

## Research Article

# Design and Development of Manual Textile Chemical Mixing and Processing Machine

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### Abstract

The interest in producing textile and textile related product has increased significantly in the last few years. The abundance in nature combined with the ease of Textile chemical processing was an attractive feature, which makes it an important income for the development of a given country. In Ethiopia there is large number of small scale woven and knitted fabric producers. During wet processing and chemical finishing of fabrics, they mix chemicals by using stick. This method will not give uniformly mixed chemical solution, it causes shade variation on treated material and it is time consuming. Now a day there is different automatic wet processing and chemical finishing machines. To but it is expensive. Author designed and developed manual textile chemical mixing and processing machine. The machine can be driven by using hand. The machine has a barrel with mixer. The mixer can be fixed and removed easily during Textile chemical processing.

**Keywords:** Wet processing; Finishing; Textile; Chemical mixer; Small scale enterprise.

### Introduction

The Textile industry is one of the oldest sectors which consist of complex production processes [1]. The Textile sector has a heterogeneous structure due to its large number of sub-sectors [2]. It is also one of the sectors that play a leading role in the social and economic development of countries and nowadays more than 150 countries are supplying Textiles [3]. Textile Processing is an important sub-sector in the Textile industry. It converts a virtually un-brand raw product to a differentiable consumer product. Finishing is the last manufacturing step in the production of Textile fabrics. As an integral part of wet processing, Finishing is the operation where the final fabric properties are developed. Finish can be either chemicals that change the fabric's aesthetic and/or physical properties or changes in texture or surface characteristics brought about by physically manipulating the fabric with mechanical devices [4-5].

In chemical finishing, water is used as the medium for applying the chemicals. Heat is used to drive off the water and to activate the chemicals. Mechanical finishing is considered a

dry operation even though moisture and chemicals are often needed to successfully process the fabric. The textile industry includes a variety of processes ranging from the manufacture of synthetic fibers and fabric production to retail sales. The wet-processing operations, namely preparation, dyeing and finishing of textile products which are used to give the desired characteristics to the yarn or fabric, require the use of several chemical baths. [6-8]. In wet processing it is generally recognized that the steps encompassing preparation are:

**Sizing:** In the production of woven fabrics, warp yarns are sized with a protective coating to improve weaving efficiency.

**De sizing:** It is a Process where warp size is removed.

**Scouring:** It is a Process where mill and natural dirt, waxes and grease are removed.

**Bleaching:** It is a Process where colour bodies are destroyed and the fabric is whitened.

**Mercerizing:** Caustic treatment of cellulosic fabrics improving lustre, water absorbance, dye yield and fibre strength.

**Carbonizing:** It is a Acid treatment of wool for removing vegetable matter.

Various Mechanical types of equipment can be used in wet processing and chemical finishing for preparing fabric. The ultimate goal of any preparation process is to produce fabric that is clean and rid of all impurities that interfere with dyeing and finishing. In mechanical wet processing and chemical finishing machines, the preparation steps can be carried out as either batch or continuous processes. In batch processing, machines are used where the entire load of fabric is immersed in the total amount of liquid needed for that process [9-12].

In Ethiopia there are many local small scale fabric producers. In Textile chemical finishing, they use different manual Textile chemical finishing process. They use a stick to mix chemicals on a barrel. Mixing chemical using stick will not give uniform solution. This can cause shade variation on treated fabric. Different automatic chemical mixing and processing machines are available in the market. These machines can mix chemicals uniformly and bring a good result during fabric treatment but they are expensive. The Author designed and developed manual Textile chemical mixing and processing machine that can improve the quality of fabrics produced by local fabric producers in the area.

## Methodology

### Materials

The researcher used Barrel, CHS pipe, RHS Tubular steel, Sheet metal, Bearing, Pulley, Bevel Gear, Water faucet, Gate valve etc.

### Methods

The Author gathered required data through observation, Interview and referring books. The project mainly concerned on designing and fabricating a manual Textile chemical mixing and processing machine which used for local small scale textile producers. This machine can be operated by hand and used to process up to 20 liter of chemical solution. There is a boiling unit under the machine which used to boil chemical solution. The mixing unit can be fixed during chemical mixing and removed easily during textile treatment.

## Design of manual chemical and wet processing machine

As indicated in Fig. 1, at the time of chemical preparation, the mixer part can be fixed in the machine and the mixer part removed easily after chemical solution is prepared for further processing.

