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Design and Development of Textile Manual Chemical Mixing and Processing Machine

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ABSTRACT

The interest in producing Textile and 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, they used a stick to mix chemicals on a small mixing barrel. Mixing chemical using stick by hand will not give uniformly mixed chemical solution, it causes shade variation on treated material and it is time consuming.

Nowadays there is different automatic Textile wet processing and chemical finishing machines, but they are expensive. Author Designed and developed manual 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 material chemical processing.

KEYWORDS: *wet processing, finishing, Textile, Leather, chemical mixer, small scale enterprise.*

I. INTRODUCTION

Textile industry is one of the oldest sectors which consist of complex production processes [1]. The Textile sector has a heterogeneous structure due to it is 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, Textile product manufacturing is one of a key sector that identified by the government since 2010. In the country there are many domestic small scale fabric producers. In Textile chemical finishing, they use different manual Textile chemical finishing process. During wet processing and chemical finishing, they used a stick to mix chemicals on a small mixing barrel. Mixing chemical using stick by hand will not give uniformly mixed chemical solution, it causes shade variation on treated material and it is time consuming.

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 present work aims at fabricating manual Textile chemical mixing and processing machine that can be operated easily by hand that can improve the quality of fabrics produced by local fabric producers in the area.

II. Methodology

Materials

Barrel, Hollow Structural Sections of circular (CHS) pipe, Rectangular (RHS), Sheet metal, Tubular steel, Bearing, Bevel Gear, Water faucet, Gate valve etc..were used in fabrication work.

Methods

Data are gathered through observation, Interview and referring books. The main aim of designing and fabricating manual Textile chemical mixing and processing machine which process up to 20 Liter chemical solution has 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. The machine can be operated by hand and used for local small scale Textile producers.

Design of Manual chemical and wet processing machine

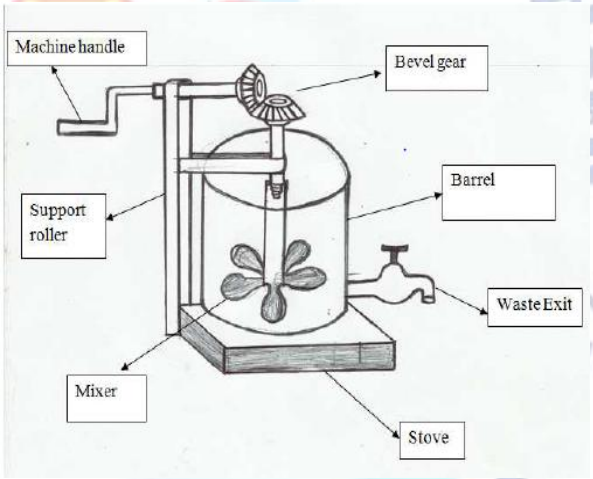

FIG 1. Manual Textile chemical mixing and processing machine (Design by Author)

As indicated in Figure 1, during 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.

Table 1. Machine Description

S.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

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 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.

III. RESULTS

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$.

FIG 2. Fabricated Manual Textile chemical mixing and processing machine

As indicated in Figure 2, 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.

Figure 3. Engaging and removing chemical mixing part.

As indicated in Figure 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.

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