DrM

SOLID*LIQUID*

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Bulletin for the information on the technology of solid/liquid separation, applied in the chemical and petrochemical industry

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APPLICATION: Gas Sweetening

DrM's first integrated Amine purification plant went into successful operation at BP Grangemouth Refinery in May '97. The unit, comprising two precoat filters, activated carbon adsorption and downstream polishing, was started-up within two days including full proof of performance guaranties. With its closed system, full automation and the efficient dry discharge ability, the FUNDABAC® represents one of todays most advanced filtration system.

Oil and Gas processing industries are confronted with the removal of H_2S, CO_2 and other contaminants from a gas stream. The general concept is an absorption followed by a desorption through heating and depressurization. A straightforward method is to pass Alkanolamines in the form of MEA, MDEA, DEA, etc. through a scrubber to absorb the disturbing substances and "sweeten" the sour gases.

Contamination
However, in circulating solvent systems, ingress of contaminants or degradation of the solvent is often inevitable. Even if vapor losses are replenished, this does not purify the solvent since contaminants tend to be non-volatile. Contaminant removal is always necessary to maintain the purity of the solvent and to keep negative side-effects under control, such as corrosion and foaming (Figure 1).

Corrosion
The scrubbing liquid in turn becomes fouled with corrosive contaminants, mainly sharp-edged char, traces of iron sulphide and H_2S, which have to be eliminated together with the stripping process. If these solids are not removed, the protective layer of complex iron sulphide on the reactor and pipe walls would be pierced and the amine-sulphur complexes would eat through the walls very quickly.

Foaming
In gas treating, bubbles form in the solvent normally by the sour gas that is being scrubbed. Foaming may cause severe problems such as cavitation damage, carryover of solution into overhead systems or reduced gas purification.
Surface active contaminants identified as typical foamers in Alkanolamine gas treating are:

- Finely divided small solid particles
- Long-chain hydrocarbons close to saturation in the solvent
- Long-chain compounds such as proteins or other oxygenated polymers

Adding foam depressing agents to "fight the symptoms" has always been the measure of choice. However, as more and more surfactants and particles are accumulated, more anti-foam has to be added, which then can cause upsets like reduced adsorption efficiency of activated carbon or forming heat stable salts.

Common counter-measures and their limitations:
In the past various measures have been applied for amine purification with more or less success and different disadvantages:

- bleeding off a solvent slip-steam is nowadays unacceptable because of the high loss of solvent
- thermal methods like redistillation or reclaiming have high energy consumption and are, in case of todays efficient solvents like DEA or MDEA, very troublesome
- existing disposable bag or cartridge filtration systems are called upon to

