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Sulzer India Ltd., is part of Sulzer Chemtech Ltd., a member of the Sulzer Corporation, with global headquarters in Winterthur, Switzerland. The company is active in the field of process engineering and employs some 1500 persons worldwide.

Sulzer Chemtech is represented in all important industrial countries and sets standards in the field of mass transfer with its advanced and economical solutions.

The activity program comprises:

- Process components such as packings, trays and internals for separation and reaction technology
- Engineering services for separation and reaction technology such as optimizing energy consumption, plant optimization studies, pre-engineering for governmental approval, basic engineering
- Separation and purification of organic chemicals by means of crystallization and membranes
- Mixing and reaction technology with static mixers
- Tower field services

Mixing and Reaction Technology

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Sulzer Chemtech

Sulzer Chemtech is dedicated to developing solutions that optimize the performance of industrial processes and plants through greater energy efficiency, higher product quality, and increased capacity. Our application knowhow, dedication to exacting fabrication standards and rigorous quality management characterize all our products.

Our steadfast commitment to providing the right mass transfer equipment is supported by an in-house development group and a state of the art research facility with multiple pilot and industrial scale columns. This innovation and commitment to our customers has taken existing random packing technologies beyond its past threshold and created a new outlook in a conventional product.

Sulzer India

Sulzer India, an ISO 9001:2000 & ISO 14001:2004 company, began its full fledged manufacturing operations in 1989, building upon Sulzer's inherent strength in process engineering which dates back to the end of the 19th century. At the very onset, there was a necessity to deliver quality products as a means to stay ahead of the competition. Guided by the same philosophy as it's parent company, Sulzer India has been delivering total turnkey solutions from conceptualizing to designing, installation and commissioning to customer support service. Thousands of customers have benefitted from the breakthrough made at Sulzer in various fields.

Sulzer India's role goes beyond being simply an equipment supplier. At Sulzer, the accent is on nurturing relationships that last beyond the lifetime of a Sulzer equipment.



Sulzer SMF mixer

The SMF mixer was specially developed for mixing flocculent chemicals into sludges, chemicals into suspensions in the pulp and paper industry, or fruit pieces into viscous foods. Solids can also be homogenized in-line, under gravity flow.

The SMF mixer consists of inclined vanes which cross without touching each other. The open mixer design guarantees reliable operation without the danger of clogging.

SMF mixers are supplied in stainless steel, Stellite, FRP or polypropylene. Installation of the mixing elements can be in non-removable (welded) or removable design.

The SMF mixer can be used in the turbulent and laminar

flow regime for mixing liquids containing solids.

Applications

- Mixing bleach in chemicals into pulp.
- Mixing stock suspensions
- Adjusting consistency
- Adjusting pH value
- Mixing polymer in front of flotation cell



Sulzer SMI mixer

The SMI mixer is employed for blending turbulent flowing liquids soluble in each other as well as gases.

Pairs of inclined vanes arranged in parallel, generate two counter-rotating eddies of large-volume. These eddies create an ideal cross-flow pattern embracing the complete cross-section including the wall area. Due to its large open cross-section, this mixer is not susceptible to clogging.

Even at extremes in the Flow Rate Ratio of the components, a homogenous final mixture is achieved.

Applications

- Blending of low viscosity liquids soluble in each other as well as gases, in order to achieve uniformity of concentration, temperature or density.
- In the treatment of water and waste water, to adjust the pH value, to admix flocculation aids, or to carry out neutralization.



Figure 11 - Plants for the production of 30,000 t/year of crystal polystyrene (left) and 35,000 t/year of high impact polystyrene (right) using the SDS process (Sulzer - Dainippon Ink & Chemicals - Sumitomo).

Industrial Plants

Our Components can be used economically and ecologically in many continuous process. As an example of our activities in the field of Polymer production, we have developed a novel process for plastic production based on a loop/plug flow reactor concept. The SDS process produces Polystyrene of superior quality with a high

yield at lower production costs when compared to conventional stirred tank process. Our other specialities include devitalization of Polymer melts to extremely low monomer and solvent contents of <100 ppm without product damage. CPS, HIPS, SAN, ABS, S/MSA and LLDPE are included in our list of experience.

