

# GLOSSARY OF TERMS FOR INDUSTRIAL MIXING APPLICATIONS

## **ADHESIVE**

A substance capable of holding two materials together by surface attachment. Adhesive can be in film, liquid, or paste form

## **AGITATOR**

A mixer consisting of a power drive, shaft and impellor to provide agitation of the contents of a vessel, container or tub

## **ANCHOR PADDLE**

A paddle with vertical blades whose contour conforms to the vessel

## **AXIAL FLOW**

The circulation of a fluid from top to the bottom or bottom to top of the mixing vessel

## **BATCH MIXER**

Batch mixing is the simplest mode of operation. The industrial mixer is filled with media and product mixing is allowed to proceed. When mixing is complete, the vessel's contents are emptied for downstream processing. The mixer is then cleaned and refilled for mixing another batch

## **BITUMEN**

Bitumen is a black, oily, viscous material that is a naturally-occurring organic byproduct of decomposed organic materials. Also known as asphalt or tar, bitumen was mixed with other materials throughout prehistory and throughout the world for use as a sealant, adhesive, building mortar

## **BLENDING**

Mixing two or more miscible liquid components into a more uniform mass

## **BULK DENSITY**

The density of a particulate, granular or powdered solid material that includes the voids between the particles. It is the mass of many particles of the material divided by the volume they occupy. The volume includes the space between particles

## **CENZIPOISE**

The centipoise is the unit of dynamic viscosity in the centimetre gram second system of units. Centipoise is abbreviated to cP or cps. Water has a viscosity 1 centipoise at 20 °C

## **CONTINUOUS MIXER**

With continuous feed industrial mixers, the media to mix is added continuously as mixed fluid is removed. Continuous mixers are suitable for production applications because they can run for long periods of time without being shut down

## **DENSITY**

Density is the relationship between a material weight (kg) and its volume (ltr). It's usually measured in kilogrammes per cubic metre (kg/m<sup>3</sup>). A cubic metre of water weighs 1000 kilogrammes, so its density is 1000 kilogrammes per cubic metre. The density of water is 1.0". Oil is lighter than that at a density of 0.8 and floats on top of water

## **DILATANT LIQUIDS**

Viscosity increases as shear rate increases. Mixers can bog down and stall after initially mixing such liquids. Dilatant liquids include slurries, slips and clay

## **DISPERSION**

A process where solids are broken down through intensive high speed agitation to disperse particles into a homogeneous liquid

## **DISSOLVING**

A change of phase from solid to liquid by combining with a miscible solid with a liquid solvent to become incorporated into a liquid so as to form a solution

## **DRIVE UNIT**

The mechanism in the agitator's power drive which converts motor torque into shaft torque

## **DRUM**

A cylindrical metal container used for shipping or storage of liquids. A common size is the 200 litre or 210 litre drum with either a closed top or removeable lid. Other vessels used for storing liquids include plastic barrels, kegs and tubs

## **DRUM MIXER**

Drum mixers will agitate fluids and chemicals in drums and barrels. The most common container is the 200 ltr drum (45 gallon) which is produced in steel or plastic. Mixers can be fitted to the top of closed head as well as open head drums or mounted to pedestal mixing stands. Other container sizes include 25 ltr, 50 ltr and 100 ltr. The IBC (intermediate bulk container) are large rectangular 1000 ltr containers

## **DUTY CYCLE**

The time interval devoted to starting, running, stopping, and idling when a device is used intermittently

## **EMULSION**

A colloidal dispersion of two or more liquids, which are immiscible with each other

## **EPOXY**

Epoxy is a thermosetting epoxide polymer that cures when mixed with a catalyzing agent or hardener. Epoxy mortar is normally a two or three component material that mixes together resin, hardener with an aggregate to produce a high strength, hard-wearing mortar resistant to abrasion, weather and chemical attack

## **FOLDING IMPELLORS**

These impellers fold for entry into a drum or when in a bulk tank and then open use. 2" bung opening on drums and totes

