



*Research Paper*

# DESIGN, FABRICATION AND ANALYSIS OF PROTOTYPE TWIN ROLL PRESS PULP WASHING

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The aim of this project is to develop, and evaluate a concept for a new pulp feeding system to one pulping processing machineries. This new system shall enable feeding with a higher pulp consistency, and will wash the dirty pulp compared to existing pulp feed systems. A pre-study is conducted to get acquainted with the washing, and understand the problem. This study can be resulted in a number of goals and demands. After the pre-study concepts generated, and evaluated, one was selected to continue working with washing process. The selected concept will further evaluated through personnel visit to the chemical/mechanical pulping industries. And the potential will be find out from the result. In the pulp washing machine and method therefore, pulp to be washed is fed between the rotating drum and the pressing roll inside it, so that pulp passes along a spiral-formed track around the pressing roll, being thereby pressed several times. Washing liquid is fed to the pulp at one or several points along its track of movement, between the pressings and/or at the pressing position. Washing thus takes place partly as diffusion and partly as a displacement washing process. Washing is efficient and reduces the breaking of pulp fibers down to a minimum.

Keywords: Pulp washing, Twin roller press, Water recycle

## INTRODUCTION

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By adopting principle of displacement and press, wash press can achieve continuous dewatering and washing. It can be recognized as world advanced function and higher technical standard of black liquor extracting,

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pulp bleaching and washing equipment. It's suitable for chemical pulp, chemi-mechanical pulp and recycled paper. It's reliable in performance, and reach advanced international standard. It can be equipped with a production capacity of 100,000-1,500,000 tons annually.

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A method for washing pulp or any corresponding material, comprising the steps of: transporting the material to be washed between a rotating drum (1) and a rotating pressing roll, (2) inside the drum, in a direction

along a longitudinal axis of the drum from one end thereof, at least one of the drum and the pressing roll being perforated, pressing the material to be washed a plurality of times between the drum and the pressing roll during the transporting step, and wetting the material to be washed with washing liquid at least at one position during the transporting step.

## LITERATURE SURVEY

### Current Options Available in Pulping Plants

Washing of pulp is difficult task in pulping plants to wash and separate the pulp must be supply for dewatering. Dewatering can be done by pressing pulp mechanically.

### Vacuum Drum Type Washer

Here, dewatering is carried out by vacuum pressure vacuum pressure from inside the drum pull solid pulp on outer surface and layer of pulp move through wash water spray and partially cleaned pulp through out of drum surface as shown in Figure 2.

### Rotary Drum Type Washer

Pulp is passed into drum with specific volume as per the pulp production rate. Rotary drum collect and mixes the pulp by rotations for

