RECONNECT SYMPOSIUM 2022

16 - 19 MAY
UTRECHT
THE NETHERLANDS

KNOWLEDGE • OPTIMIZATION • INNOVATION

Experiences with the large scale revamp project in Azomures Romania

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The innovation & license company
of Maire Tecnimont.

Stamicarbon 75 YEARS

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1. ABSTRACT

Stamicarbon has a long history in revamping urea plants. Existing urea plants have been revamped to raise the capacity by 10 up to 250 %. This paper deals with a revamp on a large scale, in which the capacity of a traditional conventional total recycle plant comprising two identical units, is raised by about 60 % by converting these units into a single line CO_2 stripping plant.

The revamped urea melt plant is multi-finctional: urea solution is used as feedstock for the existing UAN production facility, the existing melamine production facility as well as for the newly installed granulation plant. In addition the urea melt plant is able to process the returned carbamate vapor from the existing melamine facility. Since all operational conditions needed to be accomplished in the design, the revamp project was one of the greatest challenges in the Stamicarbon revamping history.

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2. BRIEF PROJECT HISTORY

The urea plant of Azomures is located in Târgu-Mures in Romania. The plant was designed as a conventional total recycle plant in the 1960's. It was built by the contractor Coppee-Rust from Belgium which nowadays belongs to SNC-Lavalin. The urea plant comprised two lines that each produced 450 metric tons per day. The plant used to produce urea prills and part of the urea production was used as a feedstock for the existing melamine plant

In 2008 Azomures management approached Stamicarbon to revamp the urea plant. The goal was to reach a plant capacity of 1425 metric tons per day. On top of the capacity increase requirement, the prilling section as existing finishing section should be replaced by a granulation finishing section while the plant should continue in supplying urea melt to the melamine plant and the carbamate returned from the melamine plant should be processed in the installation.

In 2012 Azomures decided to continue with the project and contacted Stamicarbon to perform a process feasibility study that should obtain the following objectives:

- Increase of the urea production capacity
- Decrease of the specific energy consumption
- Product switch from urea prills to urea granules
- Emission reduction
- Safety upgrade (safety valve catch pot system and hydrogen removal application)

In 2013 the process feasibility resulted in a contract for the licensing of the urea melt project, the licensing of the brown-field granulation section and the equipment supply for the newly installed high-pressure equipment, high-pressure lines and associated equipment.

The newly installed high-pressure equipment as well as the involved new high-pressure lines including the associated equipment are fabricated in the Safurex® Infinity construction material.

As contractor, Chemoproject from Prague was appointed for the entire project. The engineering and construction of the plant was finished end 2015 and commissioning started in 2016. In mid 2017 a performance demonstration test was successfully executed that demonstrated the plant performance capabilities.

3. PROCESS DESIGN

3.1. PROJECT SCOPE

The goal of the revamp project was for the plant to reach 1425 metric tons per day. To reduce the consumption figures, a CO_2 stripping technology was chosen, in which maximum use is made from the existing equipment in the two conventional total recycle plant units. The plant had to produce urea granules in a newly built Stamicarbon granulation section and had to supply urea melt to the existing melamine plant and urea solution to an existing UAN plant at site. To ensure the required feedstock intake, the high pressure CO_2 compression capacity was achieved by a newly installed centrifugal type compressor including a hydrogen removal system that replaced the existing reciprocating compressors. The capacity of the existing high-pressure ammonia pumps however were found sufficient for achieving the targeted revamp plant capacity since the traditional used ammonia recycles in conventional total recycle plants units were significantly reduced in the revamp concept.

The urea synthesis section is expanded with a pool reactor and a CO_2 stripper. A part of the solution leaving the reaction zone in the synthesis section is sent to the existing MP dissociation and pertaining ammonia recovery sections. Thereafter the urea solution is further purified from non-converted ammonia and carbon dioxide in the existing low-pressure recirculation sections.

The remaining part of the urea solution leaving the reaction zone in the synthesis is subject to stripping in a newly installed CO_2 stripper where after the urea solution is further processed in a newly installed low-pressure recirculation section operated at a pressure of approximately 4 bar.
The urea solutions leaving all low-pressure recirculation sections are pre-concentrated in a newly installed pre-evaporator before being collected in the existing urea solution tank. The released vapor from the medium-pressure dissociation sections are condensed in the process to process heat exchanger of the pre-evaporator and thus the released condensation heat is used to pre-concentrate the urea solution.

The urea solution leaving the urea solution tank is used partly as a feedstock for the UAN production and the remaining is supplied to the two existing evaporation sections and/or to the newly installed evaporation section. The urea melt leaving the newly installed evaporation section is sent to the existing melamine plant at site as a feedstock while the concentrated urea solution leaving both existing evaporation sections is sent to the newly installed granulation section. The condensed process condensate leaving the evaporation sections is collected in the existing ammonia water tank where after this process condensate is treated in an upgraded waste water treatment section that is expanded with a newly installed second desorber downstream the hydrolyser. Of course, caused by the increased volumes in the urea synthesis, a newly installed urea storage vessel and a newly installed ammonia water tank belonged to the scope in order to have sufficient volumes available needed after draining of the synthesis section. In order to reduce gaseous emissions in the urea melt section a newly installed atmospheric inert scrubber was also part of the scope.

