International Journal of Research in Advanced Engineering and Technology
ISSN: 2455-0876; Impact Factor: RJIF 5.44
www.engineeringresearchjournal.com
Volume 2; Issue 3; May 2016; Page No. 40-42

Design of modified bottom scraping unit

[1] Shashikant D Patil, [2] Seshagiri Rao GVR

[1] P.G. Student, Department of Mechanical Engineering, BM College of Technology, Indore, Madhya Pradesh, India.
[2] H.O.D. Department of Mechanical Engineering, BM College of Technology, Indore, Madhya Pradesh, India.

Abstract
Proposed research paper is to design and development of bottom scraper to perform MDF stirrer and feeder operations in pulping equipment. In this research paper analytical analysis carried out of modified bottom scraping unit in MDF Processing machine. Research work gives solution for developing the bottom scraper with flat Weldment which is made by using weldment techniques standard material plates, Bottom scraper looks z shaped from top view and circular hub is designed to hold the structure of bottom scraper. On the basis of mathematical calculation, it is prove that the strength in designed bottom scraper. Along with agitation process of pulping stirrer is also considered which is mounted on top of the bottom scraper hub.

Keywords: MDF (medium density fibre), Bottom scrapper

Introduction

Generally in pulping industry pulp is mostly feed to different processes by screw feeder mechanism here also screw feeder is already designed and standardized, in that standard screw mechanism upper hollow tank collecting the pulp which is very unmixed and not properly stirred after bleaching and other operation in chemical as well as in mechanical pulping . So to make this purpose solve practically in existing setup we need to design a bottom scraper which will help to distribute the pulp in feeder opening of screw conveyor.

Now while distribution pulp must be previously stirred for that on the top of bottom scraper assembly stirrer is to be mounted preliminary it can be T shaped vertically mounted as shown. Stirrer will be designed in such a way that it must hold load of coming pulp from the top and must be rotate without any bending deformation occurred in the bottom scraper

Aim and Objective

- To perform the design and validation for stirrer mechanism which can be withstand with the boundary conditions coming with the working system.
- To design conical a light weight effective bottom scraper
- To increase the Quality of pulp
- To increase the Mixing Percentage of pulp
- To reduce the weight of bottom scraper
- To reduce the cost of the bottom scraper
- To increase the production rate

Design of modified bottom scrapping unit

Work Layout

Design and optimisation of Z shaped weldment- Bottom scraper for stirrer mechanism in Screw feeder assembly

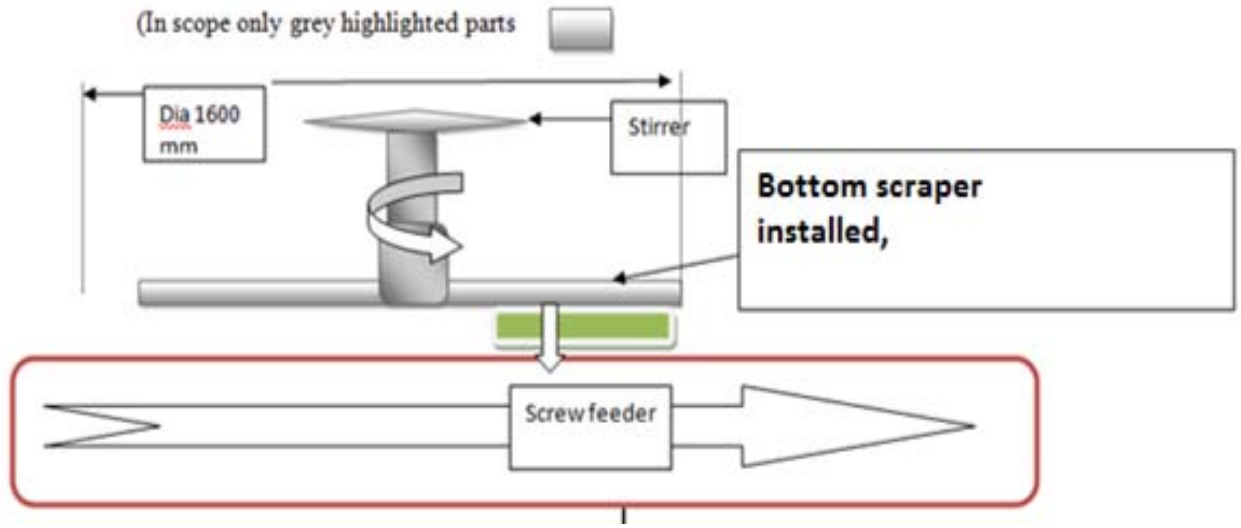

Fig 1: Process equipment

Modified CAD structure of Bottom scraper

The following fig. is S shaped weldment Bottom scraper. Made from simple standard plates with repairable hub Weldment. The material is bottom scrapper is stainless steel AISI304.