Figure 1: Condition of Pulp During Process Cycle

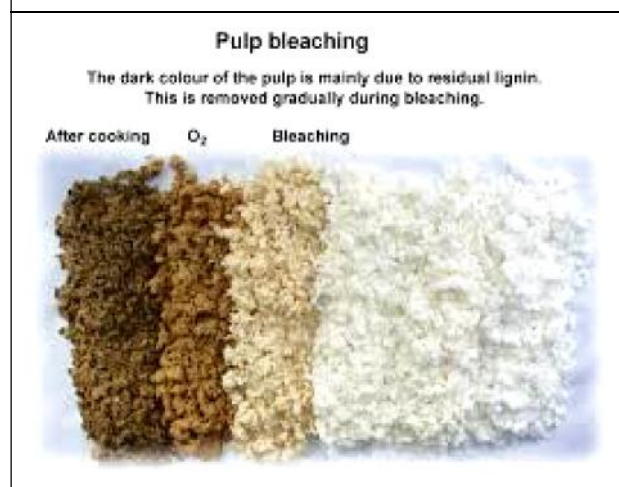
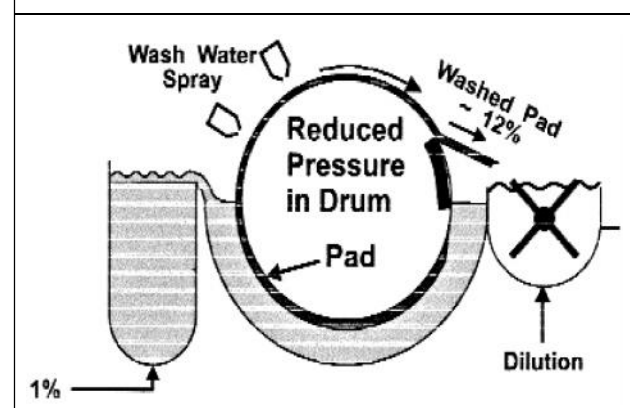
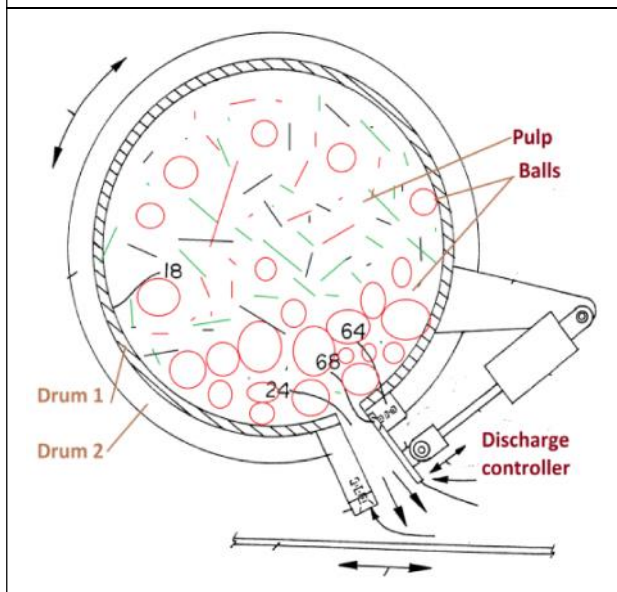


Figure 2: Vacuum Drum Type Washers



dewatering on down side exit baffle is mounted which removes water by gravity pulp can't be out because of perforated sheet at exit so only pulp will remain inside the drum and number of solid metal ball create pressurized dewatering on pulp.

Figure 3: Rotary Drum Type Washers

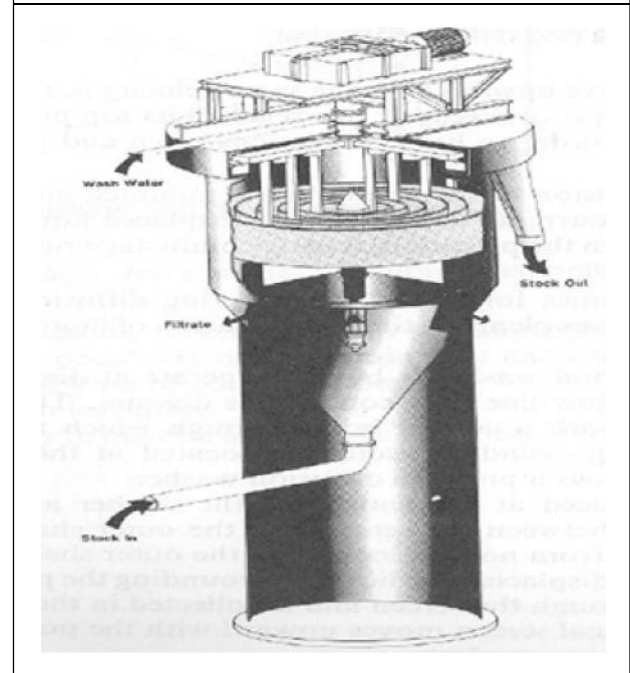


#### Diffusion Washer

Diffusion washer is pure displacement washers. There are two types: one stage or multistage ring diffusion washers, and pressure diffusion washer.

