CHAPTER 1

INTRODUCTION

1.1 Background

Generally industrial process powder is used for material which to improve reaction rate in heterogeneous reaction. Fluid is mostly used for process powder transfer such as liquid, pneumatic etc. Powder particle disperse in gas stream cause of pneumatic is used to handling powder or carbon particle in stack gas from petroleum combustion then power handling is concerned. Separation of particle from gas stream is very important because of its harmful to human respiration system. Air containing a lot of particle will cause tuberculosis. There are several dust collector equipments are used to separate particle from gas stream such as cyclone, electrostatic precipitator (ESP), bag filter, scrubber, etc.

For mechanical collectors is generally taken to refer to devices in which particles are collected either by the action of gravity or by inertial effects upon the particles or perhaps by a combination of both. In the case of gravity collectors, particles simply settle out of the gas stream due to their weight. In momentum collectors, the flowing stream of particles in suspension is subjected to a sudden change of direction. The resulting inertial effect causes the particles to tend to be thrown out of the gas stream. Collectors employing centrifugal force (cyclones) are an important special case of the inertial effect.

The rate of particle removal is proportional to the size of the collecting force. Because the weight of small particles is quite low, gravity collection is generally a slow and ineffective process for particles smaller than 100 μm in size. The rate of collection can be greatly increased by employing the inertial effect. This reduces the size of equipment and

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extends the range of effective collecting generally down to particles of about 20 μm in size. In the case of certain cyclones it may go down to 2-3 μm.

There are two types of cyclone dust collectors: the axial inlet flow (uni-flow) cyclone as shown in Figure 1.1 and the tangential inlet flow cyclone as shown in Figure 1.2. In Figure 1.1, the dust laden gas in the cyclone body is rotated by the guide vanes and the dust or solid particles are separated by centrifugal force. The clean gas flows to the atmosphere through the exit pipe or inner pipe. This type of axial cyclone can be applied in a multi-cyclone system. In Figure 1.2 in the tangential inlet flow cyclone, the dust-laden gas rotates by flowing from the tangentially connected inlet pipe into the cyclone body. This type of tangential flow cyclone can be applied as a multi-cyclone system and also can be used for high temperature gas.

All of these types of equipment are characterized by simplicity of construction and operation. They are relatively inexpensive in comparison with other kinds of collectors. Generally there are no moving parts and any material of construction may be used as may be required to withstand operating conditions. The energy required for operation is also relatively low. It is due only to a rather small pressure drop required to move the gas through the equipment.

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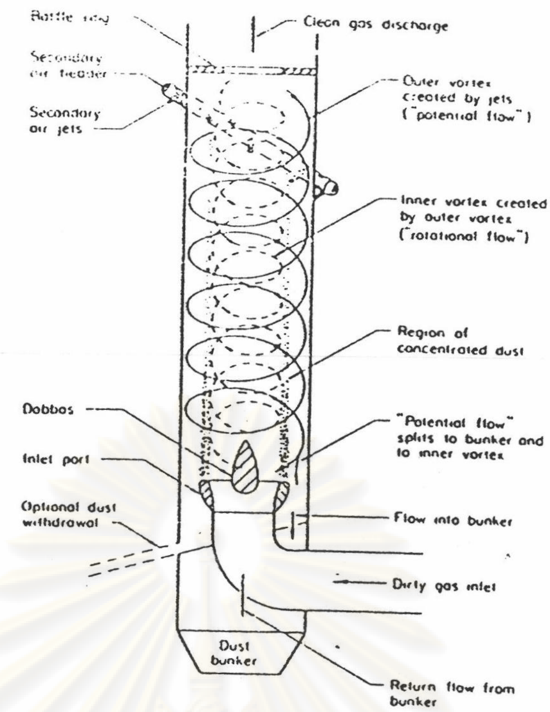

Fig. 1.1 Axial Flow Inlet

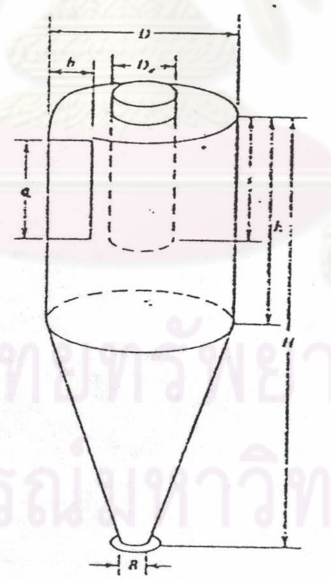

Fig. 1.2 Tangential Flow Inlet

Source: Licht, W. Air Pollution Control Engineering. New York: Dekker, 1980.

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In an optimization problem one seeks to maximize or minimize a specific quantity, called the objective. These variables may be independent of one another, or they may be related through one or more constraints.

Optimization problem contain three essential categories:

1. At least one objective function to be optimized
2. Equality constraints (equation)
3. Inequality constraints

There are two types of optimization problems.

1. Linear Programming
    - Graphical method
    - Simplex method
2. Non Linear Programming
    - Lagrange multiplier methods
    - Iterative linearization methods
    - Iterative quadratic programming methods
    - Penalty function methods
    - Simulation methods

In recent years a number of authors have presented procedures for "optimizing" cyclone design and performance. The question that is really attacked is the balance, or trade-off, between the total expense and overall efficiency. Obviously, if the total expense of improved design (to obtain lower pressure loss and cyclone diameter) or lower efficiency is omitted, the "optimized" design is that which gives the minimum pressure loss and maximum efficiency. Since the choices available to the designer almost universally effect the two desired results in opposite ways, what is available is a "compromise" rather than an "optimum"

A restatement of the objective, as usually pursued by most authors on optimizing, would be-cyclone design to achieve a required 50 % cutsize particle diameter on a known dust dispersion at minimum pressure loss.

In this research the optimization design for parallel cyclones having a tangential gas inlet dust collector in which both variables cyclone diameter and amount of cyclones concerned for maximum value of ratio collection efficiency to pressure drop, minimum total fixed cost and total operating cost in Thailand while account for the others constrains. Where total fixed cost concern only material and fabricate while transportation cost and support structure cost excluded. For total operating cost concern only electrical cost form Electrical Generator Authority of Thailand (EGAT) while maintenant cost excluded.

1.2 Objective

1.2.1 To understand behavior of cyclone

1.2.2 To compare result from the experiment cyclone between simulation cyclone.

1.2.3 To suggest the suitable optimize cyclone for Thailand solution which suit for the system requirement

1.2.4 To develop the Thailand optimization design for parallel cyclones having a tangential gas inlet dust collector program.

1.3 Scope of work

1.3.1 Create objective equation and constrains for optimize parallel cyclones having a tangential gas inlet dust collector.

1.3.2 The David Leith and William Licht cyclone model for prediction cyclone performance are to be used:

1.3.3 Develop a computer program for optimize parallel cyclones having a tangential gas inlet dust collector simulation.

1.4 Benefits expected

1.4.1 To suggest guidelines for select a suitable single or multi-cyclone that suit for requirement design.

1.4.2 To use a computer program to prediction cyclone performance and aid design.

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