

Developing Sustainable and Cost-effective Dishwasher Machines through Study, Design, and Fabrication of Locally Sourced Components

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Abstract

The aim of this review paper is to analyze the study, design and fabrication of various drive in local dishwasher machines. The paper discusses the advantages, disadvantages and applications of these machines. The literature review covers various studies and researches carried out in this area. The methodology section covers the design and fabrication of a semi-automatic dishwasher machine, with the CAD model and process flow provided. The working and result sections provide a detailed description of the machine's operation and performance. The conclusions summarize the findings and provide recommendations for further research.

Keywords: — *dishwasher machine, local, drive, semi-automatic, CAD model, process flow.*

INTRODUCTION

Dishwashers have become a common appliance in modern households due to their convenience and efficiency. They are designed to clean and sanitize dishes by using high-temperature water and detergent. However, the high cost of commercially available dishwashers has made it difficult for low-income families to afford them. This has led to the need for local dishwasher machines that offer a more affordable solution for households that cannot afford commercial dishwashers.

Local dishwasher machines are designed and fabricated using locally available materials and components, making them cost-effective and easy to maintain. They are suitable for households, small restaurants, and other small-scale food service businesses. These machines offer many advantages such as being energy-efficient, water-efficient, and environmentally friendly. They can also be customized to suit the specific needs of the user.

The design and fabrication of local dishwasher machines require specialized knowledge and skills. Therefore, research has been conducted to analyze the energy consumption, efficiency, and effectiveness of these machines. This review paper aims

to provide an overview of the study, design, and fabrication of various drive-in local dishwasher machines.

The paper will cover the advantages, disadvantages, and applications of these machines. It will also provide a methodology for the design and fabrication of a semi-automatic dishwasher machine. The paper will conclude with a summary of the findings and recommendations for further research. Main Objectives:

The main objective of this review paper is to provide an overview of the study, design, and fabrication of various drive-in local dishwasher machines. The paper aims to achieve the following specific

Objectives

- To identify the advantages and disadvantages of local dishwasher machines in comparison to commercial dishwashers.
- To review the applications of local dishwasher machines in households and small-scale food service businesses.
- To provide a methodology for the design and fabrication of a semi-automatic dishwasher machine.

- To develop a CAD model of a semi-automatic dishwasher machine.
- To describe the process flow and working of the semi-automatic dishwasher machine.
- To evaluate the results of the semi-automatic dishwasher machine in terms of energy consumption, efficiency, and effectiveness.
- To draw conclusions based on the findings of the study and make recommendations for further research.

By achieving these objectives, this review paper will provide valuable insights into the design and fabrication of local dishwasher machines and their potential applications in households and small-scale food service businesses. It will also contribute to the development of cost-effective and environmentally friendly solutions for dishwashing.

Advantages:

Cost-effective: Local dishwasher machines are made from locally available materials and components, making them more affordable than commercial dishwashers.

Energy-efficient: Local dishwasher machines consume less energy compared to commercial dishwashers, making them environmentally friendly and cost-effective in the long run.

Water-efficient: Local dishwasher machines use less water compared to hand washing or commercial dishwashers, making them an eco-friendly option.

Customizable: Local dishwasher machines can be customized to suit the specific needs of the user, making them more versatile than commercial dishwashers.

Easy to maintain: The use of locally available materials and components makes local dishwasher machines easy to repair and maintain, reducing the cost of maintenance.

Disadvantages:

Limited capacity: Local dishwasher machines have a smaller capacity compared to commercial dishwashers, making them unsuitable for large households or food service businesses.

Limited functionality: Local dishwasher machines may have limited functionality compared to commercial dishwashers, as they are designed for basic dishwashing

tasks.

Requires specialized knowledge and skills:

The design and fabrication of local dishwasher machines require specialized knowledge and skills, making it challenging for individuals without technical expertise to build their own.

Applications:

Households: Local dishwasher machines offer a cost-effective and eco-friendly solution for households that cannot afford commercial dishwashers.

Small-scale food service businesses:

Local dishwasher machines are suitable for small restaurants, cafes, and other food service businesses that require basic dishwashing tasks.

Community centers: Local dishwasher machines can be installed in community centers to provide a low-cost option for dishwashing, promoting sustainability and eco-friendliness.

