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Design and Analysis of Pressure Disc Type Filter for Beverages Making Equipment Manufacturer

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Abstract

In present, the Filters used for Beverages making industries are very bulky in shape and give low outlet discharge. Hence they are less efficient .Therefore there is a need to design compact, fully automated unit that produces completely clear liquor and clear lime mud in the same machine. This Report highlights the design of new filter which fulfill the requirements of beverages making industries for filtration.For making filtration more feasible, unit is to be design in which multiple no. of disc comprising of blades is to be mounted on a shaft for filtration. Multiple discs will get patterned throughout the shaft and number of disc decides the capacity of filter.The special arrangement of Two cake discharge blades (scraper remover) on both sides of each disc suspended from a frame mounted on the tank and serve to deflect and guide the cake to the discharge chutes. On large diameter filters,the blades are of the swing type that float to maintain the cake to disc clearance and so allow for the wobble of the turning discs.

Keywords: Outlet Discharge,Filter,Filtration,Scraper remover,Multiple Disc.

Introduction

The Disc Filters is going to be used in heavy duty applications such as the filtration of beverages and dewatering of aluminum hydrate, copper concentrate, pyrite flotation concentrates and other beneficiation processes. The filter will be consists of several rotary discs, up to 15 in the larger machines, each made up from sectors which are clamped together will form the disc.

The sectors will ribbed towards the neck and will get designed for a high capacity drainage rate. One of the main features is that the required floor space taken up by disc filters is minimal and the cost per m² of filtration area is the lowest when compared to other vacuum filters.

During operation each sector will enters submergence and a cake is formed on the face of the discs. It then emerges to the drying zone, the liquid drains to a central barrel and from there through a valve to the vacuum receiver. The valve with its bridge setting controls the timing so that once the sector leaves the drying zone it moves over a separating bridge and a snap or low pressure blow is applied to discharge the cake. Scraper blades on the side of each disc guide the cake to discharge chutes which are positioned between adjacent discs and are

wide enough to to avoid their clogging by the falling cake.

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Paper Bag: As the first stage of filtration in many of our vacuums, paper bags are available in two forms. The standard bags are made of a two-ply material. The inner lining captures particles, while air passes through the outer cellulose layer. With a filtration efficiency of 99.7% at 3 microns, the paper bag will capture the bulk of large particles for easy collection and disposal. Particles smaller than 3 microns move through this standard paper bag toward the next filter. For dust-free disposal, the container can be lined with a disposable polyliner.The electrostatic paper bag offers finer

filtration capabilities. This two-ply paper bag has an electrostatically charged inner lining comprised of meltdown polypropylene. The inner lining attracts even the finest particles, enabling the bag to be used to capture materials such as toner. The electrostatic paper bag retains 97.8% of particles down to 1.5 microns.

Main Filter: Nilfisk and CFM main filters are oversized by design to provide maximum surface area for filtering. The extra-large filtering surface, coupled with the vacuum's powerful suction, maintains a steady, even airflow, prolonging filter life and ensuring optimum vacuum performance.

Nilfisk Vacuums: The standard main filter is an oversized, napped cotton filter. This filter retains 99.8% of particles, down to 3 microns in size. The napping of the cotton provides additional filtering area by furnishing depth to the filter. Specialty main filters for the Nilfisk line include Gore-Tex and AES Polycomposite. Gore-Tex membrane filters retain 99.995% down to 0.33 microns. They are non-stick, and their smooth PTFE membrane keeps fine dust particles from passing through the filter. Ideal for fine powder filtration, Gore-Tex main filters can be used in conjunction with Gore-Tex microfilters. AES Polycomposite filters are capable of achieving a high separation efficiency when removing particles from the airflow, while at the same time, maintaining a high airflow rate and low pressure. As a result, this filter provides a longer running time because less filter loading is occurring. AES Polycomposite filters retain 99.9986% of particles, down to 0.5 microns in size. The AES Polycomposite filter is ideal for abrasive particles such as cement, steel, and lead. This filter can be combined with an AES Polycomposite microfilter.

CFM Vacuums: The standard CFM main filter is polyester and retains 99.1% efficiency at 1.5 microns. The star-shaped pleats of the filter add surface area, which lowers the air-to-cloth (ATC) ratio and increases the efficiency of the filter. The CFM line features several specialty main filters. The PVC Membrane filter is ideal for the collection of fine powders and is capable of quick release during purging. It retains 99.9% down to 1.5 microns. A Nomex filter is used in applications in which the material being vacuumed is a higher than normal temperature. The Nomex filter can withstand temperatures up to 220°C. It retains 98.4% of particles down to 1.5 microns. An Anti-Static main filter is ideal for environments where static electricity is a problem. It retains 99.7% down to 1.5 microns. The type of main filter you choose depends of the application for which you plan on using the vacuum

cleaner. Consult your local Nilfisk Representative for input on which is right for you.

Cartridge Filter: Available in large, continuous duty CFM vacuums, the cartridge filter retains 99.7% particles down to 0.3 microns. Ideal for the collection of ultra-fine dusts, this "non-stick" filter captures the dust on the surface, eliminating clogging. Dust is easily cleaned from this media, which is available for dry collection only. The filter is conductive and features Teflon coating for sticky dusts. Consult your local Nilfisk Representative for which is right for you.

Literature Reviews

In paper [1], surveys that To produce good-quality clarified juice, the enzyme liquefaction treatment carried out before membrane filtration has the advantage of lowering the juice viscosity. For tropical fruit juice industries, it represents an alternative method to diversify production and increase market share.

