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Design and Analysis of Rotary Fertilizer Machine

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A B S T R A C T

This paper is mainly focused on design and analysis of various components of rotary fertilizer machine.Rotary granulator is a machine which can granulate materials into specific shapes. It is suitable for large scale production of cold, hot granulation and high and low concentration complex fertilizer.Drum granulation is a commonly used process in a commercial fertilizer production. Many continuous granulation plants operate well below design capacity, suffering from high recycle rates and even periodic instabilities. The main reasons are related to raw material properties, process equipment and control problems. The process control still depends on the experience and skills of process operators, namely experts. Initially it was aimed that we should try to design the machine as per the customer requirement. As the customer was required the machine which will produce 1500kg of granulated fertilizer per day and it will handle max 500 kg of weight and also he wants the machine to be locally manufactured. We can have this kind of machine in the market but its capacity is very high and besides that they take more space and also cost associated with it like initial cost,installation cost,maintenance cost are more. and here our customer need not such a huge machine and also he was not able to pay for such a huge amount for ex. A 3000kg per day machine will cost more than 10,000 USD.Also the space required for installation of such a big machinery is space consuming.So our prime objective was to design the machine as per the customer requirement and try to reduce the cost associated with it. Till date, many analyses are distributed on the failure of the engine components. The analysis is completed by various software, Nowadays ANSYS could be a popular one within the industry. As Rotary fertilizer machine used to produce granules, it is continuously subjected to high speed rotational movement causing vibrations in the system. They are also subjected to varying contact fatigue loads because of contact between two rollers. Due to these fluctuations in loads and speeds, it will result in vibration and fatigue failures of the shaft. Hence, model, still as fatigue analysis have to be distributed on the shaft for the enhancement of safety still because of the lifetime of the member. during this thesis, a load of 150 kg was applied on shaft model to hold out the above- mentioned analysis. Primarily, the model was designed in CATIA software and so prepared during a STEP format for further analysis. Then this model is then spooled in ANSYS software, to get total deformation and equivalent stresses on the Shaft and other components.

Keywords:- *Stress Analysis,ANSYS, CATIA*

1 INTRODUCTION

Rotary granulator is a machine which can granulate materials into specific shapes. It issuitable for large scale production of cold, hot granulation and high and low concentrationcomplex fertilizer. What's more, it is one of
key facilities to make compound fertilizer. Youcan equip with other machines to form a complete compound fertilizers production line. The rotary wet granulator can produce not only compound fertilizers, but also organicfertilizer as the disc pan granulator machines.It is necessary for you to use powdery fertilizer as materials for drum granulation. If your materials are not fine for granulating, you had better apply a fertilizer crusher for making fine powdery fertilizer materials. When you feed fertilizer powders into the granulation equipment, the cylinder will be rotating and rotate the powders to granules. The pelleted fertilizers will be out when it becomes granules. Meanwhile, if you need, it is also applicable for you to add some vapour for pelletizing better. After the granulation, you should dry the granulated fertilizers to make it more convenient for transporting and storing. There are drying and cooling machine for you to process them more efficiently.

Drum granulation is a commonly used process in a commercial fertilizer production. Many continuous granulation plants operate well below design capacity, suffering from high recycle rates and even periodic instabilities. The main reasons are related to raw material properties, process equipment and control problems. The process control still depends on the experience and skills of process operators, namely experts. Diagnostic systems show potential to apply systems engineering approaches to complex operational problems such that operators are well informed, are able

to quickly diagnose abnormal conditions, test quickly possible solutions via detailed simulations and then proceed to apply corrective actions. However, a number of interacting process variables (some of them are stochastic in nature) leads to a complex dynamic system that might be hard to predict and optimize just by intuition, especially for unskilled operators.Fortunately, it is possible to use granulation process simulations provided by PC for the investigation of such complex problems. Propose the process simulator based on an extended modeling approach for continuous drum granulation-drying processes, focused on simulation and control. This approach involves the dynamic process model built from heterogeneous knowledge sources such as physical principles, empirical (measured) data and expert information. The mechanistic part incorporates the understanding of physics and underlying mechanisms (e.g. mass and energy balances, growth kinetics). The empirical part uses raw and/or filtered process sensors' data, their storage, and retrieval and parameter identification techniques in addition to the mechanistic (white box) model. The expert component involves the process experts' recommendations, which are of great value due to the lack of other knowledge mentioned above.

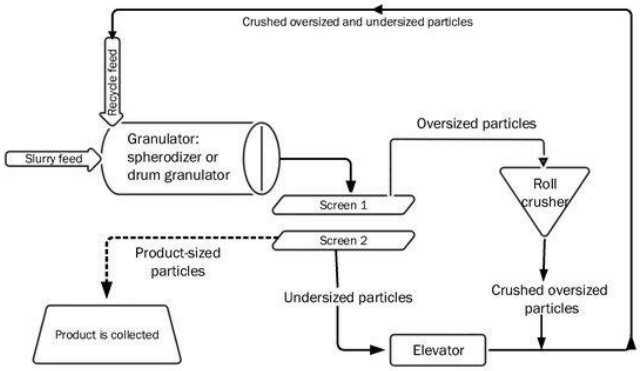

Fig 1:-Granulation process

2 LITERATURE REVIEW

The several works of literature are reviewed related to failure analysis of camshaft assembly.