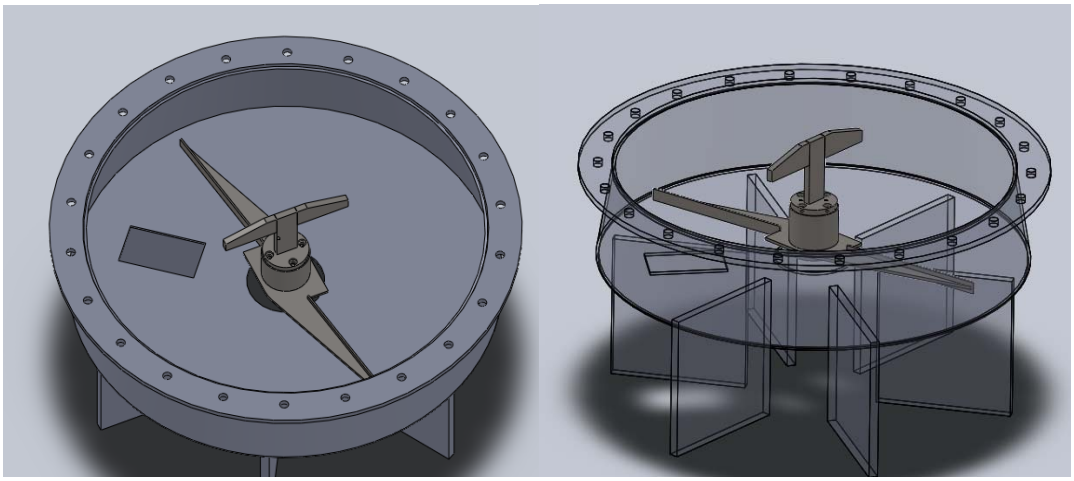

Fig 2: z-bottom scraper weldment axial mount in vessel

Stresses and behavioural study on components

The diameter of vessel is 1950 mm. And the height is 600mm.
The volume of tank is $V = \pi r^2 h = 1.794 m^3$
The density of the pulp is 1762 kg/m^3
Mass of the pulp in vessel

M = Density × Volume
M =1762 × 1.794 = 3161 kg

Hence, the maximum force exerted by the pulp on the agitator blade will be 1/6th of total Mass of pulp i.e. 526.83 kg

= 5268.3 =n5270 N

By considering the blades of agitator as cantilever beam, the force will be exerted on the blade by the pulp i.e. equal to the 1/6th of the mass of the pulp.

Consider,

W = 5270 N For cantilever beam,

We have,

b = 280 mm, h = 12 mm, L = 800 mm

Maximum reaction = W L= 5270 × 0.8 = 4216.00 Nm
Maximum Moment,

$$M = W L/ 2 = \frac{5270 \times 800}{2} = 2108000 \text{ N mm}$$

Maximum Deflection Δ max =$WL^3/8EI$

Where,

E = Elastic modulus = 193000 M pa;

$$I = \textit{Moment of Inertia} = \frac{bh^3}{12} = \frac{280 \times 12^3}{12} = 40320 \text{ mm}^4$$

Hence,

$$\Delta \max = 5270 \times \frac{800^3}{8 \times 193000 \times 40320} = 43.34 \text{ mm}$$

$$Z = \text{Section modulus} = \frac{bh^2}{6} = \frac{280 \times 12^2}{6} = 6720 \text{ mm}^3$$

$$\sigma = \frac{WL}{8Z}$$

$$\sigma = 5270 \times \frac{800}{8 \times 6720} = 78.43 \text{ N/mm}^2.$$

Here the stress developed in the agitator blade due to action of pulp is 78.43 N/mm^2, which is less than material yield strength and ultimate stress.

Feeding by bottom scraper

Total volume of pulp at feeding area r = 800 mm, h =60 mm

$$V = \pi r^2 h = \pi * 800^2 * 60 = 121 \text{ lit}$$

Consider top view in rectangular shape

$V_1 = L \times w \times D$
W= average width
$V_1 = 1600 \times 165 \times 60 = 16$ L

Torque required rotating bottom scrapper

Total load of bottom scraper, as density is 1650 kg/m3, volume of pushing zone is 121 litre
Hence, Pulp Load = 200 kg
Bottom scraper load = 205 kg
Total pushing weight L = 200 +205 = 405 kg
Coefficient of friction is 0.3 as in rolling and rotating application =0.3
Maximum push = L x 0.3 = 121.74 kg = 1217.4 N
Required Torque = max pulling load x d/2 = 1217 x 1600/2
= 974 Nm

Feeding/Rotation

Pushing zone (Cylindrical shape)

Volume $V = \pi r^2 h$, r = 800 mm, h =60 mm
= 121 lit

Volume occupied by bottom scraper

Consider top view in rectangular shape
v= LxwxD
D = average thickeness considered
v= 800 x150x12 = 14 litre

Material pushing zone volume P1 = V-v
= 121-14= 107 Litrs

Table 1: Comparison of parameters of Existing and mew modified agitator

S. No.	Parameter	Old agitator	Modified Agitator
1	Weight	497 Kg	205.7 Kg
2	Feeding/Rotation	73 Lit	105 Lit
3	Manufacturing Process	Casting Method	Weldment method
4	Assembly	Single body agitator	Separate body agitator
5	Repair ability	Whole agitator have to replace	Srparate art can be repair.

Conclusion

This research investigated modification in scrapper design. The modified z-type Bottom scrapper design is welded Assemble. And modified scrapper is replace the old casting scrapper. This work is concentrated on the calculation of the stresses developed in the bottom scrapper. First the Cad Modelling of z-type bottom scrapper with the help of Cad software solid work. The following conclusions can be drawn.

1. The feed rate of mixing and scrapper unit is increased by 30.47%
2. The weight of bottom scraper is reduced by 58.61%
3. The production rate increased due to more feeding
4. Feasible compact solution put into work is showing its workability.

References

1. Saeed Asiri. Design and Implementation of Differential Agitators to Maximize Agitating Performance in International Journal of Mechanics and Applications 2012, 2(6): 98-112. DOI10.5923/j.mechanics.2012/02/06.01
2. Rajasekaran E, Kumar B. Agitator and Wiper Design Modification for Milk Khoa Machine. International Journal of Innovative Research in Science. Engineering and Technology an ISO 3297: 2007 Certified Organization. 2007, 3(1).
3. Weber AP. Selecting Turbine Agitators, Consultant, New York, NY, Chemical Engineering, 1964.
4. Weetman Ronald J, Howk Richad A. Mixer for axial flow on a non-uniform flow field, gen signal corp US, 988.
5. https://www.google.com.ar/patents/US5239847