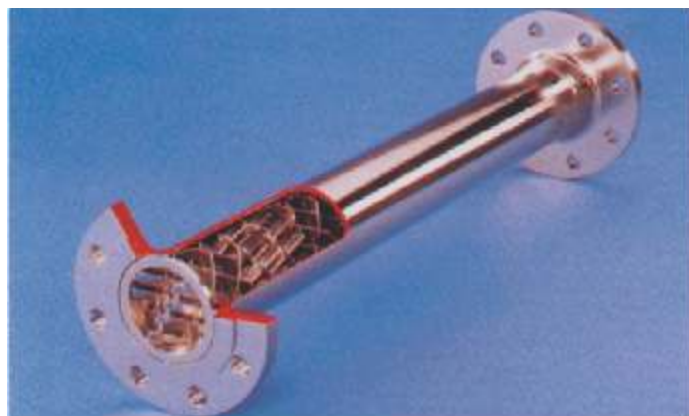


Figure 5 - Sulzer mixer 80 mm dia with removable SMX mixing elements in stainless steel.

Sulzer SMX mixer

The principle use of the SMX mixer is in the laminar flow regime : mixing high-viscosity fluids, mixing and dispersing liquids with widely differing viscosity, homogenizing plastic melts in extrudes and injection moulding machines and for reaction control with narrow residence distribution.

The SMX mixing element consists of a lattice of intermeshing and intersecting bars.

Applications

- Mixing pigment into resins
- Mixing epoxy resins with hardeners, partly filled with mineral substances
- Mixing TiO₂ masterbatch into polymer melts for delustering
- Homogenizing plastic melts before pelletizers
- Homogenizing polymers in melt lines
- Homogenizing photographic emulsions
- Mixing fresh cheese with whipped cream
- Mixing viscous additives, such as lecithin chocolate

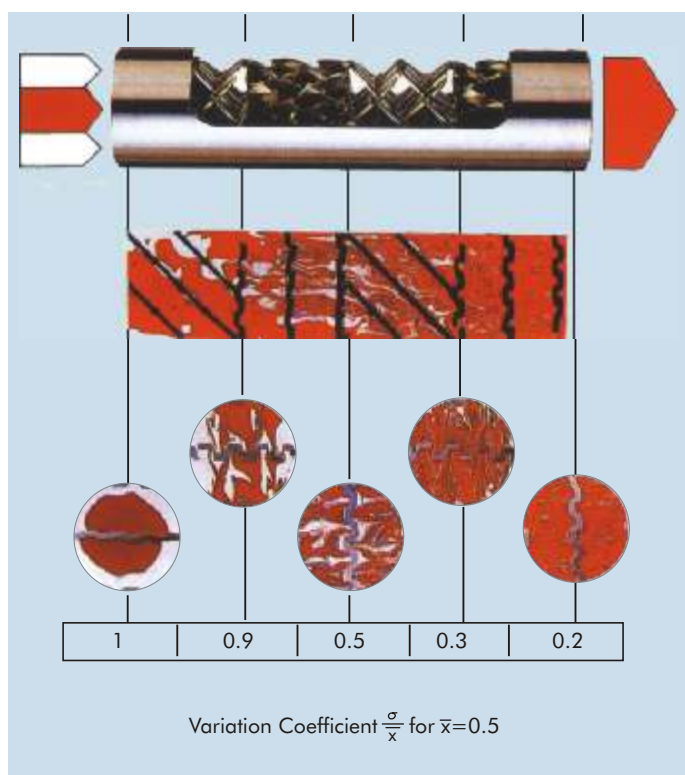


Figure 6 - Blending 2 epoxy resins in the SMX mixer. The cross-sectional cuts along mixing length show the rapid increase of layers formed.



Figure 7 - Pre-assembly of a round SMR mixer-reactor designed for 250 bar / 300 °C in a gap-free fixed tube-bundle design used as a polymer melt cooler.

