

SEPARATION OF SLUDGE BY CENTRIFUGE MACHINE

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ABSTRACT

The call of today's world is to save the environment we live in. The natural gifts given to us needs to be saved and pass on to our future generations. Modern world also needs to progress and develop. The wings of development should expand and fly. For the sake of development we are slowly destroying our nature and using the natural resources at a very fast rate and polluting it. Our project aims to build a machine which can clear the industrial waste water in a very efficient way so that we can take out the clean water separated from the industrial waste.

Every drop of water counts. The machine we are going to discuss is a centrifuge machine. Centrifuge machine works on the centrifugal force. This force acts in the outwards direction. The waste water from the industry is stored in the tank. a pump pumps the waste water to the centrifuge machine. The machine we design has two motors. The main motor runs and the waste water is supplied to it. The blades of the motor rotate and give a centrifugal force. The heavy particles (sludge) particles due to high force get deposited on the sides casing of the motor. The second motor scrapper motor rotates anticlockwise equipped with blades to remove the deposited sludge. The sludge gets deposited in the tray. The whole system is controlled by PLC program so it is automatic system which reduces human effort and efficient sludge removal is possible.

1. INTRODUCTION

In earlier days, the factories discharge the waste water directly in rivers and ponds. this cause a lot of pollution to our natural resources. Now a day's modern technology is helping factories to clean the waste water into reusable/recycled water to reuse into their processes or domestic usage. In addition to Sewage Treatment Plant and Effluent Treatment Plants with other processes such as physical gravity settling to separate the sludge or impurities in industrial waste water. In this process due to gravity the heavy sludge particles settle at the bottom. But it is a time consuming as well as this process does not do an efficient removal of sludge so it cannot be used for other process. So; we have come with the centrifuge machine concept which can clean the water efficiently and it is an automatic process.

This will help us and nature

- 1) To save manpower exposure hours and effective utilisation of manpower.
- 2) To save natural resources like fresh water, electricity and air pollution.
- 3) To save additional load on ETP & STP and more efficient working of ETP & STP.
- 4) To save money of company by means of maintenance of pipelines/pumps due to chocking... etc.

2. REQUIREMENTS OF MODERN FACTORIES

The main purpose of this paper is to come up with a machine design, testing of the centrifuge machine that will meet the requirements listed below. The requirements are based on the recent requirements and guidelines to the industries as per the environmental rules and regulations.

The design requirements are

Efficient sludge removal: The sludge in the industrial waste water needs to be removed efficiently so that clean water is discharge out. The centrifuge machine has a very powerful motor which rotates and provide a high centrifugal force to the heavy sludge particles and due to this outward force max sludge particle get stuck to the casing of the motor.

Automatic process: this machine has a whole electronics circuit with PLC programing which allows the machine to work on its own so it can run automatic without human involvement.

Processing quantity: a large amount of waste water is given out from the factories so this centrifuge machine can work 24 by 7 and can clean the water at a very quick rate. We can design our pump motor rpm and tank capacity according to the amount of waste water discharge by the company so that all waste water can be processed.

3. DESIGN

3.1 Collecting Tank dimensions

Length = 200 cm

Width =170 cm

Height =150 cm

Total tank volume = 5100 lit

3.2 Pump power calculation

Total head water to be supplied = vertical distance liquid travels +friction loss from pipe (145 + 50) = 195 cm head. = 77 feet

Specific gravity of industrial waste = 1.8

Flow rate of liquid = 13.88 l/min. (1 gallon/min = 3.79 l/min) = 3.66 gal/min

Water horse power = $(TDH * Q * SG) / 3960 = 0.12 \text{ hp}$

Horse power pump; we need to select from manufacture catalogue = water horse power/ efficiency

3.3 Centrifuge machine specifications

For above mentioned requirements centrifuge machine criteria are=

Power: 11/15 kW

Rotor volume: 40 l

Sludge capacity: 40 kg/h

Volume flow: 150/250 l/min (9/15 m³/h)

Acceleration: 1.960 x g

4. PROCEDURE

4.1. All the sludge from all the factory workstation come and get stored in a collecting tank. The collecting tank has an air nozzle at the bottom so that the sludge cannot settle below the tank. Two sensors are installed at the tank at the lower and upper level of the collecting tank so that it can give the centrifuge machine when to start and stop.