Ludmila Vesjolaja, BjørnGlemmestadNorway[1] This paper is focused on the last part of NPK (Nitrogen, Phosphorus, and Potassium) fertilizer production. A granulation loop is used in order to produce different grades, i.e., various N: P: K ratios, of fertilizers. The NPK fertilizer is a high value type of fertilizer containing the three main elements that are essential for crop nutrition. Various NPK grades are specifically developed for different crops growing in different climates and soils. The granulation loop that was studied in this paper consists of a rotary drum granulator, a granule classifier (screens), and a roll crusher. Figure 1 shows a typical schematic of a granulation process with a recycle loop. Rotary drums, as granulation units, are frequently used in fertilizer industries due to the ability of rotary drums to handle large amounts of material.

Sebastian Schab, Piotr Rusek, Norway[2] A purpose of the research was to develop a method for the preparation of novel organ-mineral fertilizers with the use of brown coal and biochips as organic additives. Brown coal was blended simultaneously together with inorganic materials used for the process of urea superphosphate production in a laboratory scale using a pan granulator and in larger scale using a rapid mixer granulator. Biochips were used for the coating purposes of the urea superphosphate granules on a laboratory scale using a pan granulator. Moreover, the aim was to measure and evaluate the physic-chemical properties of organic materials and the obtained oregano-mineral fertilizer products and to study the effects of these products on the selected yield components of spring wheat such as grain yield per plant, spike number per plant, and plant height, in pot trials.

Gediminas Valiulis, Rimvydas Simutis, Kaunas, Lithuania[3] The paper presents the model-based approach to process simulation and advanced control in the industrial granulation circuit of fertilizer production. Different knowledge sources, such as physical phenomena, statistical analysis of process parameters, expert information cover different cognition domains of the process. The mechanistic growth model developed is based on particle coating phenomena, mass and energy transfer. The model partially takes into account the main process parameters, features and the equipment used. Simulation has been executed to test the model performance. The model built can be used for the evaluation of plant control methods and staff training. The aim of this paper is to propose the process simulator based on an extended modeling approach for continuous drum granulation-drying processes, focused on simulation and control. This approach involves the dynamic process model built from heterogeneous knowledge sources such as physical principles, empirical (measured) data and expert information.

Klein E.IlelejiaYiLiaR.P. KingslyAmbroseaPerry H.Doane [04] Bio-feed stocks such as corn coproducts or biomass such as corn Stover are typically densified in a dry process using pellet mills to enhance transportability and use as livestock feed. Our work presents data of an experimental study using a non-traditional means, wet granulation with a lab-scale rotary drum granulator to determine key parameters that affect granule properties and yield of desirable sized granules. Granules were manufactured from corn Stover and two liquid coproducts from corn bioprocessing, corn steep liquor (CSL) and corn molasses (CM) by varying corn stover particle size, corn Stover: coproduct blend ratio and granulation residence time.The results showed that different formulation and processing parameters affected corn Stover granulation. Granulation with an initial particle size of 0.88–0.96 mm (from screen size 6.4 mm), low liquid level (1:4) with CM, and short residence time (0.5 min) could be used to produce desirable sized granules (1.78 to 7.87 mm) for ruminant livestock feed with yields of over 98%. The effect of initial particle size of corn Stover particles on density of granular products was significant.

Tomasz LESZCZUK*Faculty Of Mechanical Engineering, Bialystok University Of Technology, ul. Wiejska 45C, 15-351 Bialystok, Poland.**[05].** The goal of the paper was to assess the strength of the fertilizer granules obtained by non-pressure granulation method.

The granulation process was carried out in plate granulator, according to the three-level experiment plan. A mixture of raw materials prepared in a Polish factory of agrochemicals for agriculture and horticulture was used as a study material and water was used as a wetting liquid. Granulator design parameters and process parameters were treated as entrance sizes of the experiment. Three different anglesof granulation blade were used in experiments. This paper presents: the results of study of equivalent diameter size and the impact of changes in the angle of granulating blade on the strength of obtained granulate. Post apparatus and a set of sieves used in granulometric sieve were utilized in this study. A relation was suggested $P\infty = f(\alpha, \chi, n, ww, t)$. The results were presented in the form of graphs and tables. Conclusions were presented.

