TECHNICAL BULLETIN

Cleaning of Urea Strippers and Recirculation Heaters

Removal of deposits greatly enhances efficiency and capacity

Urea is typically used as nitrogen fertilizer, de-NOx applications and as raw material for melamine. Urea is synthesized from carbon dioxide (CO_2) and ammonia (NH_3). This chemical reaction does not provide immediately a 100% yield. In order to complete the reaction in an efficient way Urea Strippers and Recirculation Heaters are employed. Urea Strippers and Recirculation Heaters are manufactured from precious stainless steel alloys and consist of vertical tubes with the reaction progressing on the inside of the tubes while steam is introduced on the outside of the tubes. After some time very hard deposits develop inside the tubes, reducing the efficiency and capacity of the urea plant.

A typical deposit in the Urea Stripper and Recirculation Heater consists of ferric oxide (hematite) with admixtures of nickel, chromium and molybdenum oxides and is generally blueish/grey to black in color. This deposit causes reduced heat transfer resulting in a reduction of production process efficiency. Over time this will result in a decrease of production capacity as these become the “production-bottleneck”. To ensure sufficient production efficiency and capacity, it is required to periodically clean the Urea Stripper and Recirculation Heaters.

The Urea Stripper and Recirculation Heaters can be mechanically or chemically cleaned. Based on customer and Vecom experience chemical cleaning offers more efficient and far better results compared with mechanical cleaning.

Iron oxide deposits can generally be removed readily from a stainless steel surface by acid pickling. This however also results in a portion of the precious base material being dissolved and increases the roughness of the stainless steel surface. This so-called acid corrosion can be slowed down by addition of inhibitors (pickling inhibitors), however this will be insufficient to protect the equipment from material loss. Exposure to corrosion is not acceptable for any part of the base material.

Research into an alternative cleaning method for the removal of the iron oxides was carried out.
A cleaning solution based on EDTA at sufficient high temperature appears to dissolve this deposit completely, without corroding the base material. In a pH neutral medium the iron oxide will dissolve, forming a metal-EDTA complex. The cleaning temperature is selected to maximize the reaction of the EDTA with the iron oxides. During cleaning, the free EDTA and dissolved iron levels are continuously monitored in order to provide insight into the progress of the cleaning process. Prior to the cleaning process, the total quantity of EDTA is determined on the basis of the quantity of deposit and the parameters and size of the Urea Stripper and Recirculation Heater. Cleaning is carried out, employing an in house developed safe and proven method.

Vecom Industrial Services specializes in, amongst other activities, the chemical cleaning of Urea Strippers and Recirculation Heaters and has, during the past years, cleaned numerous urea production installations successfully worldwide.

Urea Stripper Cleaning Project:
At a urea plant in Roemenia, Vecom performed a Urea Stripper cleaning. The Urea Stripper was fouled to the point that it was reducing the stripper efficiency and significantly limiting the plant capacity. Based on the estimated amount of iron oxide scaling and the design parameters, Vecom calculated the amount of EDTA required.

The total amount of iron-oxides removed was 1,800 kg as iron. The cleaning result was more than satisfactory and the loss in production was totally nullified after the commissioning of the plant. Photo 1 shows the typical fouling of the Urea Stripper in the bottom part of the tubes (blueish scales).

Photo 1 – typical fouling of the Urea Stripper

Urea Recirculation Heater Cleaning Project, The Netherlands:
At a urea plant in The Netherlands, Vecom performed a Urea Recirculation Heater cleaning. The Recirculation Heater was fouled to the point that is was costing the plant roughly 200-300 metric tons per day in lost production. Based on the estimated amount of iron oxide scaling and the design parameters, Vecom calculated the amount of EDTA required.

The total amount of iron-oxides removed was 2,000 kg as iron. The cleaning result was more than satisfactory and the loss in production was totally nullified after the commissioning of the plant. Photo 2 shows the typical fouling of the Recirculation Heater after some time leading to lower efficiency and capacity.

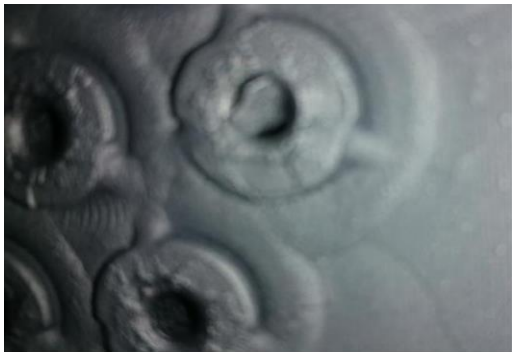
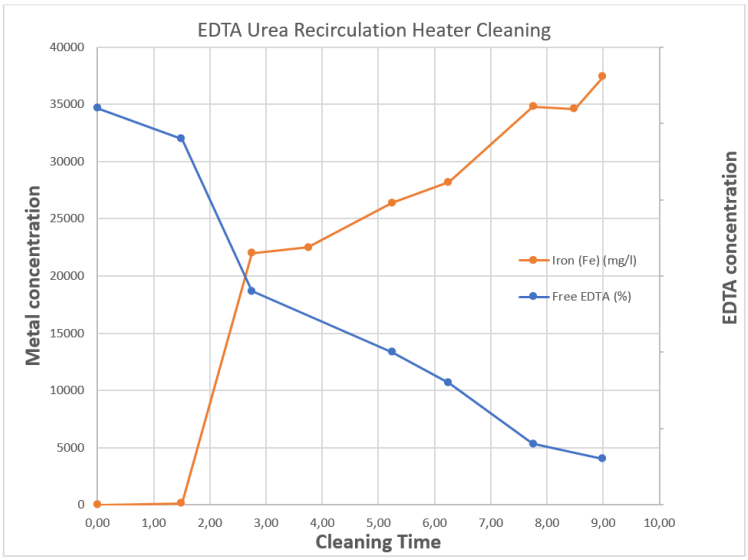


Photo 2 – typical fouling of the Recirculation Heater

The graph below depicts the progress of the cleaning session performed in The Netherlands.



Interested and want to know more?
For further information and/or questions about this subject or in case you have other questions, please contact one of our specialists via +31 10 59 30 212 or go to our website www.vecom-group.com.

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