ORIGINAL RESEARCH PAPER

Engineering

A REVIEW PAPER ON A DESIGN AND ANALYSIS OF CYCLONE SEPARATOR FOR HIGH EFFICIENCY BY USING CFD ANALYSIS

KEY WORDS: circular cone separator, vertical cone , centrifugal force, low pressure-drop,

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ABSTRACT

A review of the literature was undertaken to discover recent particulate control technology developments in other industries that may benefit the flour mill. In these researches we can design compact and Economic a cyclone separator for satisfy primary benefits like high efficiency, reduce pressure-drop etc. In the review paper we can change the geometry of cone section for develop high efficiency and low pressure drop. In these review paper are developed of cyclone separator with circular cone section in same capacity of vertical cone cyclone separator. We give comparisons for two cyclone for using experiment method and optimization by computerize analysis (CFD).

INTRODUCTION

"Cyclones are mostly used for removing industrials dust from air or process gases". Force at the back cyclone separation is centrifugal force and the variation in specific gravity between the particle and the carrier gas. In a cyclone, the air or vapour contain particulate material is forced into along the tangential axis. A helical flow pattern is place on within the chamber. The centrifugal force causes the particle to travel to the outside of the chamber. Here they dropped to the bottom of the cyclone by earth gravity. The air move up the centre of the cyclone and reaches the top. They are mostly two principal form of gas-solid separator. The collect product remains dry and generally useful. Low initial investment and repairs costs. Its Very compact, No moving parts and very robust. Can be constructed from most any material suitable for the intended service including plate steel, casting metals, alloys, aluminium, plastics, ceramics, etc. Can separate either solids or liquid particulates; sometimes both in combination with proper design.

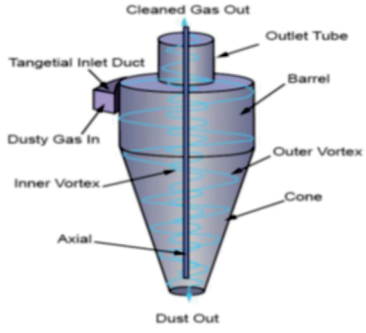

Figure 1: cyclone separators
Sources: www.googleimages.com/cycloneseparator

LITERATURE SURAVEY:

Prachi k. Ithape,et. All [1] In This paper mainly observation on variations of geometric parameters of a cyclone and analyzing its effect on the collection efficiency and give following conclusion.

TABLE – 1[1]

Changing parameter	Impact of Collection efficiency
Cylinder height decrease	Increase by 25% keeping overall height constant.
Cylinder height decrease & keeping cone dimensions constant.	and increase by 25%
Cone height increase and & cylinder height constant.	decrease by 25%
Cylinder height increase and & dip tube height increase by 30%.	decrease by 25%
Dip tube height increase	decrease by 30%.
Outlet tube dia.	decrease by 30%.

Mahesh r jadhav [2]A small scale cyclone considered for flour mill is evaluate and conclusion are derived. for experiential investigation its conclude that the pressure drop is increases as the inlet velocity increases for same capacity model By changes at inlet geometry of cyclone. In this article Two symmetrical inlets the flow gets divided in to two parts. The investigation performance parameters compare of symmetrical inlet cyclone are optimum than single inlet cyclone. It also concludes that as inlet velocity increase the cyclone efficiency also increases for same capacity model.

P.A. Funk [3] Evasés or exit diffusers potentially process could reduce outlet pressure drop without changing collection efficiency. Three rectangular evasés and a radial evasé with a variable opening were tested on two cyclones. Pressure drop was recorded for inlet velocities from about range between up to 10 to 20 m s–1. The radial evasé reduced cyclone pressure drop by between up to 8.7 and 11.9 percent when its exit area was equal to the flow area of the cyclone vortex finder or gas exit. A simple payback based on avoided energy costs was estimated to be between up to 3600 and 5000 h, not counting installation cost.

Khairy elsayed, et. al [4] The most significant geometrical parameters are: vortex finder diameter, inlet section width, the inlet section height and cyclone total height. There are strong interaction between the effect of inlet dimension and the vortex finder diameter on the cyclone performance. The latest cyclone design results in nearly one-half the pressure drop obtained by the old design at the similar volume flow rate condition.

