

A Cleaning Method and Procedures for Cleaning Continuous Digester of Pulp and Paper Mills.

Description

Annual shutdown of pulp and paper mills for maintenance, costs pulp and paper mills owners millions of dollars, and maintenance cost of the annual shutdown directly corresponds to the downtime.

High maintenance leads to escalating costs, especially with the current global inflation, making it necessary for paper and pulp mills owners throughout the world to seek a more efficient way to clean said digester. The present invention relates to a method and procedures of cleaning digesters, with significant reduction of downtime, requirement of manpower, cost and damage to equipment as compared to mechanical cleaning.

Background of the Invention

Wood chips contain organic and inorganic material such as sodium, calcium, silica, potassium, aluminum, etc. The combined effect of these components together with cooking chemical liquor sludge will result in scaling, which affects the cooking process of the pulp due to reduced flow-rate.

The current method of cleaning the digester of the pulp and paper mills is a tedious and dangerous process that requires many man-hours. Often, workers have to work at heights of up to 50 meters. The digesters are cleaned by means of very high pressure jet washers and mechanical grinders. This laborious and time-consuming method makes use of mechanical grinders and hard brushes which are abrasive. Naturally it also causes wear of the surfaces of the digester, thus causing extensive metal loss.

The said method is a tedious and dangerous process that involved at least 15 to 20 men to be stationed inside the digester, exposing the workers to the risk of an industrial accident due the elevated work area and poorly lighted interior of the digester.

The hard scales of the internal surface of digester are cleaned by means of mechanical contact of the brush and surface grinder in rotation movement. Men deployed to carry out such task often experience injury due to over-strained muscles. Also the current method requires men to be stationed inside the digester for a considerable length of time up to 10 to 12 days on shift rotation making it extremely tedious and difficult task.

The intention of the present invention is to create a new kind of method of cleaning for the digester without experiencing the drawbacks referred to above.

A special object of the invention is to develop an effective cleaning method by removing the scale of the digester through boiling out the Digester with inhibited acid scale and rust remover and high pressure water jet washing.

The said invention involves the use of an inhibited acid scale and rust remover fortified with corrosion inhibitor and a high pressure jet washer ranging from 200 bars up to 2500 bars, drastically reducing the downtime for cleaning digester from an average of 11 days to 4 days.

A further object of the invention is to enhance the daily production yield of the digester by thoroughly cleaning the screens using said invention.

Detailed Description of the Invention

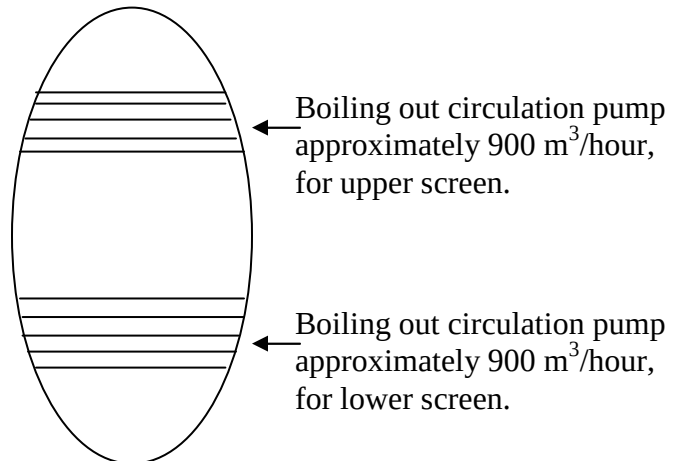
In accordance with this invention, it is an object of the invention to provide the details of the digester cleaning process using the chemical boiling out of the digester, inhibited acid scale and metal cleaner, and its equipment.

The example of cleaning a continuous cooking digester with a volume of 500,000 liters of mill water and its cleaning process is herein described;

Preparation of Chemicals and Equipment

- 1) Type of chemical for de-scaling: Inhibited acid scale and metal cleaner, quantity required- 50,000 liters.
- 2) Type of chemical for flushing the screen and neutralization of the inhibited acid scale remover and metal cleaner is 10% of sodium hydroxide solution (commonly known as white liquor in pulp & paper industries) 30,000 liters for each screen
- 3) Using Double Boiling Out Circulation Pump with flow rate of 900 cubic meters per hour, to fill the digester with approximately 500 m³ of mill water as shown in figure 1 marked in blue.
- 4) Installation of Chemical Tank of 25 Tons capacity and Chemical Transfer Pump with flow rate of 150 cubic meters per hour. Fill up the chemical tank with inhibited acid scale and metal cleaner from baby tank. Transfer the chemical from the Chemical Tank into the digester via digester manhole by using said chemical transfer pump as shown in figure 2 marked in blue.

With said installation, the boiling out of the upper and lower screen of the digester can be carried at the same time with approximately 36 hours circulation time as shown in figure 3 marked in blue.