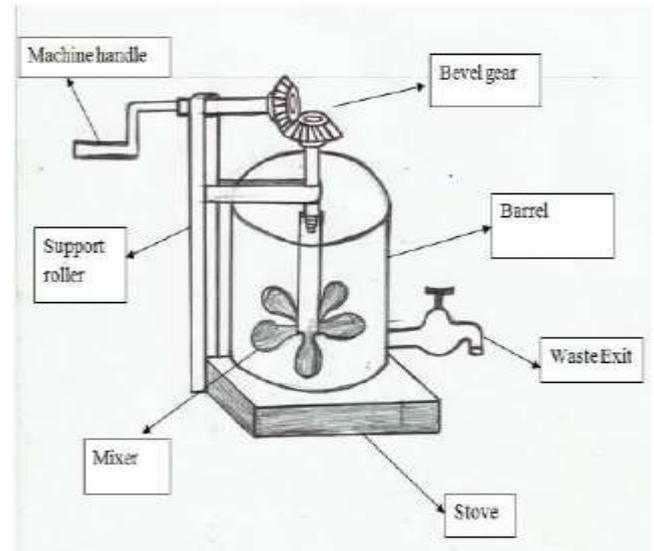


Fig. 1. Manual textile chemical mixing and processing machine

## Manual textile chemical mixing and processing machine

Manual chemical mixer has a barrel which used to hold chemical solution and have a mixer for the purpose of mixing. At the bottom of barrel there is a stove used to boil the solution during Textile treatment. The machine has a bevel gear which connected to machine handle and mixer part. The bevel gear helps to convert horizontal handle rotation to vertical mixer rotation. The mixer part can be rotated by rotating machine handle by hand. Chemical mixer part can be engaged with main shaft during mixing process and disengaged easily during Textile material treatment. The machine has a waste water exit used to remove waste water after treatment.

## Result and Discussion

The fabricated Manual Textile Chemical processing machine can be used to process up to 20 liter of solution. The machine can be operated by hand. The cost to fabricate this machine is very less compared to Automatic Electrical Textile Chemical processing machine. To fabricate this machine it costs around 200\$.

Table 1. Machine description

Sl. No.	Description	Description
1	Type of machine	Manual Textile Chemical processing machine
2	Barrel solution mixing size	Up to 20 Liter
3	Working condition	Manual
4	Required Number of operator	Single
5	Maintenance system used	Oiling and cleaning
6	Width of machine	60 cm
7	Height of machine	1.2 meter

**Fabricated manual textile chemical processing machine**

As indicated in fig. 2, the fabricated manual Textile Chemical processing machine can mix chemical solution by rotating machine handle by hand. The machine can mix the solution uniformly. After chemical solution preparation, the machine mixer can be removed and textile material can be impregnated into the solution for further processing.

As indicated in fig. 3, the mixer part has a bolt and can be engaged to the main shaft. The main shaft has a hollow teeth used for fixing of Mixer part. When Machine handle rotates, the mixing part can mix chemical solution.



Fig. 2. Fabricated manual textile chemical mixing and processing machine



Fig. 3. Engaging and removing chemical mixer part

**Conclusions**

The textile industries are major part of manufacturing production, employment and trade in many developing countries. Textile chemical processing involves a series of physical and chemical steps throughout the production

process of a wide variety of products. Textile dyeing, printing and finishing are most basic aspects of Textile manufacturing process. The ever growing demand of sustainable Textile coloration, Printing and Finishing technologies has created immense pressure on researchers and

various stakeholders in Textile industry to develop highly competitive, resource efficient, technologically advanced and sustainable methods to meet current industrial requirements. Fundamental knowledge and technical understanding of current developments is necessary for all stakeholders in Textile industry to grow and remain competitive in global market. Currently in Ethiopia there are many small scale enterprises participated in Manufacturing and processing Textile products. This sector created a big job opportunity for youths. Most of the enterprises are using traditional method of Textile Manufacturing and Processing. In order to enhance their income, different research works are required in order to develop advanced Textile production method, processing method and machines. The fabricated manual Textile chemical mixing and processing machine will have a positive impact for local Textile producers. The Author is planning to fabricate more machines for the community who participated in the sector.

### Conflicts of interest

Authors declare there are no conflicts of interest.

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