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Analysis of Double Shaft Paddle Mixing Machine shaft.

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ABSTRACT

This project deals with analysis of shaft used in double shaft paddle mixer. Paddle mixer consists of several elements- a centrally mounted horizontal shaft that rotates within a cylindrical container, paddles, openings at the top for feeding materials, flush fitting access doors at the front of the mixer, at the bottom of the mixer fitting discharge valve . Paddle mixer is specially designed to lift, shake and to get combined materials in container ,which is made of Stainless Steel. This paddle design is perfect for merging the solids or liquid of different kind of particles density, size and viscosity. It is normally used for food, fertilizer and pharmaceutical industries. The overall subject of this paper is the failure analysis of driving shaft of mixer. One end of that shaft is connected to the output of the motor through gear drive. By considering the system pressure acting on the output shaft is determined. Stresses occurring at the failure section are calculated using this pressure. Model is developed into the Pro E Software. Analysis is done by using Ansys 13.0. From that we get the stress value for the conditions. After fulfill the needed conditions of required stress we are going to manufacture and test the product for the validation.

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I. INTRODUCTION

Mixing is nothing but where phase can be achieved and by which mass and heat transfer and increase by phase. Paddle mixer is specially designed to lift, shake and to get combined materials in container, which is made of Stainless Steel. This paddle design is perfect for merging the solids or liquid of different kind of particles density, size and viscosity. Main constituents of paddle mixer are-

1) Shaft with paddle
2) Gear drive
3) Driving motor

It is normally used for food, fertilizer and pharmaceutical industries.

II.PROBLEM STATEMENT

The customer demand paddle shaft in this mixer should sustain pressure up to 7.730e-002 MPa for this they are used already design paddle mixer in which the paddle is directly inserted into the pipe i.e. into the shaft which is failed during the operation so we can redesign and modify the paddle shaft that fulfill needs of customers in which the paddle is welded on the surface of the shaft. Here the task is that FEA analysis is doing for both cases and choose best one which fulfill the requirements of customer.

III.DESIGN WORK

We can develop the model for the both condition into the Pro Engg. Software and used FEA analysis. From this we can get result of stress for the required pressure and we choose the best one which can work on the needed pressure. After the analysis we manufactured the paddle shaft and tested experimentally.

IV.FINITE ELEMENT ANALYSIS

For the paddle mixer shaft analysis we used Ansys 13.0.For the both of the cases we can apply the same pressure and boundary condition i.e. the input data used is same for both shaft, from the FEA software we get the stresses on the shaft .The max stress on the shaft is 120Mpa according to the given pressure but on the old shaft there is stress 173.09Mpa which is very much higher than needed stress. On applying the same static pressure on the modified shaft we get 105.06MPa which is under the needed stress. So we get that modified shaft is better and optimize than the old shaft. After that the shaft is going to the manufacturing

process. After the analysis is done we got result for both old and modified shaft. The result as follows,

1) OLD SHAFT

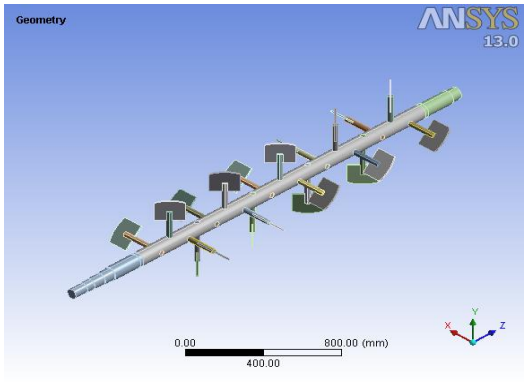

Fig.1 Model of old shaft.

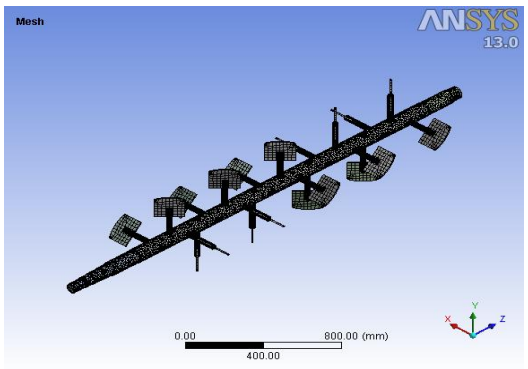

Fig.2 Meshing for old shaft.

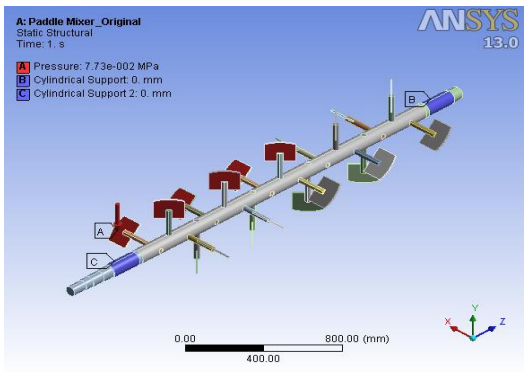

Fig.3 Applying boundary conditions.