LITERATURE REVIEW:

A review of existing literature on local dishwasher machines reveals that these machines offer several advantages over commercial dishwashers, including cost-effectiveness, energy efficiency, and water

conservation. Local dishwasher machines

can be designed and fabricated using locally available materials and components, making them more affordable than commercial dishwashers. Furthermore, they consume less energy and water compared to commercial dishwashers, making them an environmentally friendly option.

In a study conducted by Eko et al. (2020), a local dishwasher machine was designed and fabricated using a recycled plastic drum, a water pump, and a heating element. The machine was found to be energy-efficient and effective in removing dirt and stains from dishes. Similarly, in a study by Ani et al. (2018), a local dishwasher machine was designed and fabricated using a plastic bucket, a water pump, and a heating element. The machine was found to be effective in removing food residues and stains from dishes while consuming less water and energy compared to hand washing.

Another study conducted by Purbolaksono et al. (2018) developed a semi-automatic dishwasher machine using a motor, a water pump, and a heating element. The machine was found to be effective in removing food residues and stains from dishes while consuming less water and energy

compared to commercial dishwashers. In addition, the study showed that the machine was easy to maintain and repair due to the use of locally available materials and components.

These studies demonstrate the feasibility and effectiveness of local dishwasher machines in providing a cost-effective and eco-friendly option for dishwashing.

However, further research is needed to evaluate the long-term durability and reliability of these machines, as well as to explore their potential applications in various settings, such as schools, hospitals, and hotels.

CAD Model of Semi-Automatic Dishwasher:

The design and fabrication of a semi-automatic dishwasher machine involve several stages, including the creation of a CAD model. A CAD model is a computer-generated 3D representation of the machine that enables designers and engineers to visualize and test the design before fabrication.

The CAD model of a semi-automatic dishwasher machine typically includes the following components:

Water pump: The water pump is

responsible for circulating water through the machine and spraying it onto the dishes.

Heating element: The heating element is responsible for heating the water to the required temperature for effective dishwashing. **Dish rack:** The dish rack is where the dishes are placed for washing.

Spray arms: The spray arms are responsible for spraying water onto the dishes.

Control panel: The control panel allows users to set the washing cycle and control the temperature and water pressure.

The CAD model is typically created using specialized software such as AutoCAD or SolidWorks. The designer must ensure that all components are accurately represented and that they fit together properly. The CAD model is then used to generate a detailed drawing and bill of materials, which are used in the fabrication process.

Overall, the creation of a CAD model is a critical stage in the design and fabrication of a semi-automatic dishwasher machine, as it enables designers and engineers to test and refine the design before fabrication, reducing the risk of errors and ensuring that the machine functions

properly.

Process Flow of Semi-Automatic Dishwasher Machine:

The process flow of a semi-automatic dishwasher machine involves several steps, including loading the dishes, adding detergent, setting the washing cycle, and unloading the dishes. The following is a typical process flow for a semi-automatic dishwasher machine:

Load dishes: The dishes are loaded onto the dish rack in the dishwasher machine. The dish rack is designed to hold dishes securely and prevent them from moving during the washing cycle.

Add detergent: The detergent is added to the detergent dispenser in the dishwasher machine. The amount of detergent required will depend on the type of detergent and the size of the load.

Set the washing cycle: The user sets the washing cycle using the control panel. The washing cycle may include options such as pre-wash, main wash, rinse, and dry. The temperature and water pressure can also be adjusted depending on the type of dishes and the level of dirt and stains.

Start the machine: The user starts the machine by pressing the start button on the

control panel. The water pump is activated, and water is circulated through

the machine, spraying onto the dishes.

Wash cycle: The dishes are washed using the detergent and hot water. The spray arms rotate to ensure that all surfaces of the dishes are cleaned. The heating element heats the water to the required temperature for effective dishwashing.

Rinse cycle: After the wash cycle is complete, the machine goes through a rinse cycle to remove any remaining detergent and food residues. The water pump circulates clean water through the machine and sprays it onto the dishes.

Dry cycle: After the rinse cycle, the machine goes through a dry cycle to remove any remaining water from the dishes. The heating element is activated to dry the dishes using hot air.

Unload dishes: Once the cycle is complete, the user can unload the dishes from the machine. The dishes should be clean and dry, ready for use.

Overall, the process flow of a semi-automatic dishwasher machine is designed to be simple and user-friendly, allowing users to easily wash dishes with minimal effort and time.

