What are the issues in achieving optimum run length and avoiding plugging ?

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Crude distillation columns typically suffer fouling in three sections:

- In the top trays or packing of the main fractionator
- In the wash section (trays or packing)
- In the bottom stripping section (trays).

Fouling in the top section is typically the result of chlorides in the feed not being removed at the desalting stage, which later hydrolyse to hydrochloric acid in the fired heater. The acid is then carried with the vapourised feed from the flash section up to the top of the column. Chlorides are responsible for potential corrosion and salt depositions. Tray corrosion occurs when operating conditions (temperature, pressure, water and chloride concentration) approach the water dew point temperature, creating concentrated hydrochloric acid, which attacks the metal internals.

Depending on operating conditions and the presence of ammonia or amine components (typically used as H_2S scavengers), chloride salts may deposit. Salts accumulating on the top trays cause progressive plugging of the tray valves, deteriorating efficiency and capacity.

When dealing with plugging from salts, sludge or corrosion products, a review of the process conditions is an essential first step:

- Can you reduce the harmful upstream components (chloride, ammonia, amine and so on) and water (in crude, from strippers) that may reach the top section of the column?
- Operating conditions such as temperature play a role in initiating and continuing the deposition of salts. You need to understand the effects of temperature on your particular corrosive process and then properly control the temperature
- Installation of a water wash system for the top three to five trays often helps
- Last, but not least, the design of the tray or packing internals that resist fouling or corrosion should help.

Looking more closely at the last two points above:

- Modification of the top section to accommodate a water wash system including a water draw to dissolve and remove generated salts should be considered
- Adopting anti-fouling trays such as Sulzer's VG AF trays will help. Anti-fouling trays are specifically designed to operate in fouling conditions and therefore improve performance and run lengths.

Wash section fouling is the result of entrainment from the flash zone (asphaltenes) and/or a low wash rate. A combination of the two can cause dry conditions in part of the trays or on the packing surface, resulting in the progressive build-up of coke.

Potential solutions to mitigate or avoid plugging of the wash section are:

- Improved design of feed inlet distributor, to provide uniform flow and to reduce entrainment
- Understand the process parameters affecting the wash rate vs overflash
- Maintain the minimum allowable wetting rate at the bottom tray or packing
- Use anti-fouling trays (VG AF)
- Use a smooth (non-textured) packing type (Mellagrid and Mellapak)
- Better liquid distribution on top of the packed section.

The wash section is also subject to additional mechanical stress due to feed upsets, such as excessive water from the desalter and overheating at the feed heater. This requires internals to be designed with a differential uplift requirement of typically 1 to 2 psi.

In the bottom stripping section, fouling and/or plugging is the result of two major issues:

- Solids carried in with the feed (sand, rust, coke particles and sludge) to the flash zone
- Improper design of trays.

The use of antifouling trays can help to mitigate or avoid the problem, along with a progressive open area to maximise stripping efficiency. The progressive open area allows the tray capacity to match that of the rapidly changing vapour rates in the stripping section.

The stripping section is also subject to additional mechanical stress caused by high bottoms liquid levels, and/or liquid water entrained with the stripping steam. These conditions require that the trays be designed with an uplift load of 2 psi, as well as the use of a special steam distributor to reduce the impact of liquid water entrainment.