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Experimental Analysis of Reciprocating Vibro Separator in Agro Industries

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ABSTRACT
In the reciprocating vibro separator to get the final product we have to separate the final product from raw material so to remove that impurities we use vibro separator as separating machine. machine has vast area of application like food industries, Minerals, Paper mill etc. the paper is to investigate the dynamic motion behavior of separator & As we change the elasticity of foundation rubber there has another motion in horizontal direction is there which create the jurk in horizontal direction, but in vertical direction. work is done on ANSYS for the analysis besides using DEM method that was used previously.
Keywords – Vibro Separator, Dynamic Motion Behavior, Poincare, Damping

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I. INTRODUCTION

Generally, any product is not available in pure form. There are always some impurities are there in required final product. To get the final product we have to separate the final product from raw material so to remove that impurities we use vibro separator as separating machine. The machine has vast area of application like food industries, Minerals, Paper mill. agro industries etc.

The principal of Vibro Separator is based on how much amplitude is required to achieve desired output. This can work for both solid and liquid type raw material for separating material. The vibro separator is separating the final product & impurities by using basic vibration motion. Like the motion of shacking the separator box will give the output.

In this paper, We focus on range of amplitude is produced & dynamic motion behavior of vibro separator.

Lala Zhao, Yuemin Zhao, Chunyong Bao, Qinfu Hou , Aibing Yu (2016) . The average velocities of simulations with both spherical and non-spherical particle models in each case show similar trends with the tests. formost cases, the velocities of spherical particles are more highly over-predicted than those of non-spherical particles because of the simplification of particle shapes.

Changlong Du, Kuidong Gao, Jianping Li, and Hao Jiang(2014). The have used the Separator which has unbalanced mass rotor at center & after that they said that by analysing the screening process of threediff erent vibration screens, it proves that the variable linear vibration screen has better power distribution and screen surface movement the flexible screen surface can increase the amplitude of the screen surface and reduce the material blocking phenomenon. The screen experiment results of the two-style screen surface vibration screens show the huge advantage of flexible screen surface than fixed screen surface in screen efficiency and avoiding material crush and it also provides a powerful proof to verify the correctness of the simulation work. Xiaohao Li, Mingxu Ma (2014) the research results which carried out in the paper showed that, about the nonlinear vibration system which supported by the soft nonlinear characteristics spring, the amplitude value of the nonlinear system can be automatically compensated when the vibrating mass of the vibrating system fluctuating in small-scope, which make the amplitude approximate remaining constant A.V.Ramana Rao, CH.Bhanu Prakash, G.H.Tammi Raju(2014) they studied on the separator which was working on linear motion where they give the suitable parameter for motor rpm range from 1000 rpm to 1400 rpm & also use the motor angle from 25 degree 45 degree. Dong Hailin, Liu Chusheng , Zhao Yuemin, Zhao Lalae (2013) they studied on linear, circular & elliptical motion of screen they said that travel velocity of the particles during linear screening is the fastest. This results in a thin material layer but the lowest Overall screening efficiency. The circular mode gives the lowest particle velocity along the screen but the highest screening efficiency. In this case, the material layer is thick but the interaction between particles and the penetration

effect are enhanced. Jianzhang Xiao, Xin Tong(2013) this paper investigated the effects of vibration parameters including frequency and swing declination angle on screening efficiency through DEM 3D simulations leading to a set of empirical formula by regression analysis to describe the relationship between efficiency and vibration parameters for swing vibration screen.

Liu Chusheng , Wang Hong a, Zhao Yuemin , Zhao Lala , Dong Hailin(2013) they have tried to get the optimum angle between base line & separator box bottom layer line & conclude that the increment of screen deck has a same effect on banana screening process as inclination of discharge end And when the values of inclination of discharge and increment of screen deck inclination are 10 degree to 5 degree the banana screening process get a good screening performance in the simulation. HE Xiao-mei, LIU Chu-sheng(2009) Have Studied on separator & told that the motion of Separator is following the elliptical trace. A theoretical kinematic analysis of the vibrating screen was done to study how varying different parameters affects the motion of the screen. Kinematics parameters of the vibrating screen that motion traces are linear, circular or elliptical are obtained. Teir work also conclude that the position of the exciter axle center relative to the center of gravity of the vibrating screen is extremely important for screening efficient use; we can design a vibrating screen with higher processing capacity without increasing power consumption by adjusting the relative position of the axle center.