Sulzer SMR mixer-reactor

The geometric design of the SMR mixer-reactor corresponds to that of the SMX mixer, but the SMR mixer-reactor has a heat transfer medium flowing through the hollow tubes forming the mixing elements.

Thus, SMR mixer-reactor is used as a heat exchanger for applications where the product viscosity increases as the result of a temperature change

SMR heat exchangers are highly flexible since no maldistribution problems show up. They are frequently installed in a plants where they are used partly as product heater and partly as product cooler.

Applications

- Adjusting the viscosity of adhesives to obtain a uniform sheet thickness during processing

Sulzer SMXL mixer



Figure 8 - SMXL monotube mixer heat exchanger flows through the mixing elements. The heating or cooling media flows through the jacket, separated from the product.

The feature of the SMXL mixer heat exchanger is heat transfer with simultaneous mixing with or without chemical reaction.

- Cooling polymer melts with relatively low viscosity
- Cooling polymer solutions and resins in front of filling stations to prevent evaporation of the solvent.
- Cooling plastic melts in foam extrusion to increase the capacity of such plants and to produce lighter foams
- Gentle tempering of pharmaceutical pastes in front of tube filling stations
- Dissolving polymer particles in solvent when producing adhesives
- Cooling melts of polyester or polyamide
- Stopping the chemical reaction of reactive resins by lowering the temperature
- Cooling cellulose spinning solution
- Swelling acrylonitrile solutions
- Cooling and heating of pasty foodstuffs

Therefore, it is used as mixer heat exchanger or reactor for applications requiring a continuous mixing action over relatively long pipe sections.

Introduction

Static mixing

Static mixing means homogenization without using any moving parts.

Static mixing units are used in continuous processes. The mixing action is achieved by the continuous splitting, extension and transposition of components. Differences in concentration, temperature & velocity are equalized over the flow cross-section.

The pumps or blowers delivering the components to be mixed at predetermined rates to the static mixing unit, supply the energy needed for mixing. Since static mixing units produce little back mixing, components must always be fed at a constant rate.

Static mixing units are used not only for simple bending, but also where heat & mass transfer operations or chemical reactions are involved. Such processes require in addition to pure blending, good heat & mass transfer, uniform residence time, and (where two or more phases are involved) intimate dispersing and contacting.

Features of Sulzer-Static Mixers.

