

AGITATOR



What are Agitators?

- An agitator is a mechanical device that helps in shaking or stirring a liquid or mixture of liquids. Agitators are widely used for multiple operations in the chemical, pharmaceutical, food, grease, metal extraction, paint, adhesive, water, and cosmetic industries.
- The agitators are defined as a machine where an impeller with a rotating shaft imparts energy by mechanical means to mix various process media.



What are agitators used for?

- The main functions of using an agitator in any plant are:
- To get proper mixing of liquids
- To promote chemical reaction inside the equipment.
- To increase heat transfer during heating or cooling
- To keep homogeneous liquid bulk during storage
- To disperse immiscible liquids.
- To keep the product in a mixed state till used.
- To blend miscible liquids.
- To dissolve some solids into liquid.

What are the Types of Agitators?

- Various types of agitators are available for industrial purposes. The common type of agitators are:
 - Paddle Agitators
 - Anchor type agitators
 - Propeller type agitators
 - Blade type agitators
 - Turbine type agitators
 - Helical Agitators

1. Paddle Agitators:

- Containing paddle-shaped blades, these agitators are the most basic types of agitators. Their capability is limited and used mainly for laminar flow fluids requiring little shearing. They are adjustable and contain an equal number of forwarding and reversing paddles to move ingredients from one end of the vessel to the other.
- A modified version of paddle agitators is Sawtooth Paddle Agitators. The forward paddles of such agitators contain notches or saw teeth.



2. Anchor Agitators

- For mixing highly viscous and non-Newtonian fluids, anchor agitators are widely used. Their name indicates the impeller shape that resembles an anchor. They are normally mounted in tanks and vessels with conical or rounded bottoms.



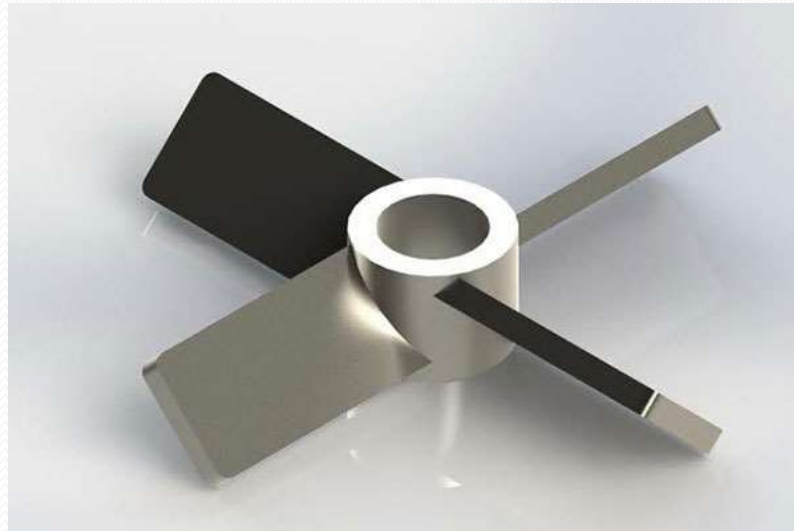
3. Propeller Agitators:

- For low viscosity products, Propeller agitators are highly suitable. Functions like homogenization, suspension, dispersion are easily achieved using propeller-type agitators operating at medium to high speeds. These axial flow agitators are ideal for solid in liquid suspensions as they prevent the deposition of solid particles.



4. Blade Type Agitators:

- These are suitable for low and medium-viscosity fluids. Blade type agitators are axial type.



5. Turbine Agitators:

- For emulsification and dispersion of fluids at very high speed, Turbine agitators are used widely. Turbine Agitators are characterized by highly effective mixing capability across a broad viscosity range. Turbine agitators have an axial input and radial output. They combine rotation and centrifugal motion during working.



6. Helical Agitators

- As the blades are arranged in a structure of a helix, they are known as helical agitators. Appearing like a threaded screw, helical agitators are axial flow agitators that provide vigorous motion within the vessel or tank. This type of agitator is widely used in polymer industries.



The following table provides the main applications, advantages, and disadvantages of various types of agitators.

Type of Agitator	Applications	Advantages	Disadvantages
Paddle Agitator	Mixing of Solids, Slurry Mixing, Used during Crystals forming phase during Supersaturated Cooling	Heavy-duty, Slow Operation, 2 to 4 blades.	High power consumption, Inefficient mixing.
Turbine Agitator	Liquids and gas reactions, widely used for reaction and extraction operations.	High radial flow, good for dispersion operation	Not preferred for highly viscous solvents
Anchor Agitators	Widely used in the pharma industry.	High heat transfer rate.	High power and high-efficiency gearbox requirement.
Propeller Agitators	Can handle corrosive materials with a glass lining.	Increase homogeneity. Can be used for drying and pressing.	High-speed requirement.
Helical Blade	The Paint Industry.	Can efficiently handle visco-elastic liquids.	Low possibility for radial Mixing.

Components of an Agitator

- An agitator is usually composed of three main components. they are:
- A shaft with an impeller and impeller blades
- A mechanical seal and
- A motor with a gearbox option for speed control.
- The shaft of the agitator is connected to the motor and gearbox and the impeller rotates to perform mixing. The number of impellers depends on the height of the liquid inside the vessel or tank. Each impeller usually has 2 to 6 blades. Magnetic-driven agitators are also available where a hermetic seal is used in place of a mechanical seal. Fig. 2 below shows typical components of an agitator

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- The impellers used in agitators can be of various types like:
 - Standard or Wide blade Hydrofoils
 - Straight blade or Pitched blade turbines.
 - Retreat curved impellers.
 - Gas dispersion impellers.
 - Rushton turbine impellers
 - Sawtooth disk impellers, etc

Selection Criteria of Industrial Agitators

- The selection of agitators for a particular application depends on various factors like:
- The phase to be mixed (single-phase or multiphase).
- The viscosity of the bulk.
- Exact function required (blending, dissolving, dispersion, heat exchange, chemical reaction, crystallization, emulsification, suspension, etc).
- The mixing cycle (batch size, the time required for agitation, material addition sequence, etc)
- Properties of the materials to be mixed.
- Initial ingredient and final product viscosities.
- Solubility of solids and concentration used.
- Desired process outcomes.
- Corrosive or flammable properties.

Data required for the design of an Agitator

- The following data are required for the industrial design of an agitator:
- Purpose/Function of agitation.
- Mixing cycle.
- Foaming tendency
- Individual physical characters and their quantities of the materials to be mixed.
- Tank/Vessel/Reactor dimensions preferably with a sketch.
- Duty hours.
- Electrical duties
- Material of Construction

Applications of Industrial Agitators

- Industrial agitators are used in various applications like
- Mixing in tank
- Viscous products and non-newtonian liquids
- Clean and lightly contaminated liquids,
- Fibrous and Non-fibrous slurries
- Liquids with high gas or solid content



THANK YOU