

NEW DESIGN AND FABRICATION OF AUTOMATIC DISH WASHER

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Abstract This paper discusses about how to reduce the human efforts and washing the two side of plate in dishwasher. The dishwasher has made wiping and drying plates much easier and more efficient. Automatic dishwasher uses to minimize the time of washing and reduce human energy . By separating assembly parts for spraying of water, injection of soap solution and brushing of plates. By using this process large amount of work can be done in considerably lesser time. In conventional dish washing process large amount of human power as well as quantity of water is used. So keeping that in mind, to reduce those problem and it is developed. Also we can use this in places where there is vast use of dishes for example, marriage ceremony, college mess etc. This dishwasher in which can conserve time and cost rather than spending in washing dishes by hand and wasting large amount of energy.

Keywords: DC motor , vertical plate, Dish washer,

1. INTRODUCTION:

Now a days, the automation can takes place everywhere. More and more works are developed into fully automatic. Now the dish washing also developed into automatic. The dish washing is commonly done everywhere in the world, that work is done by hand. So the washing and scrubbing will affect muscular pain, wastage of time and spend more energy for washing. Dish washing is a common activity, in most of families. People wash dishes by hand which gives muscle strain in various parts of the body and detergent is chemically harmful to their skin. In India, Dish washing is done manually which gives more strain to the muscles of the workers. Since, India is a 2nd populous nation in the world, dish washing by manual process takes more time. Hence there is a need of dish washing machine in the market. The automatic dish washing will make useful to reduce the washing time and energy. It can works mainly 4 process—

- Initial Spraying of water to the plate.
- Apply detergent to the dishes.
- After scrubbing dishes.
- Finally spraying of hot water.

2. LITERATURE SURVEY:

J. G. GOCHRAN- “Dish washing machine” [1] (1886): This paper gives brief idea described about improvement of dishwashing machine. It related to improvement in machine washing a dishes in which a continuous stream of either soap-soda or clean water is supply to crate holding the rack or cage hot water is supply to crate is rotate so as to bring the greater portion thereof under water.. The wire chamber placed inside a wheel that lay flat inside a copper boiler. A motor turned the wheel while hot soap water squirted up from the bottom of boiler and rained down on the dishes. The result indicates that model is first reliable hand powered machine use s a water pressure instead of scrubber to clean the dishes inside the machine. [1]

Odesola & Afolabi- “Design, Fabrication and Performance Evaluation of a Domestic Dish Washing Machine” [2] (2012): This paper discusses about the design, fabrication and performance evaluation of a domestic dish washing machine. The objective of this work is to design and fabricate a dish washing machine that is efficient and easy to operate. Stainless steel and mild steel was used for the construction of the machine considering their availability, cost reduction and corrosion resistance. The result indicates that the dishes are cleaned by spraying hot water rather than cold water typically, between 55 to 75 °C (130 to 170 °F) to loosen the sticky and oily substances. A mix of water and detergent is used for cleaning purposes, followed by clean water to remove the detergent residue.

Dhale A. D. - “Design and development of semiautomatic dishwasher” [3] (2015): This paper discusses about the design, construction and evaluation of a dish washing machine. The capacity of the machine was 20 plates per minutes (i.e. 1880 plates per hour). The designed dishwashing machine is very efficient and easy to operate. The result indicates that the detergent used is quite diluted and is biodegradable, with no phosphates, enzymes, or citrus

additives. This leads to less requirement of detergent and cleaning is done mostly by use of water. This might leave a greater ecological footprint than other methods of dishwashing. Also series of test were carried out in order to determine the performance and efficiency of the machine. This was done by comparing the rate of washing with the designed dish washer to the handwashing. [3]

Gaurav Gholap, Shankar Gaikwad. "Design and fabrication of dish washing machine"(oct 2016):In this paper we got a idea to carry a sish in a vertical position.

Bhor Rohan Bhimaji, Choudhari onkar kisan. "Design and Fabrication of Automatic Dishwasher" (march 2017):In this the plates are washed by water and using the scrubber to clean wastes.

