

Designing a Scrubber

INTRODUCTION

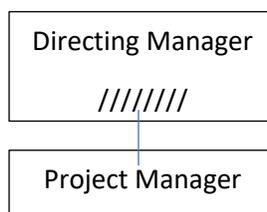
1.1. I worked for ////////////////at the time of project as a chemical engineering professional ////////////////The project was about designing a scrubber system for cleaning fumes coming from hard chromium plating and copper and nickel layer as well as hard chromium layer. The project site was //////////////// town, ////////////////. Client and contractor of the project was //////////////// and the project took 6 month to complete though I worked for 6 months' total on the project and was responsible for supervising one person at site. As a chemical engineer, I designed packed bed scrubber. Dec. 20///////// to May 20///////// is the period of project time.

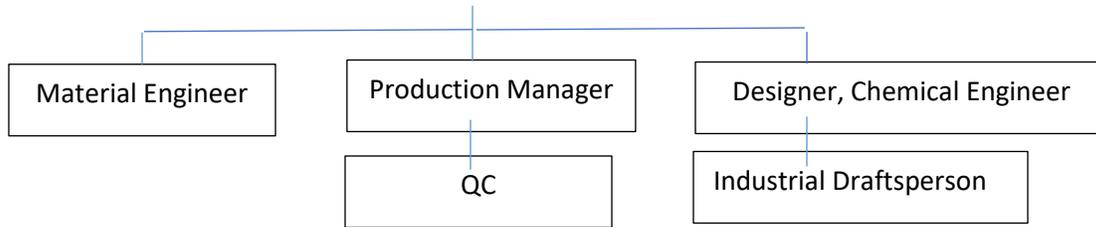
BACKGROUND

1.2. Project phases were mainly as following: phase 1 was investigation of plating lines and measuring the amount of generated pollution and calculation of the volume of ducted polluted air. Phase 2 was proposing a design, computations and preparing the proposed design for the scrubber, channels and required hoods. Phase 3 was creating a pilot scrubber, installation, and commissioning. This phase was designed for the performance test and efficiency of the proposed design and testing the chosen materials. Final phase was manufacturing scrubber, installation, and commissioning.

1.3. After the contract was made with client and sharing responsibilities by the project manager, study of plating production line with chromium and estimating pollution generated as well as designing one set of scrubbers for cleaning of fumes arising from was assigned to me in this project. In this project, I worked with technical department.

1.4. The organizational chart of the project is as following:





PERSONAL ENGINEERING ACTIVITY

- 1.5. After the meeting, I had with the technical department, I visited the project site in person. I studied plating line and performance of air induction hoods. I calculated surface of the plating tanks and then I obtained required data and information for selecting type of scrubber and dimensions and its specifics considering flow rate of required fan for the hall ventilation.
- 1.6. cleaning fumes with chromium acid: during the process of plating with chromium, large quantities of hydrogen is released in cathode as well as oxygen in anode. There is a need for a ventilation system. Because, it is impossible to make changes in the process, machineries and materials for the control of pollution as well as local ventilation seemed to be the best controlling option. I knew that there are different types of scrubbers for cleaning gas and industrial dusting. According to my researches, the most suitable option for separating chromium acid from the output air from plating bath hood was packed bed scrubber.
- 1.7. I used the following resources and references: Dust collection and gas cleaning, G. // I studied number of articles about scrubber s and chromic acid on the internet.
- 1.8. After selecting the scrubber model, considering the passing air volume and speed of air current passing, determining cross section and other factors, I calculated geometrical dimensions of it. I used AutoCAD for all drawings. In preparing documents and forms, I applied my understanding and skills in MS Office software. After field investigation of the processes and pollution sources, I designed dust collection system according to the standard and existing guidelines. After commissioning system, I evaluated its effectiveness in controlling the released fumes in the environment. I applied pertinent environmental standards at this point.
- 1.9. In the meantime, of the project, I followed up and attended regularly held meetings with the company directing manager as well as members of technical department. Considering

good deal of experiences that I had, I used their opinions in selecting the required materials for scrubber. I applied that without teamwork engineering works all are lame.