Selamidemir, et al [5] An experimental study regarding the effects of vortex finder diameter and height, conical height and barrel height on cyclone pressure drop was performed. Pressure drops were measured at six different inlet velocities in the range between up to 10 to 24 m/s. The dimensions of vortex finder, conical height, and barrel height were in the range up to D to 2D, 2D to 3D, and 0.5D to 0.7D, correspondingly. The experimental results recommended that the pressure drop decreases with an increase in barrel height and conical height, while it increases vortex finder increases. Ratios of predicted to measured pressure drops for the novel model up to 0.388 and 1.785. The middling value was 1.059. The residuals from the novel model were normally spread around the mean value of zero with a minor positive skewness. The novel model can be with assurance used for estimate clean pressure drop with R2= 0.976.

W.I. Mazyana, A et al [7] this article practical investigates the effect of addition tangential chambers on the efficiency of solid-gas separation in cyclone separators used in gas treatment. To examine the effect of such an addition on the cyclone performance, the size division of the solid particles escaping with the clean gas is compared between the conventional cyclone design and that with the proposed addition. It is shown that the tangential chamber enhances the separation efficiency by 21% in the conventional cyclones, particularly for 4-μm particles. The addition of the tangential chamber to enhance the efficiency of the overall solid-gas separation in cyclone scrubbers was

experimentally investigated. The experimental results indicated that the implementation of an additional tangential chamber can first further increase the particle division efficiency mostly for smaller particles, and second filter traces of large size particles. Ultimately, the proposed method provides a powerful tool for enhancing the solid capturing efficiency, contributing significantly to cost saving, maintenance, and safe keeping of the downstream equipment in the oil and gas, refinery, aircraft, chemical and polymer industries.

APPLICATIONS OF CYCLONE SEPARATORS

Due to the mentioned advantages, cyclones have found application in virtually every industry where there is a need to remove particles from a gas stream. Figure 1.4 presents some examples of cyclones industrial applications with wide range of sizes, locations and applications. Today, cyclone separators are found in:

- ship unloading installations
- power stations & spray dryers

fluidized bed and reactor riser systems (such as catalytic crackers and cockers)

- synthetic detergent production units
- food processing plants

crushing, separation, grinding and calcining operations in the mineral and chemical industries

- vacuum cleaning machines
- dust sampling equipment

CASE STUDY

In this paper the actual cyclone separator model was first validated by using experimental results compare. The actual model was then modified by changing its geometrical parameters cone section body diameter. Collection efficiency obtained from the analysis was then used as a means to select the final design of the cyclone separator. So the main objective of these researches a design of cyclone separator with minimum required diameter for same capacity.

TABLE – 2
Dimension of Vertical Cone Cyclone

Parameter	Diameter
Cyclone diameter	450
Cone length	800
Barrel height	300
Dust exist	130
Vortex finder diameter	120
Vortex finder length	150
Inlet section	150
Outlet section	170

Fig.1.virtical cone cyclone separators

TABLE – 2 Dimension of Circular cone Cyclone

Parameter	Diameter
Cyclone diameter	450
Cone length	800
Barrel height	300
Dust exist	130
Vortex finder diameter	120
Vortex finder length	150
Inlet section	150
Outlet section	170

Fig 3. Circular cone cyclone separators

In this paper the actual cyclone separator model was first validated by using experimental results and results obtained from the computations performed in ANSYS CFD. The actual model was then modified by changing its geometrical parameters like cylinder height, cone height, dip tube height etc. The CFD analysis of these modified cyclone separators was performed. Collection efficiency obtained from the analysis was then used as a means to select the final design of the cyclone separator. The model with maximum collection efficiency is then selected. The model with maximum collection efficiency is then selected. For the study of research paper and observation of effect of parameter of cyclone separator to the collection efficiency and what is impact of efficiency to reduce dimension of cyclone separators.

CONCLUSIONS

For study and analysis of the various papers it is observe that with decreasing cyclone body diameter, cyclone width, and cyclone inlet width cyclone efficiency are increase with increase in inlet velocity the pressure drop increase but the pressure drop decrease with rise in temperature. We can seen that centrifugal force are inversely proportional to the radius so the diameter are to be reduce the centrifugal force are to be increase. So less diameter cyclone work more high efficiency compare to other.

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