ADVANCED DEHYHDRATION IN TPA PLANTS

AMT INTERNATIONAL, INC.

ADP Process *(Patent Pending)*

OVERVIEW

Two different approaches are frequently used in the recovery of Acetic Acid from the reaction water in the Terephthalic Acid (TPA) plants, namely, via conventional distillation by the different boiling points of the components, or, via azeotropic distillation with the addition of entrainers.

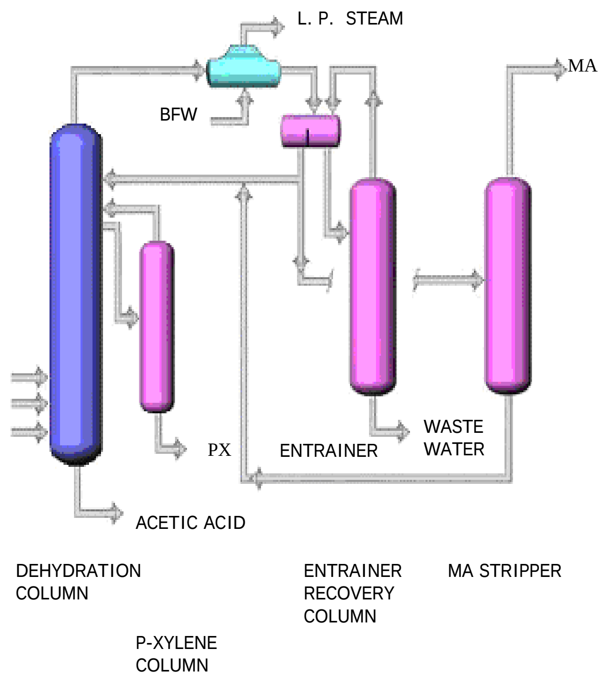
Due to the highly non-ideal vapor/liquid equilibrium characteristics of the acetic acid/water system, conventional distillation typically requires a large number of fractionation trays (70-90 trays) and high energy consumption to reduce the acetic acid content in the overhead distillate water to an acceptable level, typically 0.5-0.8wt%. Therefore, the conventional distillation approach requires high capital investment, high energy consumption, high acetic acid loss and high cost in treating the acetic acid in the waste water facilities.

On the other hand, the azeotropic distillation approach involves the addition of entrainers, such as the iso-butyl acetate (IBA), normal butyl acetate (NBA), normal propyl acetate (NPA), etc., to reduce the acetic acid loss in the waste water and the energy consumption. Compared to conventional distillation, the azeotropic distillation approach typically reduces 20-40% of the energy (i.e., steam) consumption while resulting relatively low acetic acid concentration, 300-800 ppm, in the distilled water. The azeotropic distillation approach generally operates at ambient pressure and does not generate steam.

PROCESS DESCRIPTION

AMT's ADP Process is a further improvement of the azeotropic distillation process, which not only offers the benefits of a typical azeotropic distillation but also recovers energy through the generation of low-pressure steam.

The ADP Process, which uses the alkyl-acetate based entrainers, consists of four (4) columns, i.e., Dehydration Column, Entrainer Recovery Column, MA Stripper and P-Xylene Column, and an overhead steam generation system. The Dehydration Column typically operates at slightly higher than ambient pressure, and generates low-pressure steams, 0.6 – 1.5 kg/cm2 abs. typical. The acetic acid content in the distilled water is generally reduced to approx. 100-300 ppm. A simplified Process Flow Diagram is shown in the figure below:



PERFORMANCE COMPARISION

Since its inception, the ADP Process has repeatedly demonstrated its benefits of low energy consumption, low acetic acid loss, and high energy recovery through all phases of the projects, namely, from existing plant revamping to grass-root plant construction.

The table below outlines the direct comparisons of the performances of various dehydration methods used in a typical, 350,000 MTA TPA Plant:

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	Conventional distillation	Typical Azeotropic Distillation	AMT ADP Process
TPA Production	350,000	350,000	350,000
Entrainer	none	yes	Yes
No. of trays in Dehydration Column	90	70	90
Overhead pressure	Atm	Atm	> Atm
Typical Steam consumption in Dehydration Unit (T/HR)	55-60	36-40	32-36
Pressure of Steam generated from Dehydration Section (kg/cm2 abs.)	none (typical)	none	0.6 – 1.5
Amount of Steam generated from the Dehydration section (T/hr)	none (typical)	none	30-33
Typical Acetic Acid conc. to Waste Water treating, ppm	7000	< 300	< 300
Total Acetic Acid loss to WWT, Ton/year	728	31.2	31.2

As shown in the table above, compared to the conventional distillation approach, the ADP Process offers the following advantages:

- Reduces energy consumption by 35-45%
- Reduces acetic acid loss to the waste water by over 95%
- Generates approx. 0.7-0.75 ton of low pressure steam per ton of PTA produced
- Reduces waste water treatment costs
- Allows the Dehydration Unit throughput to increase by 30-40%

APPLICATION

The ADP Process is most advantageous in debottlenecking an existing Dehydration Unit, which uses conventional distillation approach, for maximum throughput, minimum acetic acid loss, and minimum energy consumption. The low-pressure steam produced from this Process is used to generate electricity, which further reduces the operating costs.

The ADP Process is also suitable for converting an existing azeotropic distillation unit to an ADP system for greater throughput and energy recovery.

This Process is especially attractive for debottlenecking the Dehydration Unit where the existing Waste Water Treatment facility is also limited.

The application of the ADP Process also allows the TPA Plant to have the option to recover additional energy from the oxidation section by generating low pressure steam which can also be used to generate electricity.

COMMERCIAL EXPERIENCES

AMT International Inc. applied its first ADP Process in conjunction with AMT's high performance mass transfer technology to replace the entire Dehydration Unit of an existing 500,000 MTA TPA Plant in April 2001 with great success.

Subsequently, AMT converted another Dehydration Unit that was using the conventional distillation method to the ADP Process in an existing 300,000 MTA TPA Plant in June 2002.

The ADP Process was chosen for a grass-root 400,000 MTA TPA Plant, which was started successfully in March 2003. In all cases, AMT has provided the complete process know-how, basic engineering packages, and high performance mass transfer equipment with great success.

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