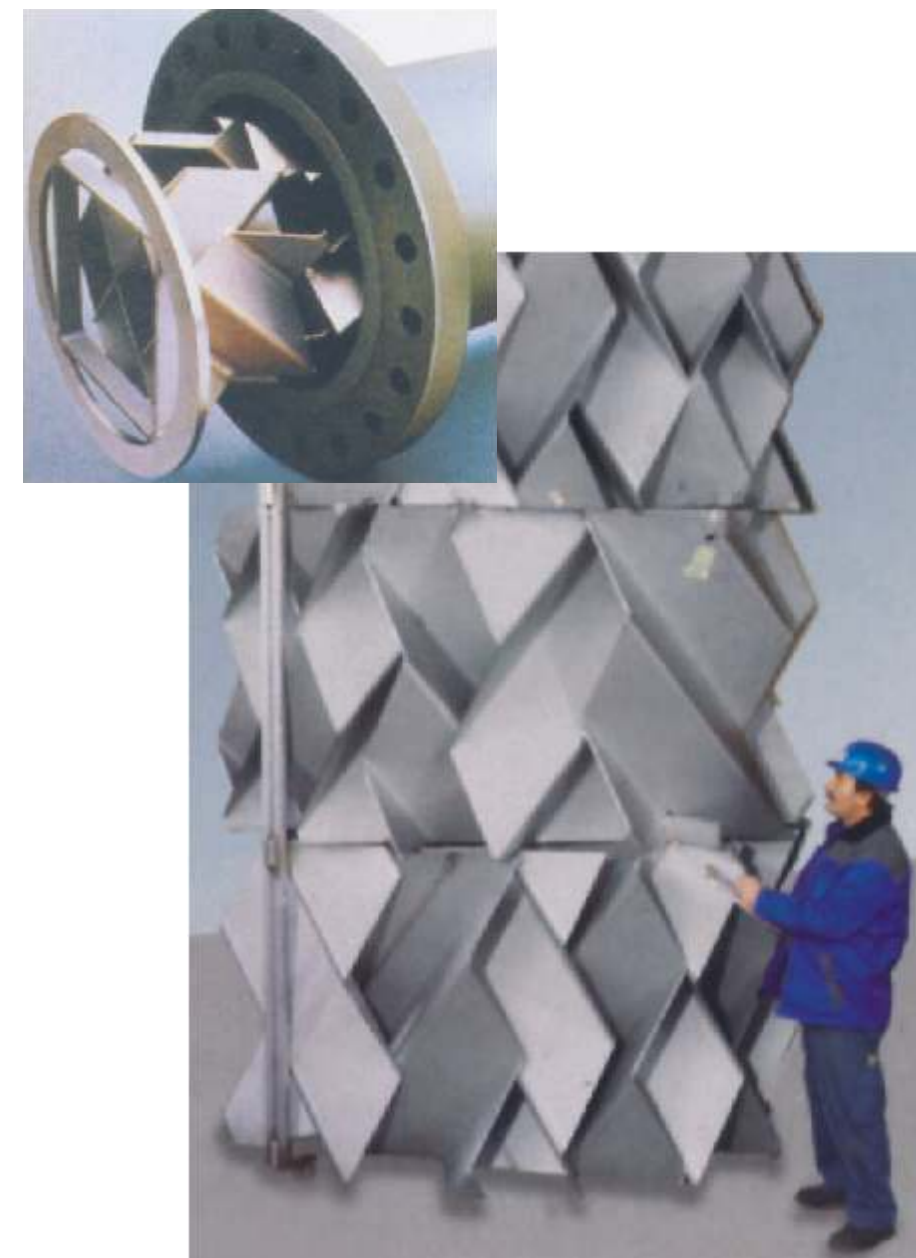
The design principle of Sulzer mixers with their open, interesting flow channels is unique. Mixing is not random but is governed by a reproducible, geometric mode of operation. They exhibit low pressure drops. So the energy demand and operating costs are low. Sulzer mixers have no moving parts. The need for motors & electrical wiring is eliminated. This results in comparatively lower investment.

Going by their working, the efficiency of Sulzer mixers is outstanding, even with fluctuating throughputs.

Applications in industrial sectors :

Sulzer mixers are increasingly finding use in a variety of industries due to their proven advantages. Low investments and operating costs are the reasons for their use in following process industries for mixing and reaction duties.

- Petroleum, Natural Gas, Refineries.
- Petrochemicals, Chemicals
- Polymer Production and Plastic Processing
- Pulp and paper Industry
- Cosmetics, Detergents
- Foods
- Water and Wastewater Treatment
- Environment Protection