Monica Soldinge (2002) he has use the monte carlo simulation to check the effect of angle between base line & separator box bottom layer line ,then he conclude that for the value of 5 degree the rpm speed is range from 900 to 1100.

work is to investigate the dynamic motion behavior of separator by ansys besides using discrete partical simulation. In the past, the set up for experimental work is done on the placement of motor at the up side center place of vibro separator box whereas in present work the motor is connected at two side of separator box.

Aim of the present work is to find the dynamic motion behavior of separator for different angle and different RPM to get to observe the motion behavior of separator box.

II. COMPUTATIONAL MODAL ANDANALYSIS

The reciprocating vibro separator has different parts which are modeled out in cre-o 3.0 Softaware & analysis is done on ansys workbench 14. The box main part of Reciprocating vibro separator separator are Motor, Connecting plate, Rubber pad, Unbalanced mass. The parts with their Dimensions are made in cre-o software.

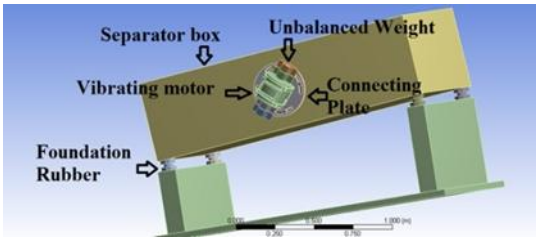

Figure 1. Whole assembled Reciprocating vibro separator the mainly three materials that are affecting the vibration of vibro separator are rubber, gray cast iron and structural steel.

Mesh size of part is taken by manually for box as 150 mm The meshed element size of box is taken as large than default for reducing complicity and reducing in number of nods. This can help to reduce the time for solving result. Total number of nods in the machine is 12.

The modal frequency for the foundation rubber shows the 6 mode of failure frequency, where the harmonic analysis will give us the critical frequency at 1st & 2nd are same but in different direction at 184.84 Hz mode and 4th & 5th are nearly the same. Based on that value the damping ratio is calculated. For the rubber pad the damping ratio is as Natural frequency fn=184.31, f1=184.1614Hz, f2184.8601Hz and and calculated value for is 0. 0018. As discussed earlier in this paper we focus dynamic motion behavior of vibro separator. So, to find out the maximum amplitude in reciprocating vibro separator, we are considering different input parameter like motor angle, motor speed & properties of Foundation rubber.

In the above figure angle between motor axis & vertical line of separator box is taken as α and Angle between position of separator box & base line is taken as So, by varying the input parameters the dynamic motion behavior will be observed.

III. EXPERIMENTAL WORK

In above table we have found that magnification factor different motor angle & different speed. Based on this, we observe that higher magnification factor is at 30degree motor angle & 1080 rpm of motor.

The experimental work is performing in **Gajanand industries** at **Unjha**. Where the setup was prepared as per the computational work but the two motors are running at 980 Rpm motor speed having 0.5 Hp each vibro motor.

The experimental Setup is running at 980 rpm motor speed with 3-degree motor angle

Figure 2 Vibro analyzer

IV. RESULT AND DISCUSSION

The current vibro separator computational work is matching with the experimental & from this if we change in input parameter the change will give us the idea for motion of separator. Up to the work done on the motion of vibro separator the motion is elliptical now as we change the property, we have diff erent type of motion like

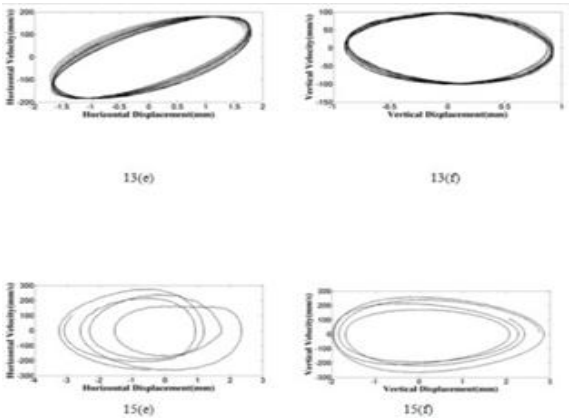

Figure 3 result from the computational work motion analysis the motion is diff er in horizontal direction as we change the elasticity of Foundation rubber this will lead to increase the production rate.

V. CONCLUSION

1. In the figure 13 (e-f) figure 15(e-f) the motion of experiment setup is quasi periodic similar to the motion of computational work done at25 MPa elasticity of foundation rubber.
2. As we change the elasticity of foundation rubber there has another motion other than elliptical motion in horizontal direction is there which create the jurk in horizontal direction, but in vertical direction the motion is nearly same as experiment.

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