaning.

**Keyword-** *complete, efficient, and affordable solution for the bottle washing purpose which has countless benefits.*

## **INTRODUCTION :**

The idea of this bottle washing machine is mainly originated from tissue culture industry, where the plant tissue is grown into a sapling and finally a plant to supply to the consumers (mainly farmers) with the finest quality and at a affordable rate. The process briefly includes the preparation of media (chemical necessary for the growth of the tissue into a plant which includes all the qualities nutrients of soil essential for fast and healthy growth of sapling in a high quantity). This tissue is grown in a glass bottle in precisely controlled environmental, lightning, temperature, and completely germ-free conditions, without contamination. One tissue is grown into up to 7 saplings or even more, consisting of multiplication and rooting process on the plant tissue. After each process the tissues are separated after

they have become saplings and placed into another bottle containing different hormones for the sapling. In this way thousands and lakhs of saplings are produced in a typical tissue culture industry.

In this all long, complex, and careful process the bottle/jar used plays a very important and crucial role, as it directly affects the result and quality of the product. Using new bottles each time at such a large scale for such high number of tissues is extremely costly and increases the cost of final product i.e., saplings, as observed in case of tissue culture industry. thus, it is a necessity to wash and reuse these bottles for further plantation. As for the purpose a machine which can solve this problem and wash the bottles at a rapid rate is required, which can be operated easily by unskilled or any other ordinary personnel. Washing manually with hands is not hygienic, time consuming, costly as well as a slow process.

This bottle washing machine provides complete solution to all these problems at a very affordable cost with low maintenance, compactness with maximum reliability and durability. It washes the bottles efficiently and thoroughly and makes it perfect for its reuse. It drastically reduces the cost of labor and time required for washing simultaneously also improving the quality of cleaning achieved. Its major benefit includes its usability as it accommodates 4 bottles at the same time and 2 workers can work on either side of machine individually. It provides a rapid cleaning action, consumes low power and it is manually operated without any complex control panels or programmes. The 0.5 HP motor provides powerful & plenty of output for heavy and continuous usage.

Not only in tissue culture industries but any other industry such as food, beverage, medicinal, agriculture, chemical, etc. which uses a storage element such as a bottle/ jar / container for storage/ transport/processing of its products, this machine can be used in all these types of applications.

**OBJECTIVE:**

- To create a machine which is easy to operate & install.
- To create a machine which performs its function efficiently at low cost, low maintenance, less capital investment in less space.
- A machine on which 2 operators can work simultaneously & individually.
- To make a machine which consumes less power.
- Machine which reduces washing time and improve cleaning quality.
- To understand the industrial problem and give perfect and efficient solution.

**COMPONENTS OF BOTTLE WASHING MACHINE**

**1. BASE FRAME:**

Material: M.S  
Section of pipe 30 x 30  
Weight: 20kg  
Finish: powder coating  
Joint: welding

**2. MOTOR MOUNT:**

Motor mount is mounted on top of the base frame at the center with bolts it consists of the complete drive system. It is the main part of the machine. The drive system consists of the motor, shaft, pulleys, and the complete drive assembly. This complete unit can be completely disassembled from the machine. The main purpose of this mount is to hold the complete drive system in their correct relative position and the parts can be easily serviced and dismantled for transport and parts replacement without taking out the complete machine. It is made up of 50 x 50 x 5mm M.S angle.

**3. MOTOR:**

The reason behind using AC 3 phase motor is that, it is much more beneficial over single phase motor, another major reason for selecting 3 phase motor is the machine is going to be used in industry where 3 phase supply is easily and mostly available. Also, the cost of single phase is much higher than 3 phase motors for same torque. The

requirement for project was a foot mounted type motor. The reason for selecting 0.5hp is cost effectiveness and the correct requirement of torque and speed for washing glass bottle should be sufficient to wash the bottle properly and not too much to cause breakage of the bottle.

- **Specifications:**

- Current: - 3 phase induction AC motor 1.40 A
- HP/Kw: - 0.5/0.37
- Frequency: - 50hz + 3% AC
- Motor type: - TEFC
- Mounting: - foot mounted
- Voltage: - 415V AC
- RPM: - 1440
- Rated speed: - 1310
- Efficiency: - 70.10%
- No. of poles: - 4
- Connection: - Star
- Insulation class: - F
- Fixed output: - 370 W

#### **4. SHAFT**

The shaft used in this machine is Mild steel Ø28mm. The reason for mild steel shaft is cost effectiveness. The shaft length is 740mm. suitable for table length, motor capacity and bearing capacity as well as reduced cost. Processes done on the shaft are: - Plain Turning, Threading, Facing, Step turning, Chamfer, Slotting. The shaft has sufficient strength for the application. The bearings mounted on the shaft are of Ø25, hence the shaft is step turned up to 25mm for proper interference fit of bearing on shaft. Threading on both sides for chuck are provided. Slots for key and chamfer for smooth burr free finish is given

