

# Power Efficient Dishwasher

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## ABSTRACT

Dishwasher is a machine that facilitates the washing of utensils and cutlery during its operation. We had observed that household and traditional way of washing utensils was a very cumbersome process that led to waste of time and energy. We conducted a market research on various dishwashers present in India and observed that dishwasher present have low power efficiency. This paper explores the design decisions and steps implemented in achieving a customised power efficient dishwasher.

**Key Words:** Dishwasher, Power Efficient, Fabrication

## 1. INTRODUCTION

Dishwasher is a mechanical device utilized to carry out the basic operation of washing dishes and utensils. In a dishwasher, water is sprayed at high speeds with the help of pump and a rotating arm. In most of the dishwashers hot water is used for heavy duty utensils while water of lower temperatures is used for delicate utensils to avoid damage.

A dishwasher comprises a dishwashing tank with a compartment for receiving articles to be washed, and a magazine provided below this compartment for receiving washing liquid and blasting agent [1]. The densities of the blasting agent and water are different. A pump is usually connected to a conduit which provides water and blasting agents at higher pressures to a nozzle which deliver the pressurised water and blasting agent to the utensils present in the chamber. Water and blasting agents discharged from the nozzle arrangement impinge upon the articles to be washed [1]. Water and the blasting agent are usually drained from the bottom of the compartment through a conduit.

Household and industrial dishwashers utilize hot water to remove the heavy derby present on the articles inside the compartments.

Most dishwashers employ a heating mechanism to provide warm/hot water. A coil is usually situated at the bottom of the compartment. Water is then allowed to enter the compartment and the water is initially heated for a period of time. The water is then pumped through a conduit and sprayed onto the articles present inside the compartment.

To solve the problem of heavy debris or dirt, it is advised to follow a pre-wash prior to the main washing step. More concentrated soap solution is sprayed and allowed to stay on the articles before the main-washing step. Adding this step improves the cleaning ability of the conventional dishwasher model, thereby enabling it to remove stubborn or heavy debris it could not [2].

## 2. DESCRIPTION

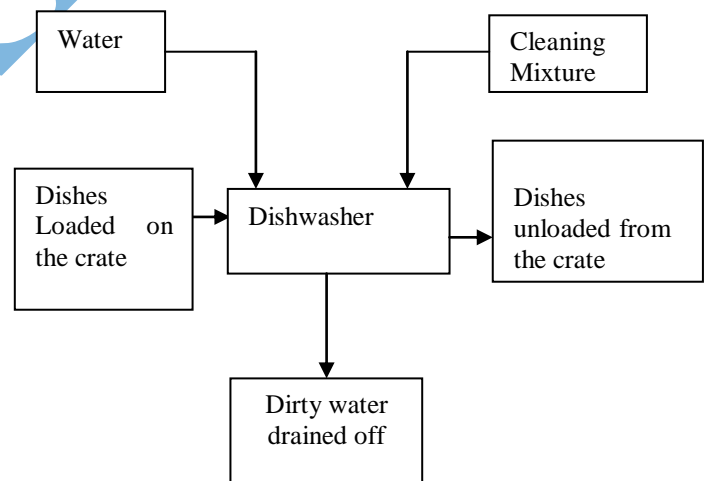


Figure 1: Flow Chart Dishwashing Process

The dishwasher is supplied with water through a conduit. The water is supplied to a self rotating nozzle. The design of the nozzle facilitates high water velocity jet due to the reduced ejection of outlet area. We observe similar phenomena while using a hose pipe, higher velocity of water is attained when the outlet is partially covered with a finger.

The articles are rinsed with water for 45 seconds. The next step involves spraying of cleaning mixture on the articles present in the compartment and this process lasts for 30 seconds. The cleaning mixture is allowed to stand on the articles for 20-30 seconds, followed by spraying of clean water on the articles which lasts for 30 seconds. The cleaning mixture comprises of commercially available detergent and water. The cleaning mixture is stored in the compartment situated above the dishwasher.

The cleaning mixture diffuser is connected to the main conduit supplying clean water. The pipe connecting the cleaning mixture diffuser and the conduit is fitted with a valve which is manually operated.

The waste water falls to the bottom of compartment and is collected till the entire process culminates. The waste water is drained through a drain pipe present at the bottom of the dishwasher below the lower compartment wall.

The dishwasher utilised 7.5L of water during tests.

### 3. OVERALL DESIGN

The dishwasher consists of dish washing compartment, dish holder, self rotating nozzle and soap solution diffuser.

1. Dish washing compartment: The dish washing compartment is designed as per the dimensions of the washing specimens considered. The compartment can be accessed from either side, 2 sliding doors are placed opposite to each other.
2. Dish holder: The dish holder is the movable component of the machine. The dish holder can be easily removed from the compartment using a sliding mechanism. A total of 4 plates and 8 spoons can be mounted on the dish holder such that optimum cleaning occurs. The dish holder can be removed from either side of the dishwasher compartment.
3. Nozzle: A self rotating nozzle is the key element of the dishwasher. The nozzle is attached inside the dishwashing compartment in such a way that water and cleaning mixture is uniformly sprayed on the plates thereby cleaning them efficiently. Nozzle rotates

under the influence of water pressure. Spray angle is 360°.