The ring diffusion washer unit consists of a screen rings, one inside another. Each ring is connected to a radial drainage arm through which the drained liquor is removed. The whole ring assembly is mounted to a set of hydraulic cylinders and can be moved up and down. The pulp enters the diffusion washer at the bottom and moves upwards through the annular spaces between the screen rings. The wash liquor is introduced into the pulp through a set of nozzles, mounted on a rotating radial arm. Each nozzle is located at the mid-point

Figure 4: Diffusion Washer



between two screen rings. As the nozzle arm rotates, it leaves a string of wash liquor behind. This washes liquor then radially through the pulp in both directions towards the screen rings, thus replacing the liquor entering with the pulp.

#### PROBLEM IDENTIFICATION

The company, M/s. Sundaram Multipap Ltd. (Site visited) situated near Kanhan. Dist. Nagpur is a unit of Sundaram Paper Mills, where paper is made by recycling process. It is a small scale industry which produces 180 tons of paper per months. The process start from waste paper collection from local market and crushed in mixer (also called Hopper) for making pulp. Pulp is pressurized to flow by motor which is directed towards the single roller which is used for washing pulp. Roller drums are made of perforated sheet on which cloth is rounded on the surface and pulp rotate over the surface and send to bleaching

process. There is no. of roller situated in the company for washing pulp. The company produce 2 ton of paper in one shift. There is several pulp washer uses for washing pulp, photos are as follows. The company is facing the saviors' problem due to single roller that pulp manufactured is not of good quality. They need to wash the pulp multiple times to get the required output quality.

Figure 5: Single Pulp Wash Roller in Industry



## PROBLEM IDENTIFICATION

### Vacuum Type Drum Washer

Due to the structure, the pressure difference is limited up to 1 bar.

- Besides the drum, other accessories, for example, agitators and vacuum pump, are required.
- The discharge cake contains residual moisture.
- High energy consumption by vacuum pump.

### Rotary Drum Washer

The main difference in the drum construction is the absence of channel on the inside.

- The washer can be operated with two or three displacement stages only when having separate draining systems for each set of shower.
- Traditional pulp washer type, washing is based on thickening and displacement. Outlet consistency 12-14%.
- The required pressure difference either with vacuum or over pressure. E-value typically 2-4.

### Diffuser Type Pulp Washer

It takes place in submerge environment, which excludes the possibility of air entrainment and foaming.

- There is no release of odour gases.
- Feed consistency 8-12%. Outlet consistency about the same.
- Washing is based on pure displacement.