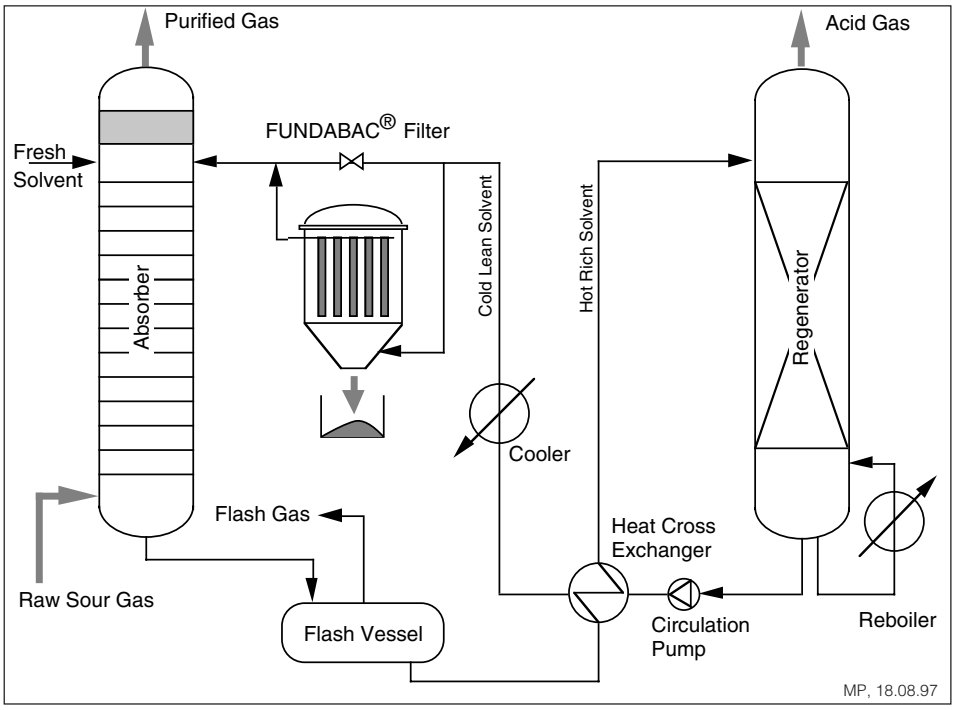

Figure 1: Basic configuration for a gas sweetening process utilizing a FUNDABAC® filter for removal of fine solid particles from the circuit.

perform a job beyond their capabilities, mainly due to quick clogging of the filter elements, high input of manpower and exposure of personal to hazardous substances
- permanent filtration systems like metal-leaf/etched disc filters with backflush facilities are limited in filter efficiency and have clogging problems. In addition, the handling and disposal of a considerable high amount of contaminated backwash slurry is to be recognized.

The FUNDABAC® way

In long pilot trails and in close cooperation with refinery experts DrM, Dr. Müller AG, have developed a filtration process with respect to the specific requirements in Alkanolamine gas treating plants.

FUNDABAC® filters use self regenerating dynamic filtration elements which have proven their excellent performance in over a thousand applications in various industries.

Due to the discharge of a dry filter cake, disposal costs are kept at a minimum and the loss of solvent is almost zero. The completely enclosed system prevents operating personal from exposure to the hazardous substances of the process.

Filter cloths of different materials and mesh sizes are available in order to assure a clear filtrate, even down to 0.5 µm particle size and under. Clogging or damaging of the filter medium is very unlikely since a precoat can be applied if the nature of the solids handled calls for.

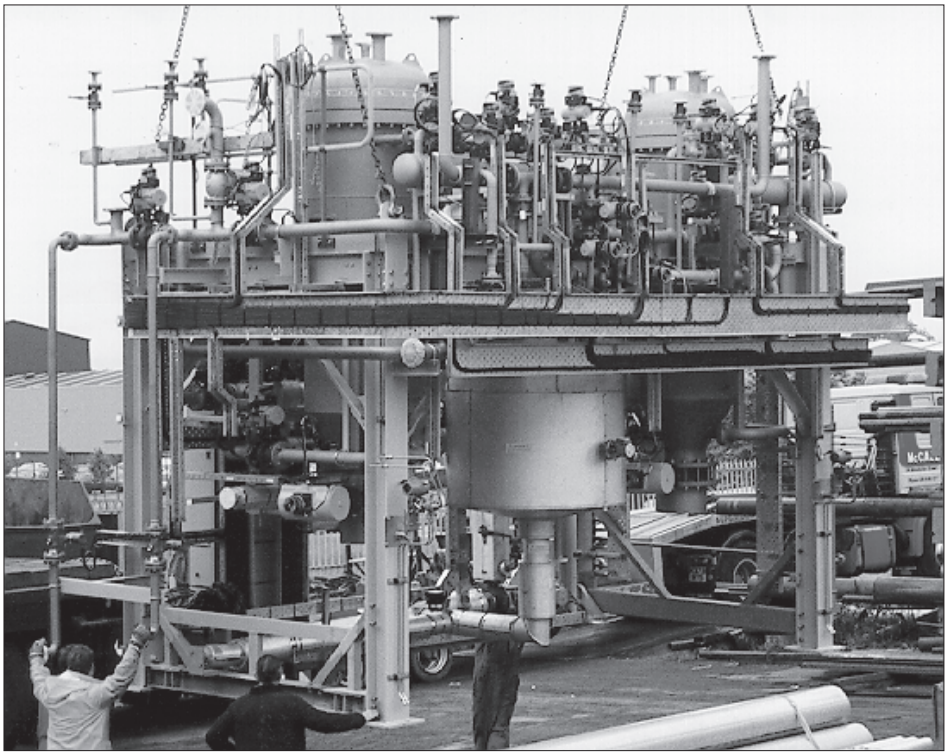

Figure 2: The photo shows the skid mounted FUNDABAC® filtration system during delivery to BP Oil Grangemouth refinery (Scotland). The two R-13 m2 filters are designed for simultaneous purification of two 73 m3/h lean DEA streams. Besides the two filter vessels, the insulated precoat tank, discharge valves and the control cabinet can be identified.