## **FORD VISCOSITY CUP**

A tool for measuring viscosity as used in the paint industry. It is a small vessel used to measure the thickness of the paint or fluid. The cup is filled with fluid and the time measured in seconds for the cup to discharge

## **FORCED ACTION MIXER**

Forced action mixers transfer motor power to a fast and efficient mix action ensuring homogeneity of materials particularly where the components are not readily miscible. These mixers include rotating drum or rotating paddle arrangements. The material is turned and folded

## **FREEFALL MIXER**

A freefall mixer is a machine with a revolving and tipping drum for discharge into a barrow or mortar tub. This mixer is commonly called a cement or concrete mixer and will combine cement, aggregate such as sand or gravel, and water to form concrete and mortar

## **GATE PADDLE**

An anchor type impeller having flathorizontal and vertical blades

## **GELCOAT**

A resin applied to the surface of a mold and gelled prior to lay-up. The gel coat becomes an integral part of the finished laminate, and is usually used to improve surface appearance and protect the laminate from the environment

## **GROUT**

Grout is a construction material used to embed rebars in masonry walls, connect sections of pre-cast concrete, fill voids, and seal joints. Grout is generally composed of a mixture of water, cement, sand and sometimes color tint which is applied as a thick liquid and hardens over time, much like mortar

## **GYP SUM**

Plaster is a building material produced from gypsum. When dry plaster powder is mixed with water it can be trowel or spray applied to wall surfaces. Unlike cement, plaster remains quite soft after drying, making it suitable for a finishing rather than as a load-bearing material

## **HELIX PADDLE**

A type of impeller consisting of one or more narrow ribbons which spiral around the shaft, affixed to arms mounted on the shaft. It is used for high viscosity liquids or solids

## **HOMOGENIOUS**

Homogenization is a process used in many fields such as chemistry for the intensive mixing of mutually insoluble materials to obtain a soluble suspension or emulsion that results in a mixture that is the same throughout the entire substance

## **IMPELLOR**

The portion of the agitator imparting force to the material being mixed. Propellers, turbines, gates, anchors and paddles are all types of impellers

## **LAMINAR FLOW**

Fluid flow characterized by long, smooth flow currents, mainly in the same direction as the bulk of the flow with little interaction between them

## **LIQUID**

Liquid is one of the three primary states of matter, with the others being solid and gas. A liquid, like a gas, displays the properties of a fluid. Unlike a gas, a liquid may not always mix readily with another liquid, will not always fill every space in the container, forming its own surface, and will not compress significantly. Liquid is the classical state of matter with a definite volume but no fixed shape. A distinctive property of the liquid state is surface tension, leading to wetting phenomena

## **LIQUID VISCOSITY**

Different types of liquids display different characteristics when force is applied

## **MIXER**

A mixer consisting of a power drive, shaft and impellor to provide agitation of the contents of a vessel, container or tub

## **MIXING**

The process of putting power into a system, usually for the purpose of producing greater material uniformity. Industrial mixers use a shaft, screw, blades, ribbons, impellers or propellers to mix industrial materials such as adhesives, chemicals, construction materials, minerals, coatings and paints. They are also used in food, beverage, pharmaceutical, and water treatment applications. Industrial mixers force sediment to flow in one direction and can intensify physical and chemical processes

## **MISCIBLE**

Relating to two or more substances, such as water & alcohol, that can be mixed together or dissolve into one another in any proportion without separating

## **MORTAR**

Mortar is a material used in masonry to fill the gaps between blocks in construction. Mortar is a mixture of sand, a binder such as cement or lime, and water and is applied as a paste which sets hard. Portland cement mortar is the basis for concrete, a mixture usually comprised of this particular mortar with the addition of gravel

## **MOTOR DRIVE**

The drive unit of a paddle, normally mounted above the mixing vessel. It converts power into the mechanical energy for mixing. Drive units are normally electric or air powered