## METHODOLOGY

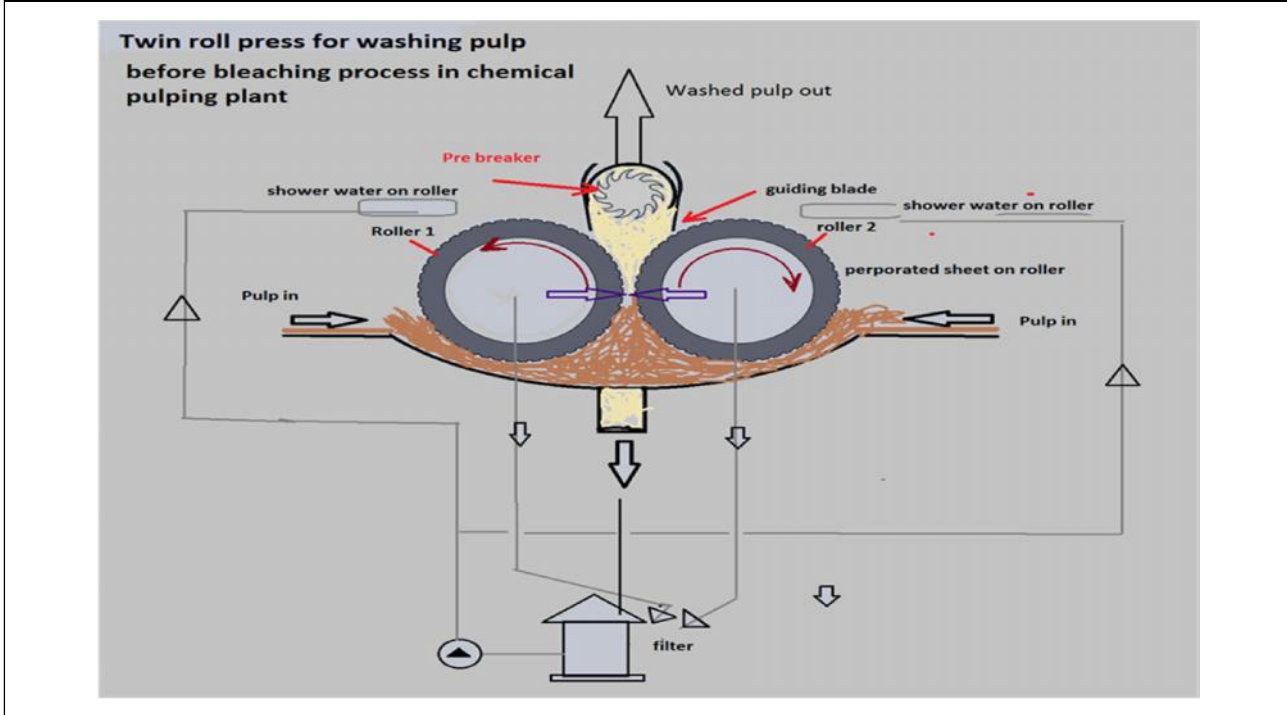
- Design a concept for pulp washing
- Design all the parameters required in this work
- Material selection
- Dewatering pressure phenomenon
- Roller forces calculation
- Torque required to drive the twin roll press
- 3D modeling by using Pro-e and Fabrication.
- Design analysis

## SPECIFIC DESIGN

The length and diameter of the rolls are mainly what determines the capacity of a wash press. When designing a fiber line the size of the



Figure 6: Twin Roll Press Concept



presses (length and diameter of the rolls) is chosen to match the capacity of the fiber line. The technical designation of a press is a combination of type and size. Ex. RPB-1572 means that it is a twin roll press type B with roll diameter 1500 mm (15) and roll length 7200 mm (72). The efficiency of a displacement wash press partly depends on the formation quality, i.e., how even the pulp is distributed along the length of the rolls. Since pulp is fed to a press via a pipe, and the slot where the pulp enters the press is rectangular, the pulp flow has to be transformed from a circular cross section flow into a rectangular cross section flow. This transformation is mainly what a pulp distribution system has to do.

SELECTION OF MATERIAL

According to Grades identified, stainless steel AISI 310 Grade can be select for rollers making, because it improved High

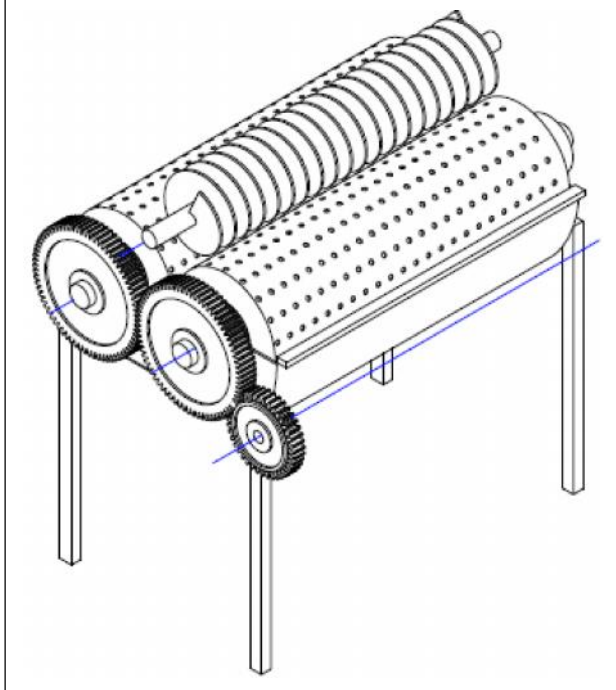
temperature resistance environments and suitable for paper industry.