4.2. A self-priming centrifugal pump is attached to the collection pump. It pulls out water from the collection tank and supply's to centrifuge machine

4.3. Two valves are provided i.e. main valve and rinsing valve. Main valve supplies the mixture to the centrifuge and the rinsing valve supplies clean water to clean the casing internally.

4.4. In the centrifuge machine the main motor starts at low speed and clean water is supplied through flexible pipe to clean the casing internally. Then the motor reaches a high rpm then the rinsing valve close and the main valve opens and the mixture flows to the motor through the pipe.

4.5. The system is provided with scrapper motor which rotates anticlockwise equipped with blade to remove the deposited sludge inside the motor. This sludge gets at the bottom in the tray.

4.6. The whole system is controlled by PLC program. And the whole process goes on automatically.

5. SEPARATION PROCESS

In the first stage the slurry and water mixture from the collecting tank comes to the centrifuge machine. The main motor moves at 2600 RPM and the mixture experiences centrifuge force. The centrifuge force makes the heavy denser particle to move at ate sides of the motor casing. This sludge particle gets stuck on the side of casing

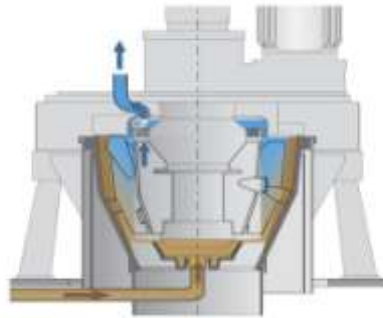


Figure 5.1

5.2 The clean water separated from the mixtures are discharged from the centrifuge machine. The water discharged is free from sludge particle

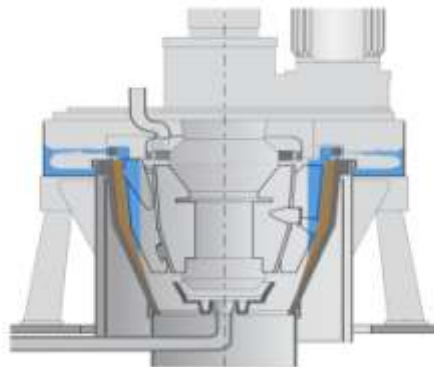


Figure 5.2

5.3 The system is provided with scrapper motor which rotates anticlockwise equipped with blade to remove the deposited sludge inside the motor. This sludge gets at the bottom in the tray