- 1.10. My utmost effort was to use the existing facilities and with the minimum possible expenses solve the material selection problem. Existing standards regarding corrosive gases, recommend steel from inside of the body made resistant using an anti-acid coat. In this project considering the customer's limited budget and lack of steel plate, using my studies at the time, and according to my investigations, I realized that I could even use water specific polyethylene in the body of scrubber. Therefore, after calculating scrubber volume, I prepared two water specific polyethylene tanks and using polyethylene weld, I completed the work with the least expenses. I applied //////////////// on this issue.
- 1.11. Not to forget mentioning the fact, that I got great help from mechanical engineers especially in relation to ventilation required appropriate system. A civil engineer also helped me in installation of scrubber at the required place and construction of proper foundation.
- 1.12. Considering the corrosive property of chromium acid, and existing budget problems, I used polyethylene and to make sure of the quality of material, I conducted required tests on the material at the lab.
- 1.13. I cooperated to health and safety experts regarding samples that they collected. I measured the amount of chromic acid in the air. Majority of references and source books are in English language, I tried to read many papers on the internet as well as reference books for troubleshooting so naturally I improved my English reading skills as well.
- 1.14. I defined the role of team members in the technical department clearly; then I proposed schedule and job description. I made the best communication and contact with the others and applied my engineering experiences to manage processes though I have a good competency in tutoring others and directorship. I applied working experience of labour and operators at the production line. I believe in communication which is a key for successful operations. Moreover, I believe in planning and follow the works according to the plan.
- 1.15. I read variety of papers in ////////////////. I tried my best to apply the most recent research works in manufacture and increase of scrubber efficiency. Considering the budget as deemed by client, I proposed and executed the best available option. I sent reports of the work to the directing manager especially regarding work progress, supervising on installation, commissioning and quality control.

- 1.16. Another successful proposal that I as a professional chemical engineer applied was using PVC packing since gas entering the scrubber had acidic quality. In the pilot scrubber that I made in the first phase of the project, I studied the efficiency of machine refining using PVC packing though according to the conducted tests carried by Ministry of Health it was acceptable. I calculated the level of required packing according to the formulas and existing relationships. I applied dust collection and gas cleaning by ////////////////
- 1.17. Research method that I applied in this relationship was experimental which was one of the most accurate and efficient research methods. In this method, manually I changed variants and controlled conditions, then I observed the obtained results about a group selected accidentally.
- 1.18. After concluding that I could use the PVC pipes at the market as the source for preparing packing materials, in consultation to the technical department, I studied pipes selection method and cutting and distribution of them in the scrubber.

SUMMARY

- 1.19. There are clues that every inspector could detect and call this project successful especially considering the problem that I solved regarding air pollution emanating from production line; ministry of health was satisfied. In the second stage of the work, considering budget limit that buyer had, project completed with the minimum cost. I gained a bundle of experiences in the production line of plating with chromium, contaminations, environmental obligations regarding chromium treatment and preventing of its spread in the environment as well as selecting the right materials for the production process of this corrosive materials according to the domestic resources.
- 1.20. Round the clock during the project, I did not face any kind of really challenging problem unless that I could solve relying on consultation, my knowledge, and experiences. I researched and searched in reliable resources and work shoulder to shoulder with technical team so that we could complete the works with the minimum cost and make the client happy.

Designing a Fluidized Bed Dryer

INTRODUCTION

2. 1. I worked //////////////// at the time of project as a chemical engineering professional ////////////////The project was designing a fluidized bed dryer – //////////////// litre capacity. The project site was ////////////////. Client and contractor of the project was //////////////// Company and the project took 7 months. I was responsible for supervising one person at site. As a chemical engineer, I designed fluidized bed dryer. The time of project for designing was from Feb. 01, 20///// to Feb. 30, 20/////; though the project completed on September 20/////.

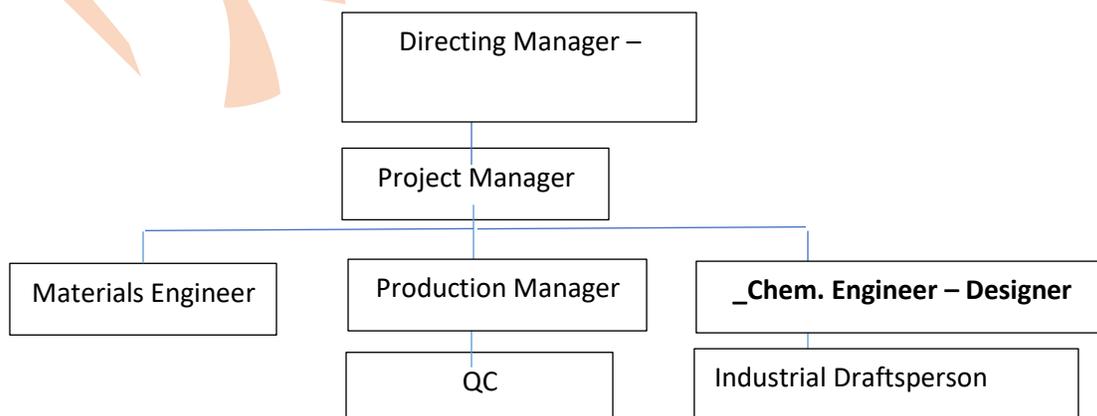
BACKGROUND

2. 2. After the customer order was finalized, study and selection of the most appropriate dryer and also dryer design according to the needs and budget of the customer, I was assigned to perform this project as a professional experience. I was designer and assigned to do computations related to fluidized bed dryer as well as selection and proposal of proper equipment for manufacture of it and supervising on installation and commissioning of it.