OUR PRODUCT RANGE

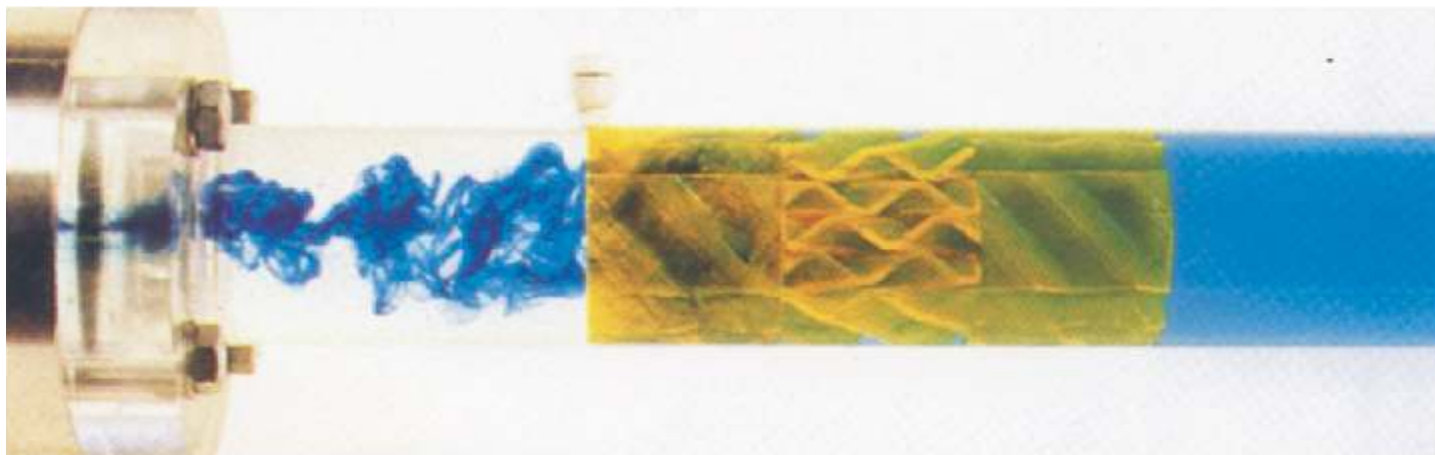


Figure 1 - SMV mixer in operation
Blue colour concentrate is added to water in the pipe axis. A homogeneous mixture is achieved with a few SMV mixing elements.

Sulzer SMV mixer

The SMV mixer is used principally in the turbulent flow regime : mixing low-viscosity liquids, gases, dispersing insoluble liquids, contacting gases with liquids and as a mass transfer device.

The SMV mixing element is made from corrugated plates forming open, intersecting channels. These channels

divide the main stream into many substreams. In addition to the lateral displacement in the channels, a portion of each substream shears off into the adjacent channel at each intersection.

The operation of the SMV mixer is shown in Figure 1. Turbulent flowing fluids are mixed over very short distances. Adjacent

mixing elements are oriented 90° equalize inhomogeneities over the entire flow cross-section.

The mixing performance of the SMV mixer is shown quantitatively in Figure 2. The variation coefficient σ/\bar{x} improves 7.5 times by using 1 SMV mixing element. Pressure drop across the SMV

mixer is small. The energy consumption to achieve a homogeneous mixture is therefore low. Typical pressure drops for gases are $\Delta p \approx 50\text{--}500\text{ Pa} = 5\text{--}50\text{ mm w.g.}$ and for low-viscosity liquids $\Delta p \approx 0.05\text{--}0.5\text{ bar} = 0.5\text{--}5\text{ m w.g.}$

Applications of SMV mixer for low-viscosity fluids

Gas Applications

- Mixing process gases for optimal distribution onto catalyst beds found before reactors in the chemical industry
- Mixing steam with natural gas before crackers or reformers
- Mixing feed gases before synthesis
- Blending natural gas with propane to adjust the calorific value
- Mixing fuel gases with air before burners

- Heating humid flue gases by mixing with a hot gas stream after flue gases scrubbers
- Mixing small amounts of ammonia with flue gas before the catalyst bed in power station denitrification plants
- Homogenous distribution of a solid in a gas stream, e.g. for adsorbing pollutants
- Eliminating temperature or density differences in gas streams

Liquid Applications

- Blending refinery & petrochemical products
- In-line neutralization or pH adjustment
- Mixing flocculants in water treatment
- Diluting concentrated acids & alkalies solutions
- Mixing additives or inhibitors into chemical product streams & reaction products at reactor inlet
- Homogenizing product streams in continuous processes

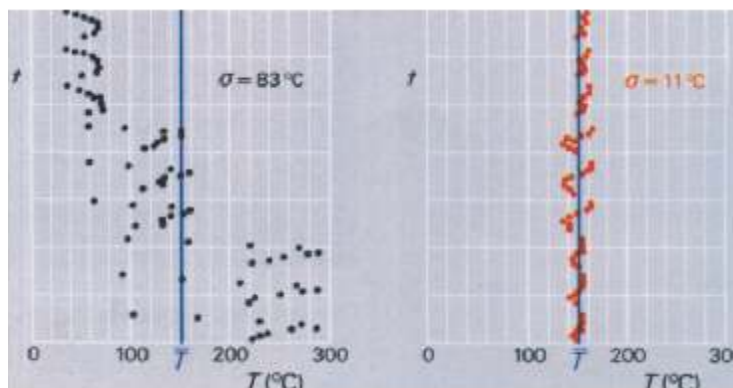


Figure 2 - Temperature distribution measured in an empty duct (left), and with a Sulzer gas mixer consisting of a single SMV mixing elements (right)