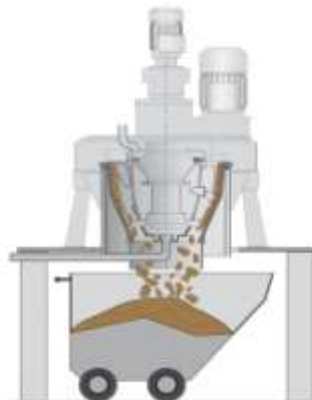


Figure 5.3

6. CONCEPT LAYOUT

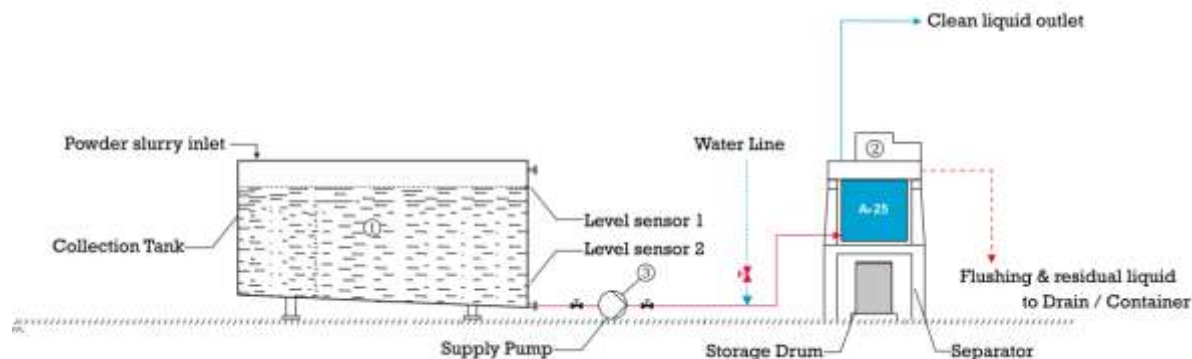


Fig. Concept sketch diagram of whole process

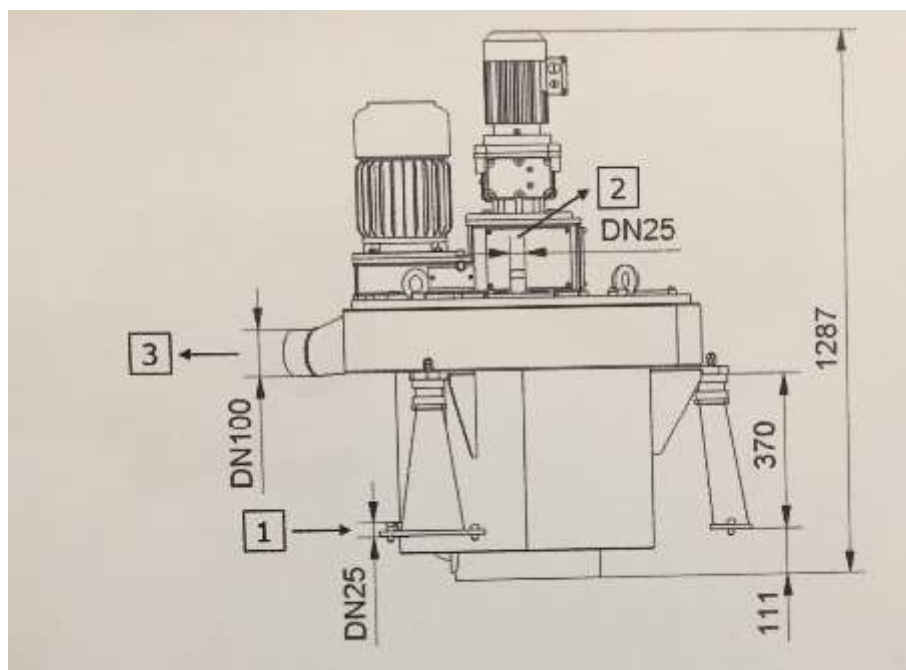


Fig. Centrifuge machine.

7. Test Result

This the test result we gained by processing the effluent in centrifuge machine

Water Comparision Report				
Parameter	Units	Limits Max	Raw Water	Centrifuge Water

Colour	Hazen Units	5	<1	>1
pH	-	6.5 - 8.5	7.06	7.90
Turbidity	NTU	1	<1	>1
TDS	mg/l	500	66.9	140
Chlorides	mg/l	250	9.784	14

This is the water collected from the centrifuge machine



8. CONCLUSION

In this paper, we have discussed a technology which can be used for separation of the slurry from industrial waste water. The main need of today's industry is auto work, efficient sludge removal and high processing speed. This machine has all the features. It is a very efficient way and we can also save the precious water resource. Factories can install this machine and they can reduce the pollution they cause. So this machine is the call of the day.

9. REFERENCE

- [1] "Hydraulic and fluid mechanics including hydraulic machine" Dr. P N Modi
- [2] "Hydraulic and fluid mechanics including hydraulic machine" Dr. R..S Khurmi , S Chand Publications
- [3] "Centrifugal pumps design and application" val s.lobanoff, Robelt R Ross
- [4] "Separation methods for waste and environment application" Jack S Watson
- [5]"Centrifugal dryers and separators" Eustase A Alliott