



Amine Optimization

Specializing in Amine Unit Performance

Fundamental Concepts for Managing Process Contaminants in Amine Treating Units

Lean Amine Filtration, Rich Amine Filtration, Inlet Separation, Amine Solvent Foaming, Carryover and Recovery

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Introduction to Amine Unit Process Contamination. Installation and operation of suitable contaminant removal systems such as filtration, coalescing and adsorption equipment, have become key components in amine units. These systems remove or avoid contaminants that negatively affect the process and its equipment. They also enable the unit to operate with stability, reliability and low operational costs, while achieving design processing capacity. Typical contaminant removal systems for amine units consist of inlet separators, gas demisters or knock-out drums, liquid filters, activated carbon beds and gas coalescers. Additional technologies, such as liquid coalescers for rich amine streams to remove emulsified hydrocarbons, and amine recovery systems for treated streams, are increasingly used to protect and maintain amine unit performance and recover often expensive amine solvents while protecting units downstream. Contaminant removal systems give amine units a greater tolerance to process upsets. Without these systems, well-designed and properly operated amine units can suffer from several inefficiencies and problems, such as high operating costs, low efficiency of H_2S & CO_2 removal, amine solvent losses, amine degradation and excessive maintenance. Amine units may experience a variety of challenges, but most of these issues come down to a few core problems. Design limitations, contaminant removal efficiencies or incorrect operational parameters are usually the central problems found in most amine units. The most common amine units difficulties are shown in **FIG. 1**.

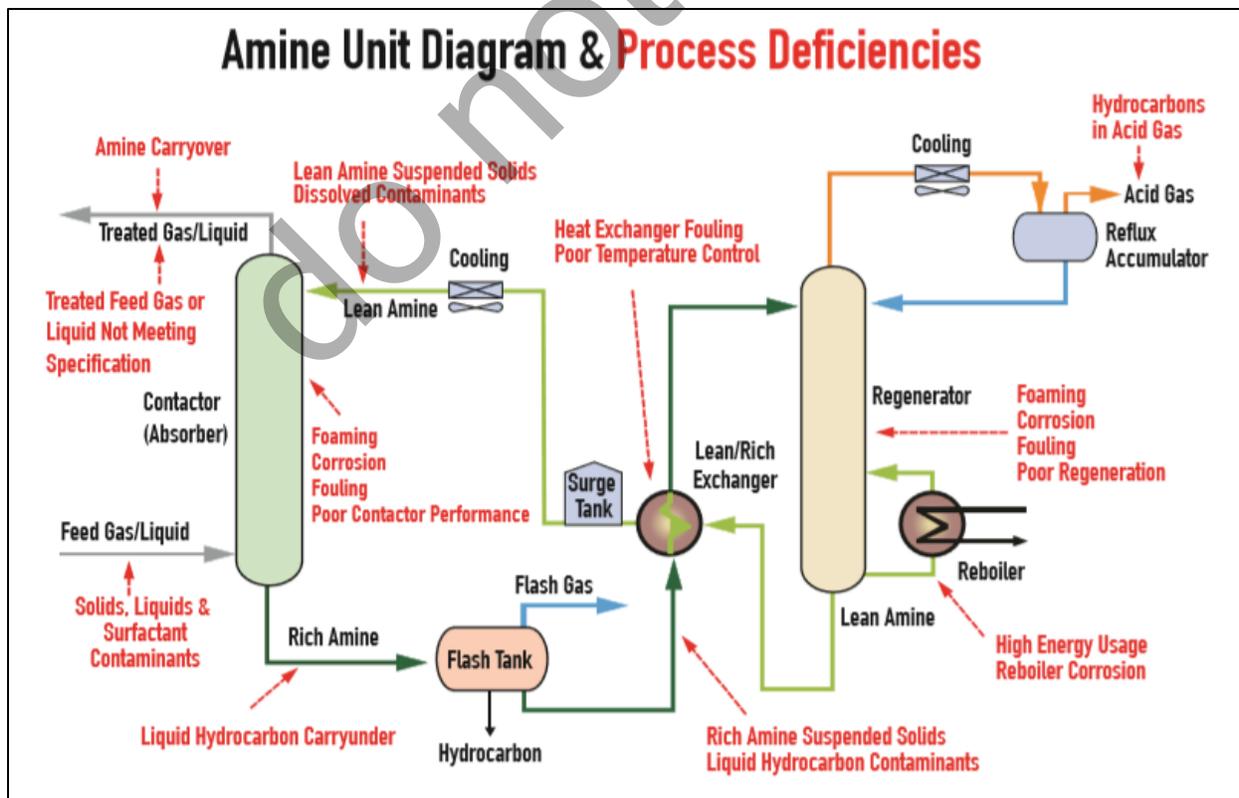


FIG. 1. Amine unit diagram showing common unit and process challenges.

Contaminant removal plays a significant role in amine unit operation and performance. Filtration and separation technologies can considerably reduce or eliminate the variety of problems frequently found in amine units as indicated in **FIG. 1**. Several of the problems amine units experience throughout their lifetime can be addressed with proper filtration and separation, as described in the following sections.

Fouling and Deposition. Fouling is a process where solids physically or chemically accumulate on the surfaces of process equipment, and it is caused by material deposition or precipitation (usually solids, salts or hydrocarbons). Fouling often takes place at high temperatures and/or low-velocity fluid locations such as heat exchangers, columns with trays (less common) and packing (more common). Fouling or deposits may have various formation mechanisms. However, it is generally accepted that they can originate from polymerization reactions by light, heat, free radicals (e.g., from oxygen), condensation of dissolved components producing insoluble materials or the settling of solids (or immiscible liquids) in suspension. Today, some types of fouling or deposition can be minimized by using chemical means, such as dispersants, oxygen scavengers, free radical inhibitors or condensation reaction inhibitors. Filtration and/or adsorption methods can be used to minimize deposition mechanisms, such as precipitation and/or polymerization and condensation reactions. Both filtration and adsorption are effective, depending on the process conditions and the type of contaminant causing fouling or depositions. Both fouling and deposits can lead to detrimental situations in amine units, such as energy losses, inefficiency of heat exchangers, column packing clogging and the most complex problem: under-deposit corrosion. Fouling and solids deposition can also significantly shorten the online life of filters and/or residency times in settling tanks, if they are not cleaned. **FIG. 2** illustrates solids deposition in column packing.



FIG. 2. Deposits by suspended solids in column pall ring packing.

Corrosion. In amine units, corrosion is continuously caused during the removal of H_2S or CO_2 if carbon steel is present in the circuit. In some cases, corrosion can occur if the unit contains stainless steel. Passivation of metal surfaces by H_2S is key for amine units; this is one reason why amine units only used

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