Plants in operation show a life expectancy of the cloth of several years. Thanks to modular construction, no moving parts and full automatic operation, investment and operating costs are kept low, maintenance costs have been reduced to almost zero.

FUNDABAC® filters have been successfully used in a number of gas purification plants and the large experience gained by our engineers allows to come up with an economical solution in a short time.

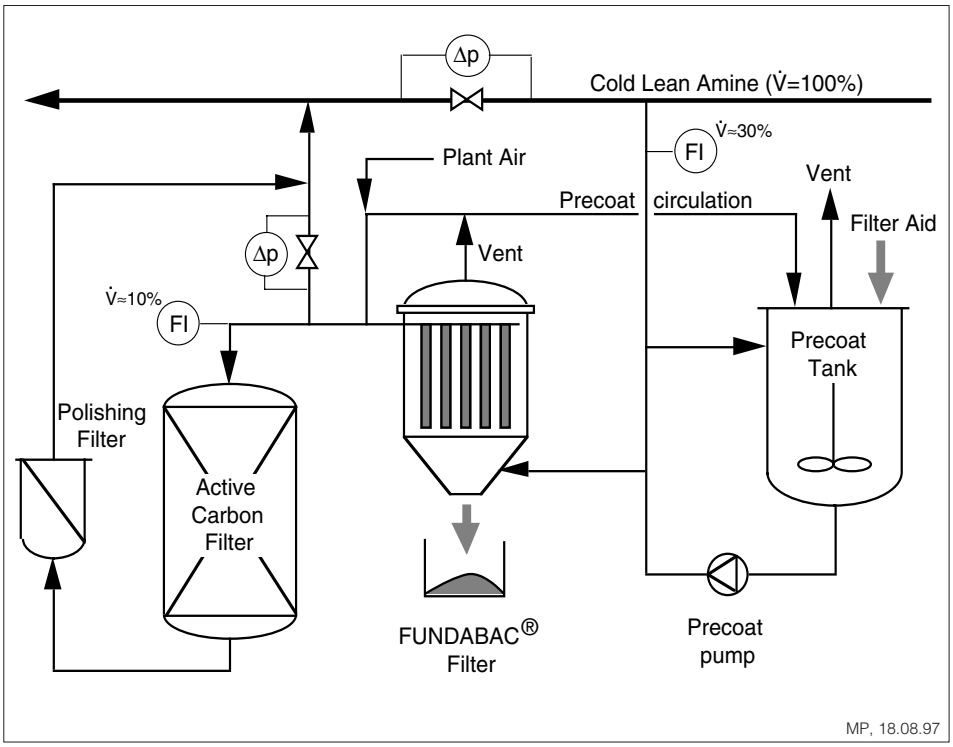

Figure 3: Schematic view of the integrated FUNDABAC® purification process including precoat facilities, active carbon adsorption and downstream polishing.

Process description (see figure 3)

A 30% slip stream is taken off from the main Amine circuit and directed through the FUNDABAC® filter for removal of particles, mainly iron sulphide. Then a slip stream of 10% is taken off and fed through the carbon filters, for removal of hydrocarbons, and through the polishing filters, for removal of any carbon fines carried over, before being returned to the main stream.

Before commencing filtration a precoat solution is made up in the precoat tank. This is circulated through the FUNDABAC® filter until a layer of precoat is built up on the filter elements and the solution runs clear.

Filtration continues until a limiting pressure drop is reached. The filter is taken off-line for cleaning, draining and cake discharge. Automatic flow control is not required. After initial setting, the flow is allowed to vary as the pressure drop across the filters increases.

Due to high automation only a low level of operator intervention is required such as manual tipping of precoat material and initiation of the filtration cycle.