AMX AGITATORS IN PETROCHEMICAL

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introduction

The petroleum industry is generally seen as limited when compared to the chemical and pharmaceutical manufacturing industry. The refinery processes are less complex than those encountered in speciality fine chemicals but only when making references to physical fluid and process conditions.
Mixing plays an important role in enhancing productivity and profitability, when considering the large volumes of petroleum. Larger petroleum companies have exceptionally integrated chemical operations with a spectrum spanning, reacting and non-reacting, single-stage and multi-stage systems.

The following process are often commonly encountered throughout refinery operations:

- Emulsion make-up
- absorption of CO2
- crude oil-water homogenisations
- sludge suspensions
- de-salting
- neutralisation and alkylation
- pH control

Small enhancements in mixing can yield large benefits and reduced operating costs, as well as lower the risk of losing large volumes of product.
Most petrochemical processes experience similar mixing challenges found in the chemical mixing industry.

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emulsion make-up

During the emulsion make-up process, the final product is prepared in batches by combining clay with stable water in oil emulsion. The emulsion is prepared by dispersing water in oil in agitated tanks. This final emulsion is required to be highly stable so as to avoid the solids settling out during the on-site storage periods. The emulsion storage stability is achieved by the formation of a solid protective film at the interface between water droplets and the continuous phase. The protective film is a product of the chemical reaction between PIBSA (polysiobutylene succinic acid) and polyacrylic acid. The acids are added into the oil and water phase before the emulsification process.

In order to overcome potential phase inversion, water is added slowly into the mixing vessel with the agitator operating. The impeller selection is vital for providing the required drop dispersion for the best shear thickening results. AFX are able to size and design the agitator required for such applications as well as guarantee the process.

CO^2 reduction

THE GAS TREATING PHASE

Natural gas has a high concentration of CO2, making it unsuitable for direct use as a fuel. The concentration of CO2 is required to be less than 2%. This process conventionally requires an amine solution that the CO2 absorbs into. The absorption occurs at pressures in excess of 100Bar and with a gas liquid ration of 2:1, static mixers are favoured in these applications.

Static mixers are used in these applications, not only due to the mixing outcome, but the physical construction of the mixer that contributes to the successful use of the solution. The required plug flow is achieved with very little axial mixing which ensures great radial mixing.

Static mixers are smaller in size and weight when compared to packed bed towers and are easy to install horizontally, vertically or inclined, processing allowing. Static mixers handle foaming systems with ease and they have a high mass transfer coefficient, often 20 times higher than that of packed towers. Static mixers also require a very short resident time in achieving the target CO2 concentration.

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homogenisation of water in crude oil

High demands and expectations are placed on mixers installed in these tanks. Inadequate mixing results in large losses. A 0,1% yield error can result in heavy financial losses, hence the need to have adequate mixing.

Adequate mixing ensures good dispersion of the water in oil mixture. The emulsification in this instance should not have stabilised and should not be stable in water as the water needs to separate in the storage phase. Good mixing results in high volume returns to the refiner. Ship pumps often operate on varying rates, thus being taken into consideration, the mixer sizing depends on the overall pipe length, flow pattern sections as well as pressure drop. Therefore, the mixers are not only sized for the immediate process results but are sized to handle fluctuating flow rates.

Static inlinemixers are commonly used to provide rapid mixing and adequate turbulence causing dispersion and homogenizing of the emulsion in the pipe. The internal construction and arrangement of the sequential vanes in the mixer, force the flowing fluid into different directions abruptly and several times resulting in high shear forces.

These mixers do not need to be powered externally, deriving their power via pressure and flow transfer originating from the ships or ports pumps. It is important to note that these mixers do not operate optimally with low fluid velocities. Although there are alternate mixers that can supply variable geometry and recirculation, static mixers are economical as well as superior in delivering the desired outcomes. Consult with AFX to assist with the design and sizing of a suitable ALM in-line mixer.

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sludge control

In crude oil storage tanks, settling of sludge, which comprises both organic and inorganic products, requires agitation to ensure off bottom suspension thereby preventing downstream process problems and settling in the tank resulting in build-up which effects the tank capacity and the agitator's performance. Further issues resulting from this build-up accumulation could result in errors in the pre-heat train, thereby affecting the product process controls.

Sludge build-up causes safety and environmental issues and has implications in the frequent cleaning of tanks. This is both hazardous and an environmental problem whilst reducing the storage capacity of the tank farm. The settled sludge present in the tank can also be corrosive over a period of time.

The abnormally large diameter tanks require the the use of side-entrymixers as top entry mixers are not economically viable due to the required impeller diameters. Side entry mixers are comprised of hydrofoil impellers and in most cases are belt driven. These side entry mixers are designed with shut-off devices and mechanical seals are used. Positioning is of prime importance with side entry mixers as incorrectly placed mixers will either create a vortex, resulting in solids swirling around the bottom of the tank and not being put into suspension. Side entry mixers are sized and designed to be installed at a 10-degree angle to the left when the mixer is operating in a clockwise direction.

A cluster can be installed where high energy is required due to a high or heavy solid/sludge content.

AFX has extensive expertise in side-entry mixers throughout a number of industries and have successfully designed and manufactured side entry mixers in the sludge suspension requirement processes.

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