

Design and Fabrication of Affordable Dishwasher for Pandemic Concerns

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Abstract - The deadly coronavirus is spreading around the world, and the global lockdown on the coronavirus has revived the virtual state, causing the biggest problem to be a "lack of manpower". Provision of safe water, sanitation and hygienic conditions is essential for the prevention and protection of human health during outbreaks of all these infectious diseases Coronavirus disease 2019 (Covid-19). We have found an opportunity in homes, cafes and hotels to maintain cleanliness. A special machine called 'Affordable Dishwasher Machine', which can clean items at an affordable price and effectively without any manpower. In today's competitive world, many human activities are automated. There is a lag in the automatic dishwashers: Some machines have already been built with the help of jet water only; So, it is possible to remove impurities and strain in the dishes. Keeping these things and the problems in the mind we tried to make a dishwasher that eliminates all these problems.

Key Words: Automated, Dishwasher machine.

1. INTRODUCTION

The dishwasher is a mechanical gadget for cleaning food-dishes and utensils that makes cleaning and drying dishes easier and more efficient. The first mechanical dishwashing device was patented in the United States by Joel Hutton in 1850. From there onwards the machine is constantly improving from time to time. Demand for this sector has grown significantly as a result of recent corporate lifestyle. Existing dishwasher machines require a lot of power, time and cost, for this reason the use of dishwasher machines is low in many countries and the convention method is preferred. Most dishwashing in India is done by manual washing of dishes by hand washing and scrubbing which causes muscle tension and requires manpower. There is a lack of manpower in the current pandemic. Therefore, the purpose of this research is to reduce human effort to wash dishes. The inspection shows problems arising in the use of automatic dish washers and solutions on them. So, by developing this dishwashing machine we can significantly overcome the problems mentioned above. Unlike manual dishwashing, which relies heavily on scrubbing by hands, a mechanical dishwasher cleans the dish with a brush and a spray of water. A mixture of water and cleanser is mixed through a siphon. This mixture of water and cleanser

circulates around the vessel which cleans the dirt. After the wash cycle is complete and the water is depleted, and the dishes are left to dry.

1.1 Overview

Many factors encourage urban people to opt for a dishwasher machine. Busy schedules, lack of human resources have encouraged people to rely on dishwasher machine for their daily purposes. The use of traditional methods in large cities presents numerous challenges to people with busy schedules. As the dishwasher machine market has gained momentum, consumers have started giving preference to dishwasher machines to tackle this problem. In addition, the dishwasher machine is lightweight, durable, and requires minimal storage space to compensate for the limited residential space in modern urban homes. However, dishwasher machines still face stiff competition from traditional methods in terms of speed and performance, which affects the growth of dishwashers.

1.2 Literature survey

"Dish washing machine"- The paper gives short-term idea about upgrading of dishwashing machine. It linked to improvement in washing a dish in which an incessant stream of either soap or clean water is source to crate holding the rack hot water is supply to crate is rotate thus to bring the better portion therefrom under water. [1]

"Design of Gears in Semi-Automatic Dish Washing Machine": The paper is about why semi-automatic dishwashing machines are popular in India as compared to automatic dishwashing machine, Automatic dishwasher uses huge amount of water, time and it is expensive. And because of these reasons, the practice of automatic dishwasher in our country is less. Use of semi-automatic dishwashing machine, they can decrease time as well as efforts of human. [2]

"Design and Development of semiautomatic dishwasher". Paper discusses about the design and evaluation of dishwashing machine. The efficiency of machine was 20 plates/min (i.e., 1880 plates / hour). The design of dishwasher is very effective and give ease to operate. [3]

"Design, Fabrication and Performance Evaluation of a Domestic Dish Washing Machine"-The paper is all about the

design, fabrication and performance assessment of a domestic dishwashing machine. The objective of this paper is design a dish washing machine that is effective and relaxed to operate. Stainless steel used for the building of the machine considering their convenience, cost saving and corrosion resistance. [4]

"How Energy Efficient are Modern Dishwashers", paper discusses about how the modern dishwasher are substantially more efficient than older dishwashers. It also discusses about variety of factor affecting efficiency and performance to reduce dishwasher use. [5]

"Design of basic model of semi-automatic dish washer machine" - In this dishwasher works with help of motor, universal motor, conveyor belt and microcontroller for time delay. Microcontroller helped to provide delay to universal motor, DC brush motor & geared motor. Dish placed on the conveyor belt go in the first washing compartment where it is cleaned with soap water and rubbed with the brushes. then passed to succeeding chamber where it is washed with the clean water. [6]

2. Material and mechanism

On the basis of our study and references we use, weight and cost of machine found to be factors where improvement is to be done. This issue can be resolved by selecting proper material for the fabrication. we have used high density polyethylene. This material has property like good chemical resistance and strength.