Cleaning Procedure:

- 1) Empty black liquor from the digester.
- 2) Take some sample of black liquor from the blow-down line of the digester for analysis for iron contents, total dissolved solids and pH.
- 3) Flushing and draining of each screen of the digester with mill water.
- 4) Take water sample from each digester screen for analysis for iron contents, total dissolved solids and pH.
- 5) Fill the digester with approximately 500 m³ mill water by using Boiling Out Circulation Pump.
- 6) Transfer inhibited acid scale remover and metal cleaner from baby tank of into the 25 tons chemical tank and then transfer the chemical into the digester via digester manhole by using chemical transfer pump as shown in figure 2 estimated time required for said process is approximately 2 hours.
- 7) Start de-scaling Digester Screens for 36 hours by using Double Boiling out Circulation Pump as shown in figure 3 marked in blue.
- 8) The total time required for cleaning the digester and the process involved is detailed as follows:

Process	Time
Circulation Time of Digester Screen (By using Double Boiling Out Circulation Pump)	36 hours
Flushing and drained with mill water	2 hours
Flushing with 30.000 liters of NaOH 10 % solution (White Liquor Solution)	2 hours
Open manhole and install H-beam and scaffolding.	16 hours
Spraying with High Pressure Cleaner	12 hours
Estimation of total hours of chemical cleaning and flushing	68 hours

- 9) First sample to be taken from the digester from Double Boiling Out Circulation Pump and repeated in every two hour interval. Samples to be analyzed by for iron contents, total dissolved solids and pH.
- 10) Stop de-scaling process, total estimated time = 36 hours.
- 11) Flushing and draining of each screen of the digester with mill water to be carried out
- 12) Sample water to be taken from the digester for analysis for iron contents, total dissolved solids and pH
- 13) Flushing each screen of the digester with 30,000 liters of 10 % Sodium Hydroxide Solution (White Liquor Solution). Take water sample from the digester for analysis for total dissolved solids, iron contents and pH.
- 14) Stop flushing and empty out the digester, total estimated time = 4 hours.
- 15) Open manhole and install H – Beam and scaffolding.

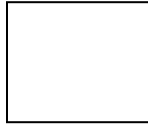
16) Open header 8 pcs each stage and channel 4 pcs each stage of screen of the digester, total estimated time = 16 hours.

Open the header



Each Stage = 8 pcs

Open the channel



Each Stage = 4 pcs

17) Spray each screen, bland plate and channel of each stage by using jet washer 1.500 bars, total estimated time is 12 hours.

18) Thickness Measurement by independent party to be carried out on the inner and outer side of the digester wall and particular spot from upper to lower of the digester so that loss metal trend from production process or boiling out process can be closely monitored.

19) Remove the H – Beam and scaffolding and close the manhole.

20) All activities will cease after the manhole is closed and the cleaning of the digester is deemed complete.

Claims:

What is claimed is:

- 1) The cleaning method and procedures that will increase the yield of the production of pulp and paper mills by cleaning the screens, headers and channels continuous digester that involves the use of chemical, pH neutralizer, mill water, high pressure jet washer, circulation pumps and chemical tanks to remove scales from the digester's screens, headers and channels so that the flow-rate will be enhanced hence increases the production yield of the digester.
- 2) A Cleaning Method and procedure for cleaning continuous digester of pulp and paper mills that involves boiling out of the digester using chemical, pH neutralizer, mill water, high pressure jet washer, chemical transfer pump, single or double boiling circulation pumps and chemical holding tank.
- 3) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim1, wherein the chemical used is an inhibited acid scale remover and metal cleaner.
- 4) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 3, wherein the inhibited acid scale remover and metal cleaner is used for de-scaling of the scales of the digester.
- 5) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 3 wherein the inhibited acid scale remover and metal cleaner consists of inorganic acids, non-ionic surfactants and corrosion inhibitor.
- 6) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 5 wherein the inorganic acids consist of Phosphoric Acid, Hydrofluoric Acid and Hydrochloric acid.
- 7) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 5 wherein the non-ionic surfactants are either Nonyl Phenol Ethoxylated or Alcohol Ethoxylated.
- 8) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 7 wherein chemical name for the Nonyl Phenol Ethoxylated is Nonylphenol Polyethylene Glycol Ether.
- 9) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 8 wherein said surfactant is either 9 or 10 moles.

- 10) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 5 wherein the corrosion inhibitor is a blend water and amine derivatives.
- 11) The cleaning method and procedure for cleaning continuous digester of pulp and paper mills as in claim 2 wherein the pH Neutralizer is Sodium Hydroxide Solution.
- 12) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 11 wherein concentration of Sodium Hydroxide Solution is 10%.
- 13) The cleaning method and procedures for cleaning continuous digester of pulp and paper mills as in claim 2 wherein the mill water is used for flushing the screens of digester.
- 14) The cleaning method and procedures for cleaning continuous digester as in claim 2 wherein the capacity of high pressure jet washer ranges from 200 bars to 2500 bars.
- 15) The cleaning method and procedures for cleaning continuous digester of pulp and paper as in claim 2 wherein the capacity flow-rate of the chemical transfer ranges from 20m³ to 100 m³.
- 16) The cleaning method and procedures for cleaning continuous digester of pulp and paper as in claim 2 wherein the capacity flow-rate of the boiling out circulation pump is 600m³ to 900m³ per pump.
- 17) The cleaning method and procedures for cleaning continuous digester of pulp and paper as in claim 2 wherein the capacity of the chemical tank ranges from 20,000 to 30,000 liters.
- 18) The cleaning method and procedures for cleaning continuous digester of pulp and paper as in claim 2 wherein the inhibited acid scale remover and metal cleaner will be circulated in the screens of digester for 24 to 36 hours.
- 19) The cleaning method and procedures for cleaning continuous digester of pulp and paper as in claim 2 wherein the mill water will be used to flush the screens of digester immediately after the circulation of the inhibited acid scale and rust remover.
- 20) The cleaning method and procedures for cleaning continuous digester of pulp and paper as in claim 4 wherein the sodium hydroxide solution is circulated in the screens for 1 to 3 hours to neutralize free acids in the digester.
- 21) The cleaning method and procedures for cleaning continuous digester of pulp and paper as in claim 5 wherein high pressure jet washer is used to remove the loose scales.