#### **5. BEARING: -**

The bearings are used to support the shaft, at equal distance from the ends. Total 4 bearings are used. The specifications are given below:

Specification:

Bearing- UC 205

Type: pillow block insert

Internal diameter (bore)- 25mm

Weight- ~0.2kg

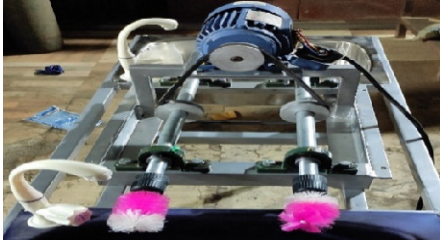
#### **6. ACCESSORIES**

- **Chuck**

The chuck is threaded at the both end of each shaft. Its function is to hold the brush rigidly and promote easy replaceability whenever necessary. A hand tighten able plastic body chuck is used. With tread size ½” and chuck diameter 12mm.

- **Brushes**

Brushes are clamped in the all 4 chucks for scrubbing the bottles. It is the part which does the actual cleaning action.



## PULLEYS & KEYS

### Pulleys

The pulleys are used to transmit the power and torque from the motor located at the top to the two shafts respectively. Both the pulleys are of same diameter, in order to provide same rpm to the shaft as that of motor.

### Specifications:

Pulley diameter- 3" (76.22mm)

Pulley type – 3"1A

Internal diameter (for shaft)- 28mm

Internal diameter (for motor shaft)- 16mm

### Keys

It transmits the power from pulley to shaft and it avoid the relative motion between mating elements. In this machine the key used is a square key with dimension of 50mm x 6mm x 6mm. two keys are used.

## WORKING :

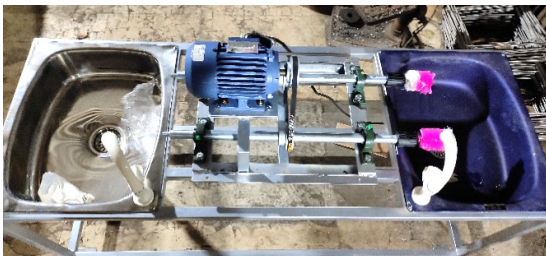
### Starting process:

To start the motor of the machine the supply of 3 phase should be given, then turn on the MCB provided at the one end on the machine. This MCB switch is given for quick ON/OFF operation of the machine as well as for safety purpose thereby to avoid electrical hazards and prevent damage to the motor. The belt drive will start rotating after turning on the switch. The power will flow from the motor to the pulleys via belt and thus the 2 shafts will rotate. All the 3 pulleys are of same diameter, as a result the speed of the shaft is same at that of the motor. Thus, the keyless chucks threaded to the shaft will rotate and brushes clamped to the chuck will rotate and the machine will be ready to use.

### Cleaning process:

The cleaning process is simple and is done by putting the bottle in the brush end connected to the shaft inside the bottle, this makes a scrubbing action inside the bottle at a high speed of up to 1440 rpm thereby cleaning the bottle thoroughly from inside providing a strong as well as continuous scrubbing brush action in the bottle cleaning it from inside. The bottle is further washed with water by the operator for flushing out the dirt & debris from the bottle. 4 bottles can be washed simultaneously on 1 single machine.

These brushes can also be customized and changes can be made according to the size and shape of the bottle to be washed and easily replaced as chuck is provided.



**Power flow:**



**ADVANTAGES:**

- Simple in design & Compact in size.
- Belt drive, hence no need of lubrication and lower maintenance
- 4-way brush on 1 single motor.
- 0.5 hp motor for efficient performance.
- Easily customizable.
- Less power consumption.
- Maintenance free design.
- No skill labor required.
- Easy to operate.
- Less noise of drive.
- Easy to assemble and disassemble.
- Two operators can work simultaneously.
- Easy replacement of brushes, as hand tighten ablechuck is provided.

**DISADVANTAGES:**

- No speed controller is provided.
- Vibrations may occur if shafts are misaligned.
- Bearing life may reduce due to moisture.
- No safety cut off mechanism.
- Heavy.
- Pulley alignment needs skilled person.

**FUTURE ENHANCEMENTS:**

- Singlephase motor can be introduced for domestic purpose applications& no 3 phase is available.
- Addition of various sensors safety mechanism for improving safety for operator.
- Introduction of automatic soap dispensing unit for addition of soap while washing.
- Providing speed controller for motor to control the speed according to application.

**CONCLUSION:**

Bottle washing machine is a perfect choice for small scale industries with requirement of washing bottles, thereby providing a smaller alternative of huge bottle washing machine at a affordable cost. Compact design and easy assembly/ disassembly makes it easier for transportation and simpler maintenance, also easy installation. Reduction in the time required for cleaning process is a major advantage. This bottle machine has great potential for increasing the productivity of the industry. Till now manual washing was used for washing bottles in small scale as well as some medium scale

industries. By using this project, we can save more time required for washing process and reduce lot of labor cost. With the adaptation of this bottle washing machine great profit will be gained

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