In paper [2], surveys that In the tomato (*Lycopersicon esculentum*) plant, the lectin responsible could be inhibited by oligomers of N-acetylglucosamine, and this property was exploited to purify the lectin by affinity adsorption on trypsin-treated erythrocytes. The lectin is a glycoprotein that cross-reacts immunologically with the lectin from *Datura stramonium* (thorn-apple).

In paper [3], surveys that Hollow fiber ultra filtration was successfully applied to obtain a clear, amber-colored pear juice. The flux reached a maximum at an average pressure of 157 kPa with an average feed stream velocity of 0.15 m/sec at 50 degree temp. High flux obtained at high temp. within temperature limitation of the membrane.

In paper [4], surveys that Kiwifruit is nutritionally rich fruit with high ascorbic acid content (193mg/100g) but the extraction of its juice is difficult due to slimy pulp. To overcome this problem a combination of enzymes + amylase + mash enzyme were used and thus, facilitating the extraction of juice. Though kiwifruit juice extraction is difficult, it can be extracted by pressing through hydraulic press. Yield is substantially increased by enzyme combinations treatment to pulp before pressing and extracted juice can be clarified to reduce total phenols (may be responsible for astringency) by passing the juice through filter press.

Existing Filtration System

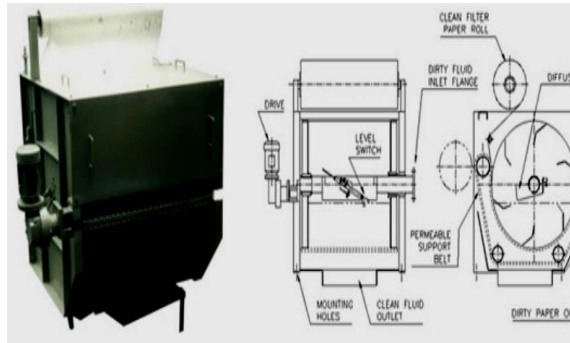


Figure 1 Band Type Filter

A compact Band Type filter Majorly work on filter paper bundle which can not be used repeatedly. It gives very low output discharge i.e. upto 13500 litre/Day. The space required for the complete filtration system is more i.e. 8 x 8 x 7 (M). due to low output discharge the production rate is low. the pulp generated after the filtration process needs to be removed manually which is time consuming.

Objectives

- Design of an automated filter system which gives high Outlet Discharge.
- Design of scrap remover for removing pulp.
- To improve the production rate i.e. upto 100 LPM
- To reduce floor space area.

Proposed Design

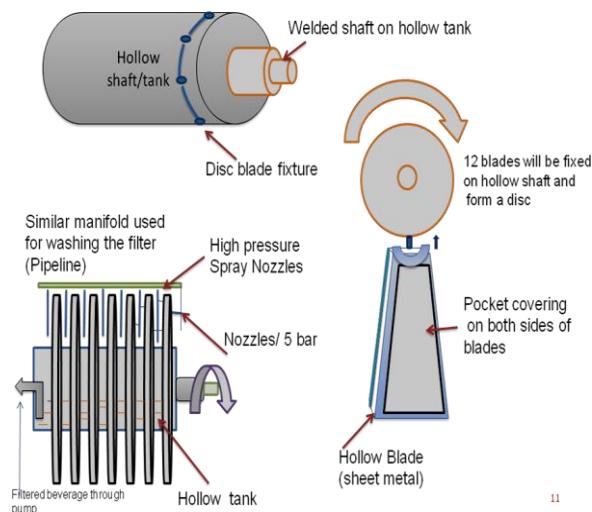


Figure 2 Disc Type Filter

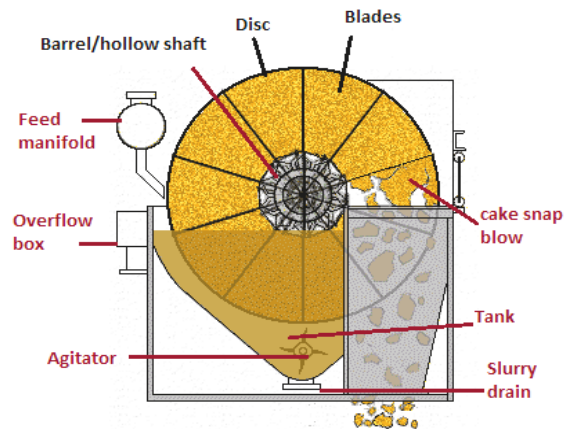


Figure 3 Cross Sectional View

The filter consists of the following subassemblies

- Discs and sectors which may be made in injection molded polypropylene, metal or special redwood/ sheet metal.
- A center barrel supported by the main bearings and consisting of piped or trapezoidal filtrate passages. The sectors are attached to the barrel through "o" ring sealed connections in a number equal to the number of disc sectors.
- An agitator with paddles that are positioned between the discs and far enough not to interfere with the forming cake.
- A tank which, on its discharge side, has separated slurry compartments for the discs and discharge chutes for the blown-off cake. When the solids are of an abrasive nature it is advisable to line the bottom portion of the tank that cradles the agitator with rubber.
- Two cake discharge blades on both sides of each disc are suspended from a frame mounted on the tank and serve to deflect and guide the cake to the discharge chutes. On large diameter filters the blades are of the swing type that float to maintain the cake to disc clearance and so allow for the wobble of the turning discs.
- An overflow trough that spans across the entire tank length and ensures full submergence of the sectors in the cake formation zone since an exposed sector in the 6 o'clock position will cause immediate loss of vacuum.

Conclusion

It has been seen that the Disc type concept for Filtration is possible and can be use majorly due to its bigger filtration medium surface than existing filtration medium surface which oriented horizontally

in the system. The special arrangement of cake discharge blades (scraper remover) on both sides of each disc guide the cake to the discharge chutes and reduces the human effort and helps to improve production and efficiency of the system.

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