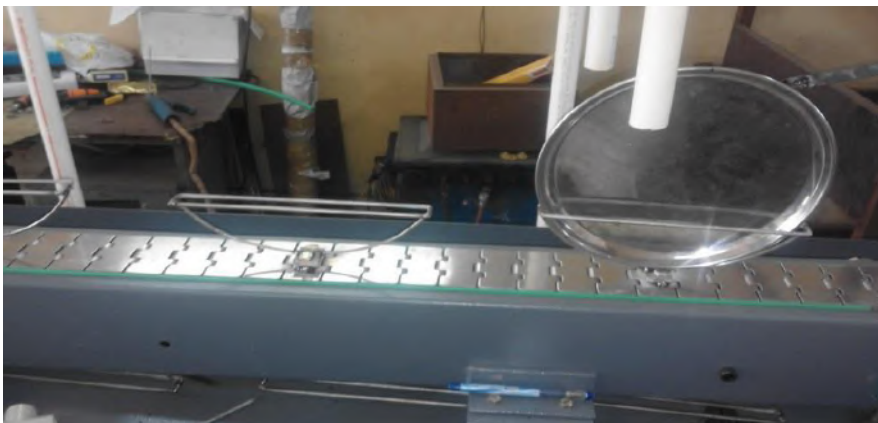
Kshirsagar P.R, Solkar R.I. "Design, Fabrication and Experimental investigation of Semi-Automatic Dishwashing Machine For Domestic Purpose" (april 2017): In this paper, the dishes are works on rotary and power consume is less.

3. MATERIALS:

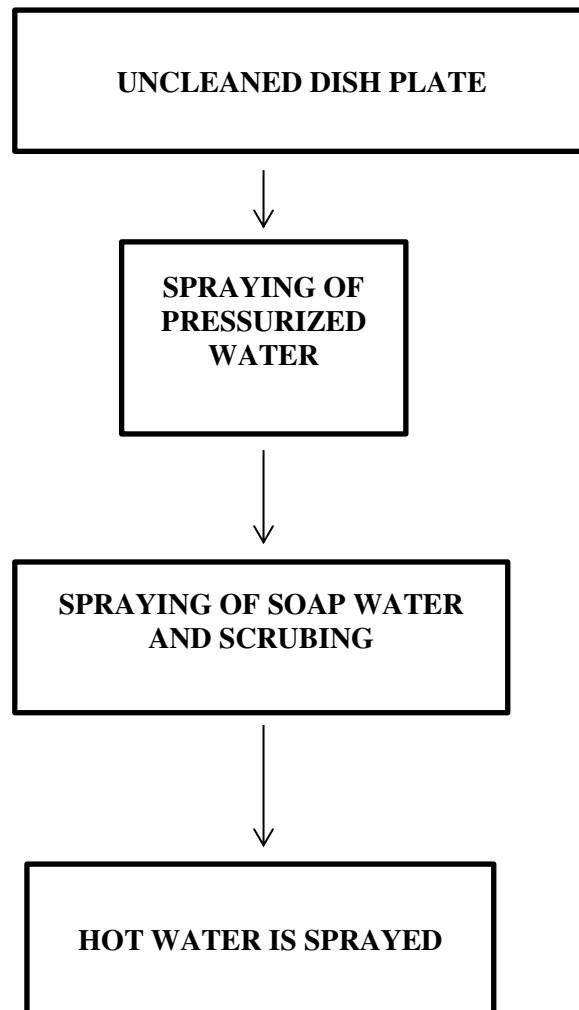
S.NO	Materials
1.	Roller with Brush.
2.	Metal conveyor.
3.	DC geared Motor.
4.	Plates.
5.	Sheet Metal.
6.	Bearing.
7.	Thermostat.
8.	Universal motor.
9.	Water controlling valves.
10.	Water pumps.
11.	Plate holder.
12.	Plastic tubes.

4. METHOD:

In washing of dish, first step is clearing off the waste food on plate and then scrub it with soap solution. Here also, we are following same first step in which the dirty dish which has to be wash is put in first washing chamber. The dishes are kept in vertical position in the conveyor belt and then it enters the washing chamber. Where the spraying of pressurized water & washing of dish takes place. Dish put on the conveyor belt is operated by using universal motor. The motor stops when dish enters in washing chamber. Universal motor is operated with delay of specific time interval and entire operation of system is controlled by the sensors. At first pressurized spray of detergent water is thrown on dish with the help of nozzles. The operation performed with help of water pump. Here the waste foods are removed in this stage and it is sent to second stage which is scrubbing. There the plates are cleaned by using the rotary brushes, here in this stage almost all the impurities are removed in this process. Finally the dishes enter the last stage were the hot water is sprayed on the dishes to remove the soap solution present in the dishes and then the dishes are collected wiped with a cloth and arranged in a proper manner . The water is sent through the discharge port which is connected to the machine.