## **NEWTONIAN LIQUIDS**

Viscosity remains constant regardless of shear rate or agitation. As mixer speed increases, flow increases proportionately. Newtonian liquids include water, mineral oils, and hydrocarbons

## **PADDLE**

A mixer that includes the mixer impellor and mixer shaft

## **PAINT**

Paint is the general term for decorative and protective coatings used to coat and add color to a surface by covering it with a pigmented film. There are three primary components to a paint: binder, diluent, and additives. Pigments are among the most common additives as they give a color to a paint. Typical binders include synthetic or natural resins such as acrylics, polyurethanes, polyesters, melamines, epoxy, or oils

## **PERIPHERAL SPEED**

Shaft speed is measured in revolutions per minute (rpm). The main mixing action is generated at the tip of the mixer paddle; the larger the mixer paddle the faster the peripheral speed of the impellor tip. Peripheral speed is measured in metres per second (m/s). The impellor tip speed can be gauged by  $\text{Velocity (m/s)} = \text{Diameter of paddle (mm)} \times 3.14 (\pi) \times \text{Speed of spindle (rpm)} \div 1000 \times 60$ . A 100mm paddle with a spindle speed of 1000 rpm will have an impellor tip speed of 5.2 m/s

## **PIGMENT**

A pigment is a material that adds colour to another material or coating. Materials developed for use as pigments usually have special properties that make them ideal for colouring other materials. A pigment must have a high tinting strength relative to the materials it colors. Pigments are used for coloring paint, ink, plastic, fabric, cosmetics, food and other materials. Most pigments used in manufacturing are dry colourants, usually ground into a fine powder. This powder is added to a vehicle or binder, a relatively neutral or colourless material that suspends the pigment and gives the paint its adhesion. A distinction is usually made between a pigment, which is insoluble in the vehicle resulting in a suspension, and a dye, which either is itself a liquid or is soluble in its vehicle resulting in a solution

## **PLASTIC**

A material that contains as an essential ingredient an organic substance of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or its processing into finished articles, can be shaped by flow

## **POLYESTER RESIN**

Polyester resins are the most widely used resin systems, particularly in the marine industry. Unsaturated polyester resin is a thermoset, capable of being cured from a liquid or solid state when subject to the right conditions. There are two principle types of polyester resin used as standard laminating systems in the composites industry. Orthophthalic polyester resin is the standard economic resin used. Isophthalic polyester resin is now becoming the preferred material in industries such as marine where its superior water resistance is desirable

## **POLYMER**

A very large molecule formed by combining a large number of smaller molecules, called monomers, in a regular pattern

## **PSEUDOPLASTIC LIQUIDS**

Viscosity decreases as shear rate increases, but initial viscosity may be sufficiently great to prevent mixing. Typical pseudoplastic liquids are gels, latex paints, and lotions

## **PITCH**

For a turbine impellor, the angle the blades make with a horizontal plane

## **PROPELLER**

A three or four bladed impellor that generates an axial flow

## **PUMPING RATE**

The volumetric discharge rate of an impeller operating at a given speed, measured at the impeller

## **RADIAL FLOW**

The movement of a fluid from the center of the tank to the wall. A radial turbine impellor has vertical blades generates radial flow

## **RENDER**

Render is a material made of an aggregate, cement and water which is applied wet, and hardens when it dries to the exterior of buildings. In Europe the term stucco is more commonly used. Render may be used to weatherproof and finish external structures and cover less visually appealing construction materials such as concrete, block or damaged brick or masonry. It is also used to finish external insulation

## **RESIN**

Synthetic resins are materials with similar properties to natural resins, viscous liquids capable of hardening. They are typically derivatives of oil based and of organic compounds. The classic variety is epoxy resin and is used as a thermoset polymer for adhesives, mortars and composites. Other types of resin include polyester, polyurethane, epoxy, acrylic and methacrylate

## **SERVICE FACTOR**

A numerical rating system of gear trains based on operating time, type of drive, and duty required

## **SHEAR**

As applied to liquid mixing, it is that portion of the applied power which appears as turbulence, recycling drag on the blades, etc. It is the action which produces intimate mixing on a microscopic and molecular scale.