4. Cleaning mixture diffuser: The soap solution diffuser is situated above the dishwasher compartment adjacent to the main conduit. Once the plates are rinsed with water the valve is opened and the cleaning mixture diffuses into the main water supply. The soap solution is then sprayed uniformly on the washing articles.

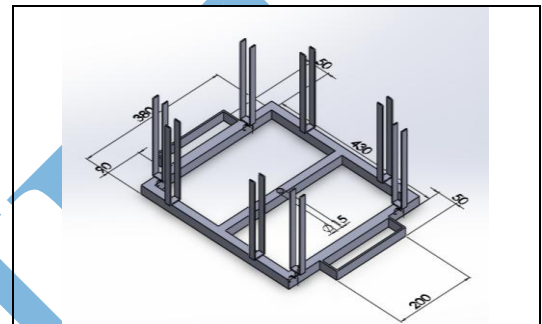


Figure 2: CAD Model Dish Holder



Figure 3: Dish Holder

Table 1: Dishwasher Holder

Length	430mm
Breadth	380mm
Thickness	20mm
Inner Length	185mm
Inner Breadth	340mm
Hole	15mm
Clamp Height	175mm
Clamp Width	27mm

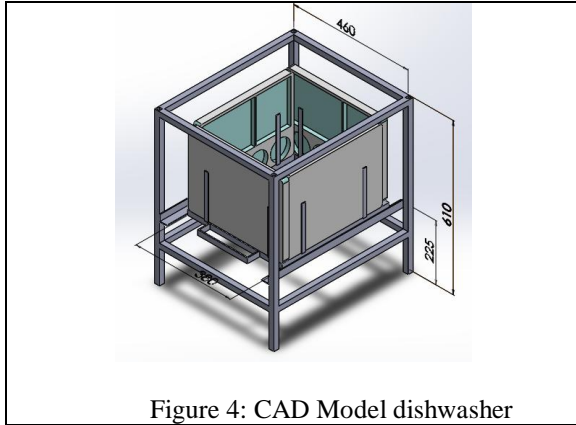


Figure 4: CAD Model dishwasher



Figure 5: Dishwasher with dish holder



Figure 6: Nozzle

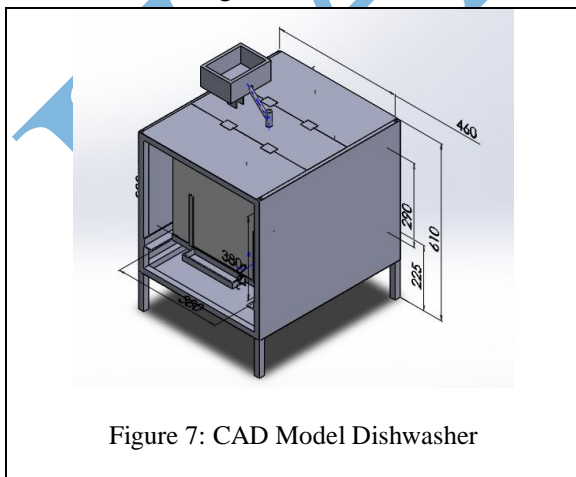


Figure 7: CAD Model Dishwasher



Figure 8: Dishwasher

Table 2: Dishwasher Dimensions

Length	560 mm
Breadth	460 mm
Height of Cabin	480 mm
Clearance Height	130 mm
Plate Holder Height	260 mm
Weight	10.5 kg

Table 3: Bill of Material

Part	Material
Structure of Dishwasher	Mild Steel
Casing	Sheet Metal
Crate	Mild Steel
Pipes	Steel/Plastic
Cutlery Holder	Mild Steel
Soap Solution Diffuser	Mild Steel

#### 4. Conclusion

We have designed and fabricated a dishwasher that has low power consumption compared to commercially available dishwasher. The dishwasher is advantageous in demographic regions where there is insufficient electricity supply or regions where there are regular power cuts. The dishwasher is cost effective as it is fabricated with low cost, durable materials. The dishwasher is capable of accommodating 4 plates/dishes and 8 spoons in 1 cycle of wash. The dishwashing machine utilizes 7.5 L of water and 50 ml of cleaning mixture for 1 cycle. The cleaning mixture composition depends upon the articles to be washed. This product is robust and

hence can be used in hostel messes, hotels, canteens and households.

#### **4.1. Future Work & Scope**

We intend to take this dishwasher a smart appliance by attaching various sensors. We intend to implement Internet of Things (IoT) concept to this product and use a Raspberry Pi to make the appliance accessible from a Smartphone or any other device connected to Wi-Fi. The dishwasher can be accessed through a Smartphone and its functions can be controlled without being in the vicinity of the product. This feature would serve a purpose in region where there are regular power cuts and restricted water supply.

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