Table 1: AISI 310 Steel Material Properties	
Category	Steel
Class	Stainless Steel
Type	Austenitic Standard
Common Names	Chromium-Nickel Steel
Structural Properties	
Young's Modulus	2.e+009 Pa
Poisson's Ratio	0.27
Density	8000 kg/m³
Thermal Expansion	1.2e-005 1/°C
Tensile Yield Strength	2.05e+008 Pa
Compressive Yield Strength	2.05e+008 Pa
Tensile Ultimate Strength	4.6e+008 Pa

PULP WASHER PRESS CONCEPT

Basically consist of two rotating rolls, covered with perforated plates, that squeeze the fluid out of the pulp, see Figure 8.

Figure 7: Machine View

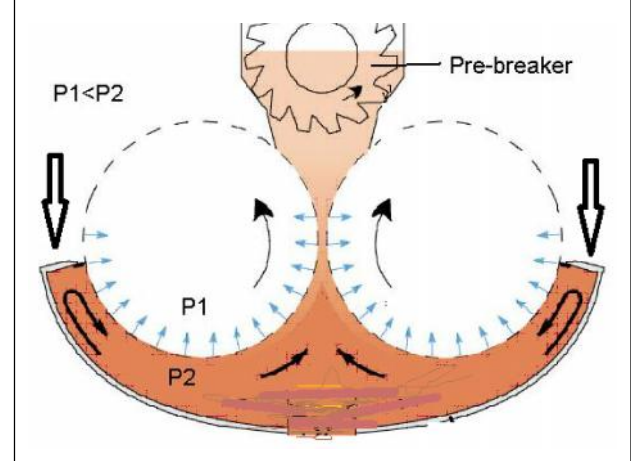


### Function

Pulp is pumped to the press, via a pipe, from the previous step in the fiber line. When the pulp reaches the press the flow is branched off, via a distribution box, into a number of outlet pipes. To get the same flow in each Outlet pipe they are equipped with flow controlled valves. Each outlet pipe is connected to a Paraformer (or Deltaformer). The Paraformers distributes the pulp flow evenly across the length of the rollers. This is roughly how the pulp distribution system works on Metso's displacement wash presses today. The function of the Paraformer describe in paper.

Inside the press washing liquor is pumped into the pulp via nozzles. The washing liquor then displaces the dirty fluid in the pulp. The reason this displacement occurs is because the vat pressure is higher than the pressure inside the rolls, see Figure 8. This is the reason why the press is called a displacement press.

Figure 8: Function



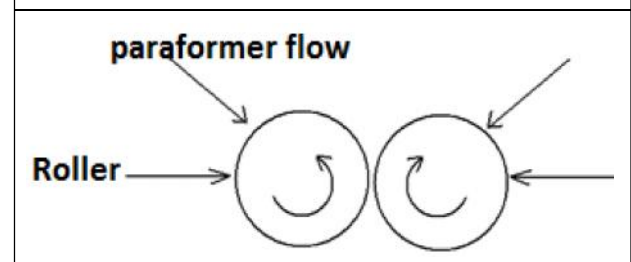
Finally the pulp is dewatered as it passes through a nip between the rolls. A screw called pre-breaker then transports the pulp away from the press. Figure 8 shows a schematic picture of the washing

### Development of Project

#### Roll Press

The main difference is that these presses will use a larger angle of the rolls for dewatering. This is done by placing the pulp inlet further up; see Figure paraformers will most probably be used for pulp formation

Figure 9: Pulp Inlet Placements



### CONCLUSION

In this paper, the design concept of twin roll press pulp wash introduce to keep the best features that made previous generations the industry's best-dealing twin-roll press, while

leveraging a decade of advances in technology to deliver capacity and cost-efficiencies that will keep it competitive today and tomorrow. 🌀

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