## **SLINGER**

A device attached to a shaft above the liquid level to prevent the liquid from climbing or splashing up on the shaft

## **SLUDGE**

Sludge refers to the residual, semi-solid material left from industrial wastewater or treatment processes. It can also refer to the settled suspension obtained from conventional drinking water treatment and numerous other industrial processes. The term is also used as a generic term for solids separated from suspension in a liquid; this soupy material usually contains significant quantities of interstitial water between the solid particles

## **SLURRY**

A slurry is a thin sloppy mud or cement or, in extended use, any fluid mixture of a pulverized solid with a liquid, usually water, often used as a convenient way of handling solids in bulk. Slurries behave in some ways like thick fluids, flowing under gravity and being capable of being pumped if not too thick

## **SOLIDS WETTING**

Dispersing solid particles so that a liquid film coats each particle. A solid suspension or slurry is a thick suspension of solids in a liquid

## **SOLVENT**

A solvent is normally a liquid that dissolves a solute, a chemically different liquid, solid or gas, resulting in a solution. Common uses for organic solvents are in cleaning, as paint thinners, in glue solvents, and in detergents

## **SPECIFIC GRAVITY**

The density of a material compared to the density of water at standard conditions. In the metric system, water has a density of 1 gm/ml, so density and specific gravity are numerically equal

## **SPIRAL PADDLE**

A type of impeller consisting of one or more narrow ribbons which spiral around the shaft, affixed to arms mounted on the shaft. It is used for high viscosity liquids or solids

## **STATIC MIXERS**

Static in line mixers mix fluids as they are pumped through a pipe line. The fluid moves through the mixer in an alternating clockwise and counterclockwise motion to ensure homogeneous product. They are virtually maintenance free and need no spare parts

## **THIXOTROPIC LIQUIDS**

A material whose viscosity drops gradually at a constant shear rate, as opposed to materials whose viscosity changes instantaneously with changing shear rate. When shear is removed, viscosity of thixotropic materials gradually increases again. Thixotropic liquids include soaps, tars, shortening, glue and inks

## **TORQUE**

The torsional moment exerted by a body such as an impeller rotating at a constant speed

## **TURBINE**

A multi-bladed short armed impeller. The impeller diameter to tank diameter ratio usually varies from 0.2 to 0.5 for turbines. An axial turbine is an impeller with pitched blades, usually 45° whose mix action is a combination of axial and radial flows

## **VIBRATION LEVELS**

Hand-arm vibration is vibration transmitted during work processes into workers' hands and arms. Vibration levels are measured in metres per second and govern how long a hand held power mixer can be used. Generally most hand held mixers will have a vibration level under 2.5m/s which is the point where vibration levels need monitoring

## **VISCOSITY**

Viscosity is the measure of resistance of a fluid to flow when a force is applied to it. Absolute viscosity is usually measured in centipoises (cp). Water at room temperature has a viscosity of one cp. Kinematic viscosity is reported in many different forms depending on the measuring instrument. It is convertible into centistokes. Centipoises equals centistokes multiplied by specific gravity of the fluid

## **VOLUME**

Volume and capacity are sometimes distinguished, with capacity being used for how much a container can hold (with contents measured commonly in litres), and volume being how much space an object displaces (commonly measured in cubic metres). One litre is also slightly less than one imperial quart. The litre is often also used in some calculated measurements, such as density (kg/ltr), allowing an easy comparison with the density of water. One litre of water has a mass of almost exactly one kilogram

## **VORTEX**

A whirlpool depression occurring in a liquid surface during mixing. A swirl is the area of a liquid about an agitator shaft where little relative motion within the mix is obtained