2. 3. The project is designing and making fluidized bed dryer for drying required veterinary pharmaceuticals for the production line of //////////////// according to the contract assigned to the ////////////////. I as a chemical engineer and designer designed the dryer.

2. 4. The objective of project was designing a dryer to dry primary pharmaceutical materials. It had to be highly efficient considering energy consumption and drying speed. I also took into consideration budget limit as deemed by purchased in the design and make of machine.

2. 5. Following is the organizational chart of the project:



PERSONAL ENGINEERING ACTIVITY

2. 6. After the preliminary meeting that I had with technical department and in person visit to the project site, I studied the considered material regarding drying from primary humidity point of view as well as virtual temperature that could be adjusted during the drying process (according to melting point of materials). Moreover, I studied various papers and references also on the internet so that I could find the most appropriate dryer for this project and suggest it to the technical department.
2. 7. Some of the issues that I challenged in this project included selection and design of proper dryer for the veterinary pharmaceuticals and my choice was designing a fluidized bed dryer. Another issue was finding appropriate method to determine the end of drying operations with the least possible expenses and my solution was controlling bed temperature and detecting work completion based on temperature fluctuation.
2. 8. Considering the customer budget limitations, I designed a batch fluidized dryer ///////////////capacity of moist powders and granules so that operations condition (temperature and air flow speed) is adjustable.
2. 9. After fluidized bed dryer selection as the best option, considering passing air and air flow speed, determining cross section, I calculated geometric dimensions. I conducted design of all drawings using AutoCAD software. In preparing documents and forms, I used MS Office software.
2. 10. During the project time, I attended regular meetings with directing manager of the company and technical department members and considering the technical team experiences, I applied their opinions in selecting required materials and equipment for the making of machine. Because in the pharmaceutical production process, granule making operation is also conducted using fluidized bed system and a mechanism like fluidized bed dryer. With design and manufacture of fluidized, it was possible to add spraying nozzles of related additives for the granule making operations or in other words for upgrading of this system, there was a need for granulator in the future. Therefore, comparing to tray dryers,

client would benefit more value added by purchasing this one. I tried to consider client future needs and propose the best solution so that client's investment in long term is also efficient, usable and optimized.

2. 11. I should add that in the design and manufacturer of proper blower, a mechanical engineer helped me a lot. Electrical engineer and instrumentations expert also helped in selecting measurement and control systems. Pharmacologist was responsible for recognizing considered drugs compound.
2. 12. According to my investigations, I found out that fluidized bed dryers are widely used in the pharmaceutical industry as batch or continuous and it is due to the following advantages: increase in drying speed and production of monotonous products, increase of production capacity in the occupied space, possibility of controlling the products temperature during the drying operations, facility of handling of materials sensitive to heat etc. According to the passing air volume and flow speed, I determined cross section and calculated geometric dimensions.
2. 13. Considering that client intended to use this system for the process of drying up different materials, my effort was designing system considering following facilities: possibility of sampling from the substance while drying for the measurement of humidity in lab, possibility of measuring weather and fluidized bed temperature via temperature probing. I designed the system output air temperature so that operator could easily perform different adjustments and pertinent measurement to the quality control.
2. 14. According to my tests, I realized that primary humidity of materials to be dried is between 20 to 35 % which should be minimized to 1%. After commissioning the system, I controlled the performance of the system through humidity measurement tools. I controlled air flow speed and pressure drop. Moreover, I dried several batches experimentally and using Sartorius humidity measurement tool, I controlled product humidity. There is this general fact that most of references were In English, so I tried to study and read many papers and related materials on the internet. I also found some reference books in this regard which I could start troubleshooting the problem.
2. 15. Reading various papers in ///////////////, I tried to keep informed of the most recent researches done in the filed especially in how to increase the efficiency of fluidized bed dryer and its application in granule making and pharmaceutical production lines. Not only I sent my proposal to the technical department and studied the design with the help of project manager, but also, I sent work progress reports to the directing manager and monitored on installation and quality control.