5. PROCESS FLOW:



6. DESIGN CALCULATION:-

In this project, it is required to calculate for belt design which is used to run the fabricated model. The following steps were used to calculate the design of the Belt Drive, FOR BELT, Rated Power=100W, Diameters of pulley = 20mm, Speed of the driving pulley =100rpm, Centre distance = 130mm.

STEP 1: In this step selecting the type of belt which was required to run it. The drive is OPEN FLAT BELT DRIVE, CROSS BELT

STEP 2: In this step first to know the diameter of driven and driving Pulleys.

And find the value of ratio 'i'.

By using PSG Data Book equation 1 is used to find the 'i' value, If we have any three values we can easily find the value by using this equation 1.

But we have to calculate only Ratio of

$$d_1 = d_2 = 20\text{mm}$$

$$i = N_1 / N_2 = d_2 / d_1 \dots\dots(1)$$

$$i = 20 / 20;$$

$$i = 1.$$

STEP 3: In this step we calculate the Power which will be calculated using PSG Data Book.

$$\text{Design power} = \text{Rated power kW} \times \text{Load correction / Correction factor } (F_a)$$

$$\text{Load correction factor } F_a = 1.2$$

Equation 2 is used to find the arc of contact. Where 'c' is the Pulley Centre distance.

$$\begin{aligned} \text{Arc of contact} &= 180 - ((d_1 - d_2) / c) \dots\dots(2) \\ &= 180 - ((20 - 20) / 0.130) = 180 \end{aligned}$$

Correction factor, $F_d = 1$

For arc of contact 180

$$\text{Design power} = 0.10 \times 1.2 = 0.12 \text{w}$$

STEP 4: To find the Belt Width and velocity of Belt by equation 3. From PSG Data Book,

Width (b) = Design power / Load rating \times No of plies Load rating,

Load rating (V) at m/s = load rating at 10m/s \times v/10

$$V_1 = \pi \times d_1 \times N_1 / 60 \times 1000 \dots\dots(3)$$

$$V_1 = \pi \times 20 \times 100 / 60 \times 10 = 0.105 \text{m/s}$$

Assume HI SPEED 878g duck belting 0.023kw/mm/ply

$$\text{Load rating at V m/s} = 0.023 \times 0.105 / 10 \dots\dots(4)$$

$$= 2.41 \times 10^{-4} \text{KN/mm/ply}$$

Belt speed v=0.105m/s so take 10m/s and minimum pulley diameter=20mm

So take

$$d = 90 \text{mm}$$

No of plies = 3

$$b = 0.12 / 2.40 \times 10^{-4} \times 3 = 166.667 \text{mm}$$

Therefore maximum standard belt width for 3 ply

$$b = 100 \text{mm}$$

STEP 5: To find the Pulley Width. By using PSG Data Book steps standard pulley width can be determined.

Including 125mm of belt width

Add 13mm

$$\text{So pulley width} = 100 + 13 = 113 \text{mm}$$

To make standard pulley width Pulley width = 125mm

STEP 6: Calculating Length 'L' of Belt.

By using Equation 5.

We know the all values in the equation 5. So easily finding the Length of Belt

$$L = 2c + \pi/2 (d_1 + d_2) + (d_1 - d_2)^2 / 4C \dots\dots(5)$$

$$L = (2 \times 0.110) + \pi (0.02 + 0.02) / 2 + (0.02 - 0.02)^2 / (4 \times 0.130)$$

$$= 0.22 + 0.0628 + 0$$

$$= 0.2828 \text{m}$$

B. In this step finding the torque for driving pulley motor.

In equation 6 is the formula for Design power but we know that the power of motor. By using this equation 6 torque of motor will be calculated as follows.

$$\text{Power} = 2 \times \pi \times N \times T / 60 \dots\dots(6)$$

Given Power = 100w

Given Speed (N) = 100rpm

$$\text{Torque} = 100 \times 60 / 2 \times \pi \times 100$$

$$\text{Torque} = 9.550 \text{N-m}$$

7. RESULT:

This project final result to clean the plate both the side very effectively. Usage of time also be reduced with reducing the human effort. The main thing in this project is to place the plate vertical in the conveyor.

8. CONCLUSION:

The design and fabrication has been done to reduce time and wash the dishes with more effectively. Finally our paper conclude with the dishes are cleaned more effective compare to conventional dishes.

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