Cleansing in dishwasher depends on four main factors mechanical action, time, chemistry and temperature. Mechanism which generally used in available dishwashers are time consuming, and not up to the mark in terms of cleansing. We have tried to improve this limitation by using agitator-based mechanism.

3. WORKING

Dishwashing machine is a sort of mechanical machine broadly utilized for cleaning eating-utensils and dishes in private homes and inns to completely eliminate the work of hand washing. Particularly have higher efficiencies than different kinds of manual dishwashing (which rely to a great extent upon actual scouring to eliminate dirtying). The dishwashers are associated with the kitchen sinks for water supply. The machine contains Inner drum where rack is place fixed which is loaded with plates, bowls etc. when it's time for washing. A blend of water and cleanser is flowed by a siphon to the inner drum. Inner drum holds the soapy water. Inner drum is water tight to prevent water leakage. Agitator which is situated at bottom of inner drum spin the soapy water around the utensils in the rack with the help of motor, which remove any dirt or stain from utensils while spinning. After the wash cycle completes and the water is depleted, then rinse the dish with clean water.

Drain and store this for next prewashing cycle. The dishes are left in the environment for drying Then rinse the plates with clean water without detergent. Drain and store water for next prewashing cycle.

4. DESIGN AND ANALYSIS

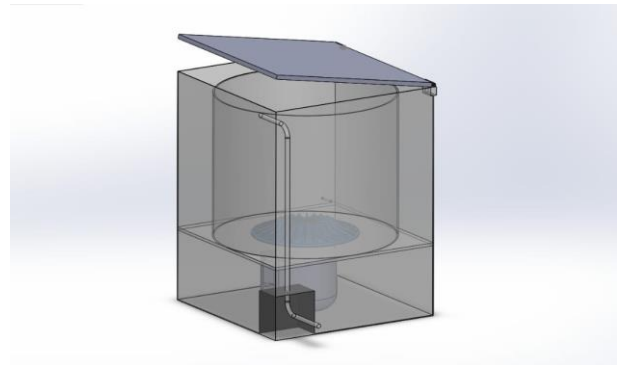


Fig -1: Model of Dishwasher machine

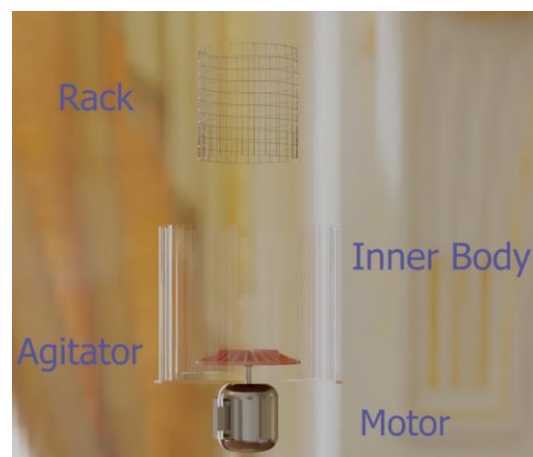


Fig: some main components of machine

- Inner Drum: The one which holds rack loaded with dishes and contains water, stopping it from leakage into the rest of machine.
- Rack: It is basically a frame which holds dishes in particular position for effective washing process.
- Motor: This is combined with the agitator; it produces a rotary motion. This is basically mechanism that gets your machine going.
- Agitator: It is located inside the inner drum of machine and rotates to spin soapy water around utensils during washing allows water to remove dirt from utensils.

- Drain pipes: All dirty water from inner drum after washing is expelled from the machine via the drain pipe.



Fig: Washing Process

It takes place inside the inner drum when it time for washing, rack loaded with dishes placed inside inner drum and inlet valve supply water to the inner drum. Agitator at bottom of inner drum spin soapy water around dishes for the effective cleaning.

4.1 SIMULATION

As the agitator spins, it's subjected to a number of forces that attempt to stop its motion. Model parts are made and assembled on the workbench in Solidworks software. In order to simulate the impact of forces on an agitator, a simulation is performed. The simulation is performed using a PVC rigid material.