2. 16. Some of the references and resources I applied were: handbook of pharmaceutical granulation technology, second edition, Dilip M. Parikh, 2005, and different articles about design and application of fluidized bed dryer in pharmaceutical industries on the internet. I performed drying experiments for different products at the lab and drew drying table to identify fixed intensity phase and lowering intensity phase as well as critical temperatures. Preparing the document, I used Ms Office software. Research method that I applied in this regard was experimental method which is one of the most accurate and efficient research methods. In this method, I manipulated variants and condition control, I observed the obtained results about a group randomly selected.
2. 17. I believe that this project had various environmental dimensions and impacts considering the fact by the husbandry food facilitation, we are serving the environment. solving the above problem, I took into consideration all existing choices and scientifically understanding the process, I proposed an accurate method for problem solution and doing this, I made a considerable amount of saving in time and cost for the client. Relying on this technique, it is even possible to automate the process. All machineries and equipment utilized were according to the safety codes and standards in protection codes and sanitary standards as approved by //////////// and //////////// standard. My other colleagues that I should thank them were electrical engineers, mechanical engineers and other in installation and selection of control and measurement equipment.

SUMMARY

2. 18. I count this project as a successful one since we could achieve the determined objectives in the beginning and definition of project and project was completed with the minimum cost. I gained good deal of experiences in introduction to the pharmaceutical production process and better understanding from fluidized bed dryer systems and their application in pharmaceutical industry and production of animal supplements.
2. 19. Anytime during the project, If I faced a problem, I tried my best to prevent project halt and relying on my own chemical engineering knowledge, searching in resources and consultation and application of technical team opinions, I could minimize the problems so that customer was happy at the end of project.

Designing a Double Cone Blender

INTRODUCTION

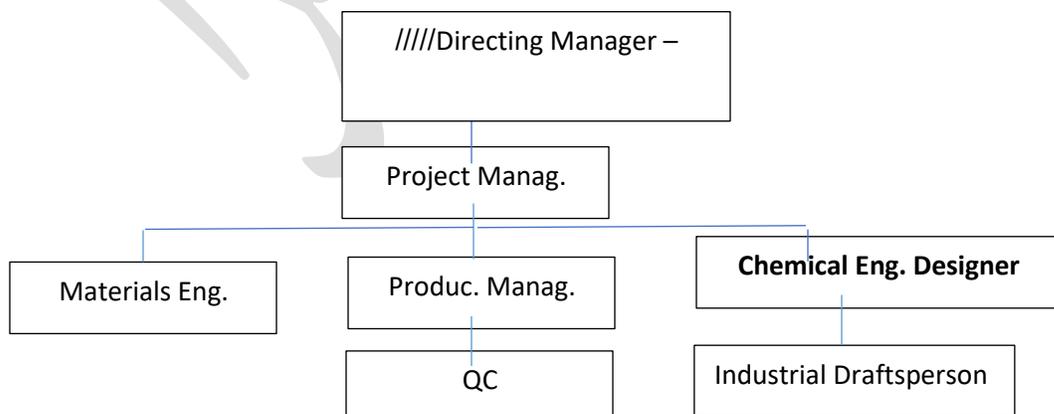
3. 1. I worked for /////////////// at the time of project as a chemical engineering professional ///////////////. The project was designing a double cone blender. The project site was /////////////// location. Client and contractor of the project /////////////// and the project took approximately 4 months. As a chemical engineer, I designed double cone blender. This project lasted from April 20///////// to August 20/////////.

BACKGROUND

3. 2. The phases that I defined for the project were primary studies of specially materials for the mix process, preparing plan including computations and design for blender, manufacturing of blender including selection of materials and monitoring on the manufacture of the blender. Next phase was installation, commissioning and quality control including supervision on installation, commissioning, and performance of the machine after installation, and commissioning as well as conducting some quality control tests.

3. 3. After contracting with the purchaser, /////////////// assigned me designing of blender considering the client needs and budget. In this project, I was in contact with the directing manager /////////////// and the company technical department. My main responsibilities were design and computations related to making a double cone blender and selection and suggestion of proper equipment for the manufacture of the considered blender and monitoring on its installation and commissioning.