RyoKinoshitaaTomoakiOhtabKojiShirakia[06]This study investigated how the process parameters of wet-granulation affect the properties of solid dispersions (SDs), such as dissolution and physical stability. SDs of nilvadipine (NIL) and hypromellose prepared by spray-drying were wet-granulated and dried under various conditions. The NIL concentration at 4 h and area under the curve from dissolution tests were taken to indicate dissolution. Then, the NIL crystallinity calculated from powder X-ray diffraction patterns of SD granules stored at 60 °C for 3 months was evaluated to indicate physical stability. A statistical analysis revealed that the amount of granulation liquid (w/w%) and the ratio of water to ethanol in the liquid (v/v%) significantly affected the dissolution property, and that the drying temperature had a significant effect on the physical stability.

Although exposure to water makes the wet-granulation process seem less suitable for granulating a SD, the results indicated that the process can be used to develop SD granules by selecting appropriate conditions, such as a lower proportion of granulation liquid, a higher water to ethanol ratio in the liquid, and a higher drying temperature.

3 FINDINGS ON LITERATURE SURVEY

- So far many researchers have been studding into this particular machine. They have focused on Assessment ofStrength of Granules, simulation of the granulation process of solid spherical particles in the presence of a viscous liquid in a horizontal rotating drum by using molecular dynamics simulations in three dimensions, Experimenting different compositions of different materials is fertilizer mixture with different moisture rations and they have analyzed the granulation process.
- In this particular thesis we have focused on efficient design of rotary fertilizer machine as per customer requirement.

4 DESIGN OF COMONENTS

- Referring the various books, design data book, availability of materials in market, besides considering cost factor we have successfully calculated the measurements and also made a its 3D model in Catia.

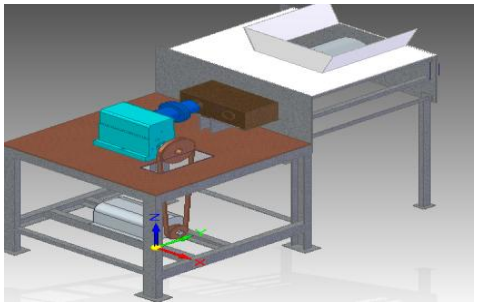

Table.1. Overall design measurements

Sr.No	**Part Name**	**Dimensions**	**Material**	**Quantity**
1	Electric motor	HP=15 RPM=1440	—	1
2	Pulley	D=250 mm d=125 mm	Stainless steel	2
3	V-belt	L=2700 mm Cross section- B	Synthetic rubber	2
4	Worm & worm wheel gear box	Z1 = 2, Z2 = 54 m=5,q=10	---	1
5	Coupling	D1=60,L1=45, D2=120,t=15	cast iron	2
6	Channel	b=7mm,d=3mm	MS 1018	--
7	Angles	--	MS 1018	--
8	Square flange Bearing	D=50	Stainless steel	1
9	Bolts	M10	Alloy steel	4
10	Key	W=7.5mm, t=5mm	MS1018	1
11	Roller	D=170mm, t=5mm	SS 304	2
12	Square bar	b=d=50mm	AISI 1018	6

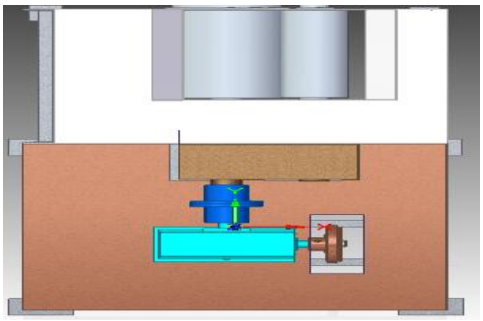

Fig.2.Model of fertilizer machine

Student Attendance Management System app deals with the maintenance of the student's attendance details. Itgenerates the attendance of the students on the basis of presence in class. It ismaintaining the daily basis of attendance, the staff will be provided with the username and password to make student attendance.Not only that, it developed for daily student attendance, in particular class, for a particular subject.

The teacher handling the particular subject is responsible to make the attendance for all students. Only if the student is present onthe particular date, the attendance will be calculated or marked. It also has the feature to access the attendance information of a particular studentonevery subject. This mobile application mainly consists of two login modules, namely admin login and teacher login.It will reduce operational time, increased accuracy and reliability. In this app, the chances of loss of data are less because all the data will bestored in a database. Security is very important when it comes to data looking to this matter, we have designed this app in a way that unauthorized access is not possible, to access data, users have to enter the username and password provided by the admin.

5 CONCLUSIONS

From this thesis, the following conclusions have been summarized below:

- In this thesis, we have successfully calculated the dimensions required for this machine &analyzed effect various loads on different components of the machine.
- Following tables No.1 describes the conclusion and finding in more details.

In the existing system, we have been taking attendance in register result of consuming a lot of time.In the register method, there is more possibility of redundant data when updating the attendance of the entire school or college, it takesa lot of time.

III. PROPOSED SYSTEM

The main goal of our project is to create a user-friendly android app to take attendance using the android app. By using this application, a teacher can take student attendance easily and view the details of the student in a single click and modify the attendance of the student.

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