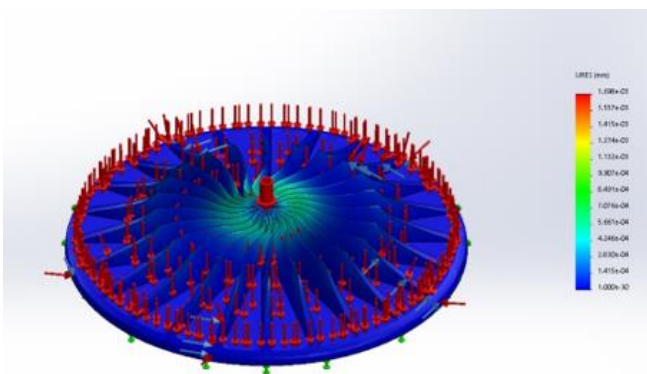


Fig: Von mises stress

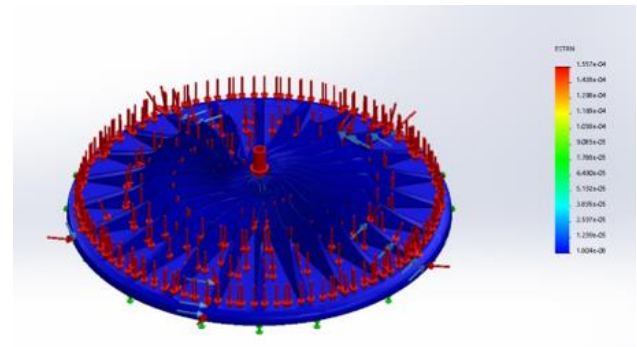


Fig: Equivalent Strain

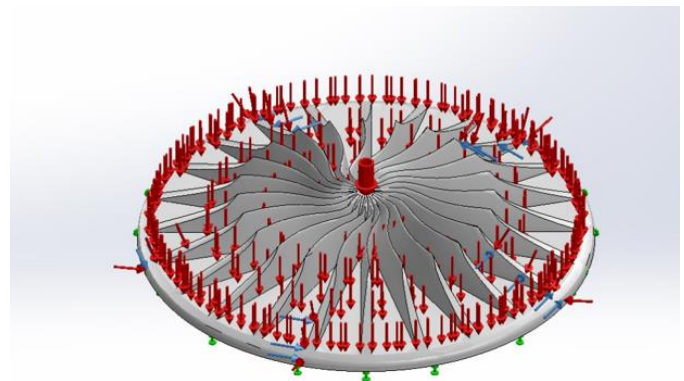


Fig: displacement due to stress

5. FABRICATION

Fabrication is done with various manufacturing processes. To bring design model into realization takes great effort and bring no of challenges. Design is done on software like Catia, Solidworks, etc. various dishwasher uses spray arm mechanism, etc. we have use agitator-based mechanism while fabrication we have consider all the factors which will affect the feasibility of machine. Type of mechanism is a factor which affects the feasibility of design. At the time of fabrication of agitator water leakage problem, rise. It is big issue because it not only hampers the life of product, but also can cause severe accident hence we used mechanical water seal to restrict water leakage. While fabrication it became important to select material properly material should have good machinability, chemical properties which are suitable according to type of product, etc. maintaining accuracy and precision is equally important to archive quality product. Proper insulation and circuit connection of wire should be done. To increase life of rotating parts and for reducing friction grease is required to filled.

6. APPLICATIONS

- It is used in large-scale kitchens such as hotels, restaurants, etc., where there is a requirement for more dishes.

- It is also used in family kitchens.

7. ADVANTAGES

- Lower the time as well as human exertions significantly.
- More number of dishes can be washed in short time.
- Water usages is less than manual process.

8. LIMITATIONS

- The filler basket needs regular cleaning in order to avoid any rotten odor in kitchen.
- Blockage in the drainpipe due to the leftover foods or other materials will effect in a slow drain system of the dishwasher

9. FUTURE SCOPE

The dishwasher market has been sub grouped in the type of product, in the capacity of water types, applications and price range. The strategists can gain detailed insights and creating the right strategy to target a specific crowd. The market will focus on this detail leading the best classification opportunity. The dishwasher has scope for research in future to make it affordable and light weight. More research carried out on dishwashing machine for the purpose of determine water usage of the machine can be reduced with the quality of washing still undisputed. Research can also run to fix the conditions and factor that can enhance dishwasher machine operation and how such factors can be incorporated into its design creating a friendly atmosphere. Let's look at the current (pandemic) situation for all types of people be more aware of cleanliness and safety. This will help the dish market grow. Dishwasher can be semiautomated and automatic. Their price range and feature may vary accordingly.

10. CONCLUSION

After the above study we got a viable design for light weight dishwasher, feasible design for cleaning mechanism and low-cost material. Different experiments were performed at a speed of agitator and the materials used Etc. High density polyethylene is material used for fabrication of machine for making it low cost and light weight. Production processes were carried out by multiple testing on prototype model. knowing failure from very machine, it needs to be modified this machine in the future.

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