

DESIGN & DEVELOPMENT OF 3D MIXER USING SPITAL MECHANISM

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ABSTRACT

Recent advances in mixer and blender designs have contributed to the growing success of food companies, meeting their requirement for consistency and developing new products while also lowering production costs. This project discusses both traditional and new specialty mixing technologies available to food manufacturers today. Phase and viscosity are used to classify different mixing categories. Sample applications are presented as well to illustrate certain processing challenges and the mixing technologies used to resolve them. In conventional method of mixing the liquid is carried out on 'Unidirectional Stirring Machine' The stirrer of conventional machine rotates in one direction only which creates a particular flow pattern in the fluids hence the particles tend to stick to the walls of container owing to the centrifugal force rather than mixing thoroughly in mixture of liquid, ultimately results into poor quality mixture of liquid there by poor quality output. In order to have a homogeneous mixing would be appropriate to have a 3D direction of rotation of stirrer shaft which will rotate stirrer blades in all over position in mixing tank in one cycle this will form turbulent flow pattern there by leading to creation of irregular flow pattern and resulting into thoroughly mixed paint mixture preparation which will create the good quality mixing.

Keyword :- Homogeneous mixture, Periphery of blades rotation, Spital mechanism motion, etc.

1.INTRODUCTION

Process industries like chemical plants, food processing plants, paint industry etc. Largely employ mechanical mixers to carry out mixing of powders, semisolid jelly fluids etc. Mixing is a process where powder or jellies are mixed together through in the form of uniform mixture where stirring is the process to mix the fluid and powder to dissolve the powder thoroughly in given mixture and form a uniform product or output. In either of above cases thorough mixing of material is desirable to give and good and uniform quality output. Mixing of powders of different material in order to form a uniform product or a powder mix is quite easy but when it is desirable to mix powder in a fluid matter specially when the density of powder is high the problem occurs due to heavy weight of particles of powder has a tendency to settle down, so we make bidirectional mixer which move opposite direction in one cycle. For that motion we using the crank and fork mechanism. Which form the turbulence in mixer and make homogeneous mixture Mixing is one of the qualities of the product.

At the heart of transforming raw ingredients into food for human consumption is the mixing operation. One of its main tasks, which other food processing steps also share, is to establish consistency. Whether a food product requires small-scale mixing by hand or high volume blending of multiple ingredients, at-home cooks and process engineers alike know the importance of proper mixing. Even with the right amount of ingredients and flavors, a great recipe will not transform into good food unless the components are well-mixed. Taste, texture, color, appearance – these are all crucial parameters intimately influenced by the mixing process. Consumers expect that the food products they patronize will be exactly the same as the one they had last. It is easy to

understand that within the food industry a high level of consistency is required not just batch-to-batch but facility-to-facility. In this market, consistency is the backbone of consumer loyalty. Various types and styles of mixing equipment are utilized within the food industry. Their use and application are determined by the phases being mixed (liquid-liquid, solid-liquid, or solid-solid) as well as physical characteristics of the end product (like viscosity and density).

In reality, many mixing technologies overlap in use and function such that certain applications can actually be successfully produced by two or more types of mixing systems. In these situations, economics rule out the more costly initial investments, but differences in efficiencies must also be taken into account. Proper mixer selection is vital to process optimization.

1.1 Objective

- To reduce the power consumption during liquid mixing.
- To maintain the accuracy in pharmaceutical production.
- To develop automation unit, so that machine can easily be adopted in today's automated pharmaceutical plants.
- This type of machine provides work practically at low cost, low maintenance, low capital investment in less space.
- To perform the most rigid operation with high-speed liquid material mixing.

2. METHODOLOGY & PROCESS FLOW CHART:

The below flow chart shows the sequential operation/steps that will be performed during the project process. We have proposed a methodology to solve the problems. Our methodology is divided in different parts, under different titles. The sequential operation/steps that will be performed during the project process.

Sequence of proposed methodology is as follows –

- Proposed Methodology 1 – Problem Definitions.
- Proposed Methodology 2 – Basic Information & literature survey.
- Proposed Methodology 3 – Design of Components.
- Proposed Methodology 4 – Selection of material & standard parts.
- Proposed Methodology 5 – Manufacturing process & testing.
- Proposed Methodology 6 – Cost Estimation & Report writing.

3. CONSTRUCTION

Components are used for manufacturing the mixer are:

Table.1. Material Requirement.

SR. NO.	COMPONENTS	QUANTITY
1.	Frame Structure	1
2.	12 Volt Motor	2
3.	Ball Bearing	2
4.	Shaft	1
5.	Rotor Blade/stirrer	1
6.	V-Belt	1
7.	Pulley	2
8.	Transformer 12 Volt	1

9.	Drum	1
10.	Nut and Bolt	-

4. WORKING

The stirrer of conventional mixer rotates in one direction only which creates a particular single flow pattern in the fluids hence the particles tend to stick to the walls of container owing to the centrifugal force rather than mixing thoroughly in mixture, ultimately results into poor quality mixture of liquid there by poor quality output of final mixed liquid. In order to have a homogeneous mixing would be appropriate to have a 3D direction of rotation of stirrer shaft in one cycle this will form turbulent flow pattern there by leading to creation of irregular flow pattern and resulting into thoroughly mixed liquid mixture preparation which will create the good quality liquid mixture. A mixer is being designed which consist of a container impeller blades, electrical motor, pair of pulleys, pedestal bearings, drive shafts and spital mechanism. We are using the container made up of PVC; it is placed at about 6 inches from ground, so that it is easy to pour the material for the workers preparing the chemical solution.

5. ADVANTAGES, LIMITATIONS & APPLICATIONS

5.1 Advantages:

1. Stirrer has spital rotation i.e. it rotates in all over the tank; this gives uniform mixing.
2. Quality of mixing is very high.
3. Low cost of mixing.
4. Fast production rate.
5. Compact size so minimal space requirements.

5.2 Limitations:

- 1) The machine develop by us is having capacity only 20 liters, which can be made only to prove models reliability or change in functionality for model synthesis. It is not an actual production model, but fulfills all basic requirements given by the company.
- 2) The machine develop by us is having small capacity of motor, so that it cannot be use large quantity of chemicals or liquid.
- 3) The machine develop by us is having low speed of motor which give less speed of chemical or liquid mixing.
- 4) The machine gearbox made by us may have misalignment while working.

5.3 APPLICATIONS :-

1. Mixing of multiple color paint in paint industry.



2. Dairy applications with suitable change in stirrer material.



6. CONCLUSION :-

By this project we have studied how to make homogeneous mixing machine and the different properties and working design of the mixer. Also, we have got the knowledge about the design procedure and about the industry how they deal with their projects. Also got the knowledge about various mixers available at market and their components survey. As we know this is the sponsor project so the company members supported us for design calculations for getting previous details. There technical support to us so that we can complete our work in minimum time and develop the basic calculations as early as possible. Our design of mixer is all about effortless model for industry. This design feature also has chances to save electricity, reduced time and reduction cost. The design of mixer is also not a critical so the development cost for the mixer is feasible as per the product development cost given the company.

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