3. 4. The organizational chart of the project could be depicted as following:



PERSONAL ENGINEERING ACTIVITY

3. 5. In the beginning of the project, I had several meetings with the technical department of //////////////// and after visiting the project site, I inspected the blending process regarding density, particle measurement, form, and adhesiveness of particles. Moreover, I studies references and papers as I found on the internet and tried to select and propose the most suitable blender for this project to the technical department.
3. 6. One of my challenges was selection and design of proper blender for the livestock pharmaceutical products; I designed a double cone blender for this purpose. Another challenge was application of proper measures to prevent segregation and the solution was selecting proper blending time, proper speed and paying attention to the closeness of size and density of particles needing to be blended.
3. 7. To have an optimized outcome, I considered different factors such as space, high percentage of blending, less time needed, high flexibility, less energy consumption, easier installation and minimum time of discharge and load, easy to wash and also optimized use of existing facilities and least need for repair and maintenance.
3. 8. The advantages that I outlined in technical meeting for my choice were as following: brittleness of raw materials necessitated easy stir without mechanical forces application, double cone blender could discharge 100% of the product at the end of process which was very economic considering cleaning process, normally blenders need to work with 50% of capacity though double cone blender was able to work with even 10% capacity apt for smaller batch process and sample production, and finally high repeatability of produced batches (1-2% difference).
3. 9. My main resources were //////////////// ////////////////, by ////////////////. I also read different articles about the design and application of Tumble Blenders in Pharmaceutical industries, in the Internet.
3. 10. Livestock and poultry industry are some of the key development factors in any country's economy and production of efficient and high quality pharmaceuticals to the market reduces waste of animals and birds which by itself is a growth factor in industry. Therefore, I know that design and production of equipment for pharmaceutical and animal food supplements are efficient and important in health and welfare of any society.

3. 11. I never ignored directing manager and company technical department experiences and during the project had several meetings and applied their opinions in equipment selection and finding proper materials as well as control systems. I cooperated to the mechanical engineers in manufacture of the machine as well as instrumentations expert and an electrical engineer for choosing the proper control system. I analyzed chemical properties of pharmaceuticals before and after going through the process in consultation and cooperation to a pharmaceuticals expert which was good at pharmaceutical compounds.
3. 12. I considered the fact that blender will be used for production of pharmaceuticals, therefore I felt and totally understood this abundant vulnerability for the hygiene of process. Therefore, I applied steel 316 in the body of machine and for the interior part of the container, I used polish. For product discharge, I used manual butterfly valve.
3. 13. I knew that machine vessel is having rotating movements and for the sake of safety, I embedded steel protection surrounding the machine and used earth connection. One of the major causes of accidents and career related diseases for the workers is safety, therefore I made a significant reduction in incidents occurrence probability by training at work site and installation of instructions and safety stickers.
3. 14. After studying different resources, I realized proper mixer selection for solids blending process considering that it had direct contact with physical properties of that material. Some materials need blending smoothly while some other materials need more energy to obtain high quality mix.
3. 15. I cooperated with lab in blending quality test so that using // machine, I measured and performed quality control on main efficient material dosage in the unit of samples taken from products different parts samples. Majority of my references were in English language and I tried my best to study different papers on the internet and resource books so that I could come across the best possible solution.
3. 16. One of the main principle in project management and progress of activities in the project that I as a professional chemical engineer applied was proper planning and determining priorities. I applied my communication skills in corresponding to organization personnel and proper transfer of information to increase work efficiency. In doing works, I managed time and determined job descriptions and followed management approved timelines. I believed in teamwork.

3. 17. I studied various knowledge resources and papers in //////////////// languages, I tried to apply the latest researches in blenders and application of them in granule making and production of pharmaceuticals; considering client budget, I prepared the best method for work progress. I prepared and submitted work progress reports to the technical department and project manager. I was responsible for installation, commissioning and quality control.
3. 18. According to my analysis, one of the major factors in the process of mixing solids which results in segregation is the difference in particles sizes. Therefore, I performed grading test using standard sieves and calibrated equipment as well as sieve shaker which is one of the main tests in recognizing particles grading.
3. 19. My solution for this problem was performing tests on the raw materials considering grading which after the test if necessary, particles larger from the stage before blending were completed softened up using disc grinder. On the other hand, by increasing the blending time, segregation potential increased, therefore, I deemed it necessary to produce several experimental bathes for every series of production so that I could obtain optimum rotation speed and time.

SUMMARY

3. 20. To me, project was successful since it attained the objectives and completed in the minimum time. I gained abundant experiences in introduction to mixing of solids and chemical compounds changes as well as different methods of homogenization. I applied the most appropriate method and application of blenders in this industry and production of animal supplements. My utmost effort during all time of project was not to let project stop. I relied on my own chemical engineering knowledge. I searched in existing resources. I consulted to experts and used technical team opinions using minimum costs in a way that client was happy