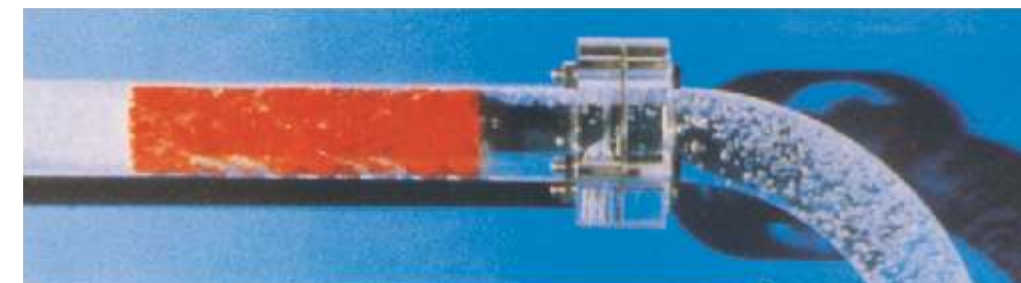


Figure 3 - Bubble bed with vertical and horizontal Sulzer mixer, SMV-50 mm dia, and phase separation in horizontal empty pipe. System: air / water.

SMV disperser for contacting gases with low-viscosity liquids

The Sulzer SMV mixer is used for in-line dispersion of gases into liquids. The shear forces set up in the mixing elements split the gas phase into fine bubbles. The interfacial surface area is continuously renewed by coalescing and reforming of the bubbles. Since there is uniform energy dissipation along the entire mixing length, bubble flow and hence mass transfer surface are maintained throughout the mixer. In addition, enhanced turbulence in the liquid assists mass transfer.

Applications

- Increasing the gas-liquid mass transfer interface e.g. for hydrogenation, oxidation, chlorination, alkylation, carbonylation or phosgenation process
- Stripping injection water with methane to reduce its oxygen content, in crude oil extraction
- Equalizing temperatures of gaseous and liquid hydrocarbons in petrochemical processes
- Improving the phase distribution of tube bundle reactors, catalyst beds or heat exchangers for uniform loading and reaction throughout the reactor cross-section
- Inducing plug-flow in a two phase mixture in tubular reactors
- As a loop reactor for absorption with slow chemical reaction
- Treating potable water with air, CO₂ or ozone,

- e.g. for removing iron and manganese by oxidation with atmospheric oxygen, for deacidification with air, or for sterilization with ozone
- Dissolving H₂, NH₃, SO₂, Cl₂ or HCl in water
- Enriching ground water with oxygen in the well shaft
- Dispersing air or inert gases into coffee extract, milk or detergents before spray dryers
- Carbonating soft drinks, wine beer or fruit juices with CO₂
- Removing objectionable flavours or oxygen from chocolate, edible oils and fats by stripping with steam, N₂ or CO₂
- Aerating liquids in fermentation processes, such as wort in fermentation tower feed
- Dissolving SO₂ in thin sugar juice or extraction water

SMV disperser for low viscosity, immiscible liquids

For in-line dispersion, immiscible components are contacted co-currently in the Sulzer SMV disperser so that a swarm of droplets is formed.

A homogeneous distribution of the dispersed phase in the continuous phase is created, in addition, the SMV disperser induces a large interfacial surface area which is continuously renewed, accelerating mass transfer



Figure 4 - Droplet pattern after SWV disperser. Dispersed phase = kerosene dyed red, continuous phase = water.

Applications

- Representative measurement of water content in crude oil
- Desalting petroleum and fuels with water
- Dispersing water in heavy fuel oil before burners
- Regenerating lubricating oils with sulphuric acid
- Neutralizing hydrocarbons
- Washing impurities out of organic substances with water
- Saponification
- Desliming edible oils with acid and neutralizing with sodium hydroxide solution