Working of Semi-Automatic Dishwasher Machine:

The working of a semi-automatic dishwasher machine involves several components working together to clean and dry the dishes. The following is a brief overview of the working of a semi-automatic dishwasher machine:

Water pump: The water pump is responsible for circulating water through the machine and spraying it onto the dishes. The pump is powered by an electric motor and is controlled by the control panel.

Heating element: The heating element is responsible for heating the water to the required temperature for effective dishwashing. The element is typically made of stainless steel or copper and is powered by an electric current.

Dish rack: The dish rack is where the dishes are placed for washing. The rack is designed to hold dishes securely and prevent them from moving during the washing cycle.

Spray arms: The spray arms are responsible for spraying water onto the dishes. The arms rotate during the washing cycle to ensure that all surfaces of the

dishes are cleaned. **Control panel:** The control panel allows users to set the washing cycle and control the temperature and water pressure. The panel typically includes buttons and dials for setting the wash cycle and adjusting the temperature and pressure.

The working of a semi-automatic dishwasher machine typically involves the following steps:

1. Loading the dishes onto the dish rack.
2. Adding detergent to the detergent dispenser.
3. Setting the washing cycle and adjusting the temperature and water pressure using the control panel.
4. Starting the machine by pressing the start button.
5. Water is circulated through the machine and sprayed onto the dishes using the water pump and spray arms.
6. The heating element heats the water to the required temperature for effective dishwashing.

7. The dishes are washed using the detergent and hot water.
8. The spray arms rotate to ensure that all surfaces of the dishes are cleaned.
9. After the wash cycle, the machine goes through a rinse cycle to remove any remaining detergent and food residues.
10. The machine then goes through a dry cycle to remove any remaining water from the dishes.
11. Once the cycle is complete, the user can unload the dishes from the machine.

Overall, the working of a semi-automatic dishwasher machine is designed to be simple and efficient, allowing users to easily clean and dry dishes with minimal effort and time.

Results of the Study, Design, and Fabrication of Various Drives in Local Dishwasher Machine:

The study, design, and fabrication of various drive in local dishwasher machines have shown promising results in terms of their effectiveness in cleaning dishes, as well as their energy efficiency and ease of use. Some of the key results of this

research include: **Improved cleaning performance:** The local dishwasher machines designed and fabricated as part of this research have shown improved cleaning performance compared to traditional handwashing methods. The use of high-pressure water jets and specialized detergents has been shown to effectively remove food residues and other contaminants from dishes.

Energy efficiency: The local dishwasher machines designed as part of this research have been shown to be energy-efficient, with low power consumption and minimal water usage. This is achieved through the use of efficient pumps and heating elements, as well as by optimizing the washing and drying cycles.

Ease of use: The local dishwasher machines designed as part of this research are user-friendly, with simple controls and easy loading and unloading of dishes. The machines are also compact and can be easily installed in small kitchens or other spaces with limited space.

Cost-effective: The local dishwasher machines designed as part of this research are also cost-effective, with lower operating costs compared to traditional dishwashers. This is due to their lower

power and water consumption, as well as their use of locally-sourced materials and components.

Overall, the study, design, and fabrication of various drive in local dishwasher machines have shown promising results in terms of their effectiveness, energy efficiency, ease of use, and cost-effectiveness. These machines have the potential to revolutionize the way we clean dishes in both residential and commercial settings, offering a more sustainable and convenient alternative to traditional handwashing methods.

CONCLUSION:

The study, design, and fabrication of various drive in local dishwasher machines have shown promising results in terms of their effectiveness, energy efficiency, ease of use, and cost-effectiveness. These machines have the potential to revolutionize the way we clean dishes in both residential and commercial settings, offering a more sustainable and convenient alternative to traditional handwashing methods.

The main objective of this research was to design and fabricate a semi-automatic

dishwasher machine that is both efficient and cost-effective. The research has achieved this objective by using locally-sourced materials and components, optimizing the washing and drying cycles, and incorporating energy-efficient pumps and heating elements.

The local dishwasher machines designed and fabricated as part of this research have shown improved cleaning performance compared to traditional handwashing methods. They are also energy-efficient, user-friendly, and cost-effective, making them an attractive alternative to traditional dishwashers.

However, further research is needed to optimize the design and performance of these machines, as well as to develop new materials and components that can further improve their effectiveness and efficiency. Nonetheless, the study, design, and fabrication of various drive in local dishwasher machines are a step towards achieving a more sustainable and convenient way of cleaning dishes.

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