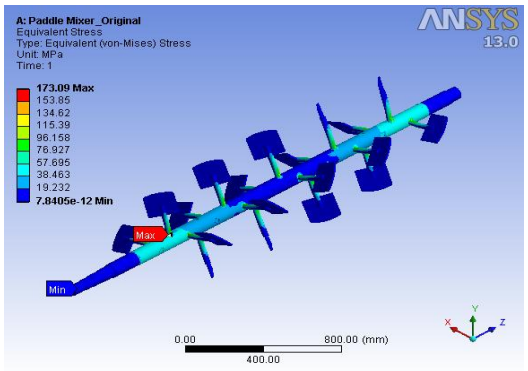

Fig.4 stress analysis diagram.

2) MODIFIED SHAFT

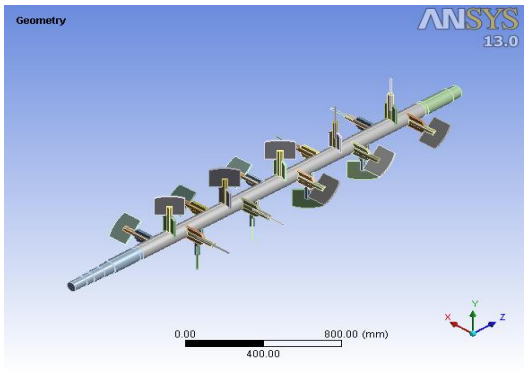

Fig.5 Model of modified shaft.

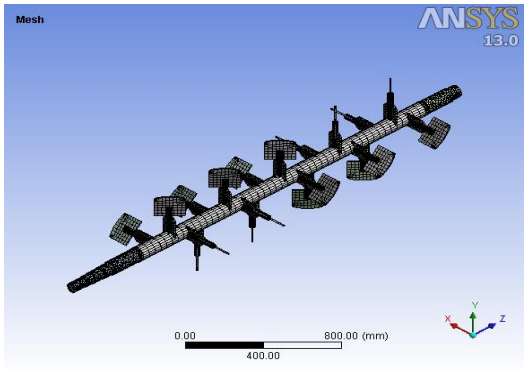

Fig 6. Meshing for modified shaft.

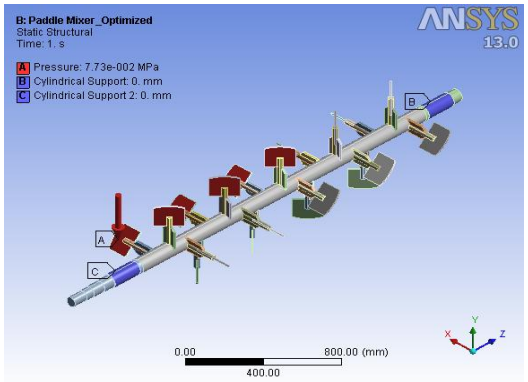

Fig.7 Applying boundary conditions.

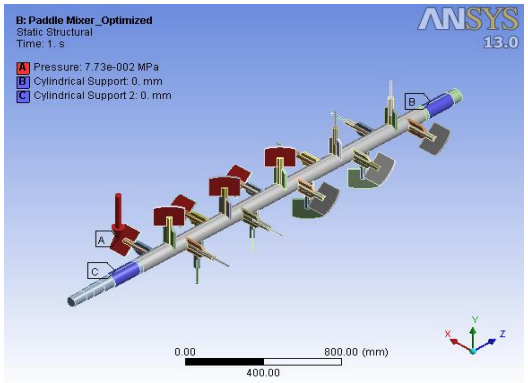

Fig.8 stress analysis diagram.

V. MANUFACTURING OF SHAFT

From the FEA result we choose the modified shaft. In Modified shaft paddle is not inserted into the pipe but the paddle is welded on the surface of shaft. Also there is stiffener attached to paddle bar which gives the extra strength to the paddle. According to the customer requirement we choose the material for the shaft and paddle. This material tested by 3rd party and result are acceptable. After that all fabrication work is done.

VI.MATERIAL USED

Table 1: Material specifications

Sr. No.	Description	Material specification	Used for	Test certificate no.
1	3NB×Sch×pipe	SA312 TP 316L	Shaft	QMTS 1114
2	SS bar ϕ 95 mm	SA479m TP 304L	Bar	QMTS H2397
3	SS plate 8 thk.	SA240m TP 304L	Paddle Plate	QTMS H1301
4	SS bar ϕ 30mm	SA479m TP 304L	Support bar	QTMS H1973

All materials chemical composition test is according to ASTM E 1086/1985 and found to be acceptable.

VII.EXPERIMENTAL TESTING

After the manufacturing of shaft we are assemble this shaft with mixer. The required condition is that shaft is rotating with 38 rpm with sustain the set pressure. The test is going for the 2 hr with the water fill into the tank. This water develop pressure that customer wants. During the testing we change the current of RYB connections of motors and test conducted for 2 hr. during this test we check the vibration in the shaft which is normal, temperature is also acceptable and also get required rpm without failure of paddle shaft.

VIII. CONCLUSION

For applying the static pressure and boundary conditions for both shaft we get the stress value by using the Ansys software. According to the analysis result we get the better and optimise paddle shaft which is fulfil the customer requirements. Also we manufacture for the same result and for validation we conducted actual test for the product. Finally the shaft is running without failure with all satisfactory conditions.

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