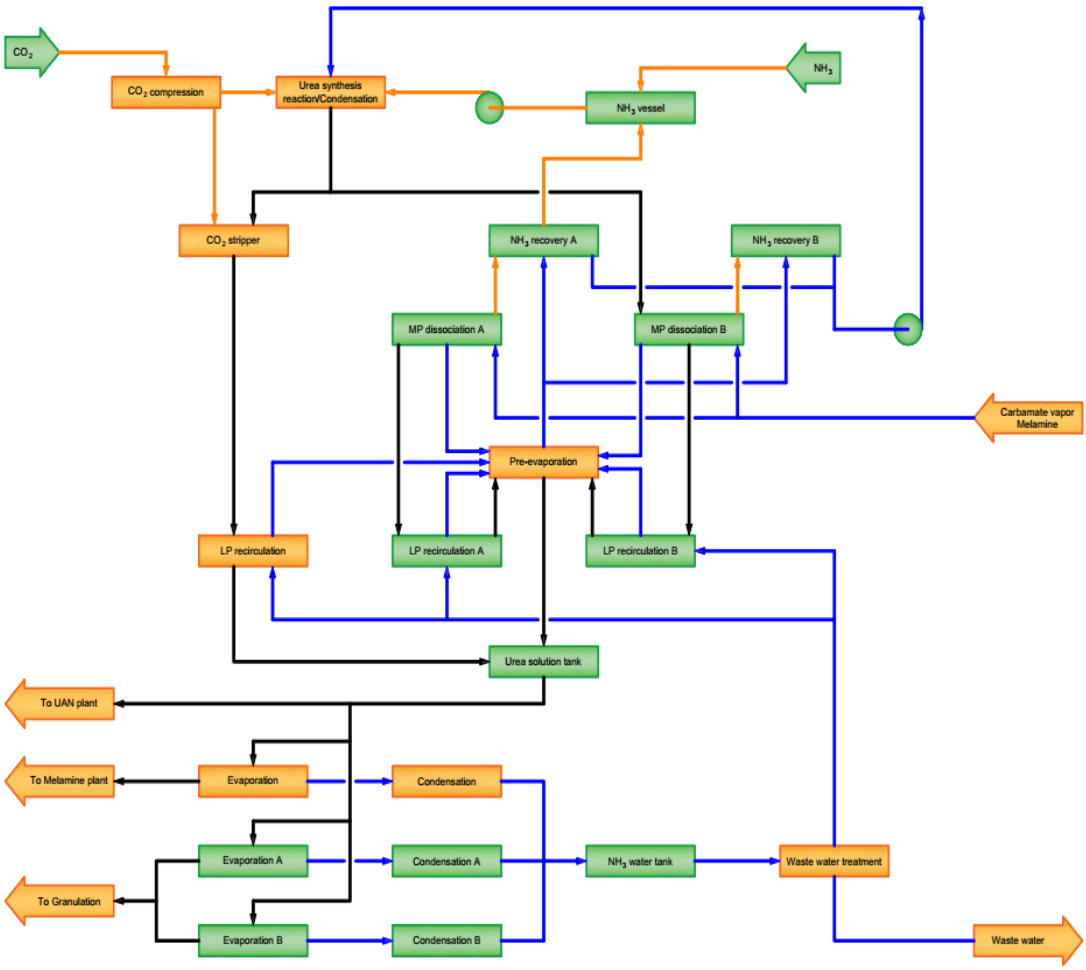

Figure 1 Block diagram of the project scope indicating the new, modified and existing sections.

Legend:	Orange blocks	New or modified sections
	Green blocks	Existing sections
		Feedstock lines
		Product lines
		Carbamate/ process condensate lines

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3.2. CONCISE UREA MELT PROCESS CONCEPT DESCRIPTION

3.2.1. Urea synthesis section

- **Design Operational synthesis conditions**

The urea synthesis operational conditions were changed into those conditions as usually applied in CO_2 stripping plants. The next table gives an impression of the operational conditions in the urea synthesis before and after the revamp.

Typical figures of urea plant	Unit	Before revamp	After revamp
Name plate capacity	MTPD	2 x 450	1425
N/C synthesis	mol/mol	~ 4	~2.85
Synthesis pressure	bar (g)	~ 195	140-145
Temp. outlet reactors	°C	188-190	183
Urea conc. at outlet reactors	wt-%	~ 32	~ 32
Water conc. at outlet reactors	wt-%	~ 19	~ 19

Table 1: Synthesis process conditions before and after the revamp

Since the ammonia to carbon dioxide molar ratio (N/C synthesis) in the synthesis section is significantly decreased, the load on the existing ammonia recovery section and in particular the washing column in the downstream medium pressure sections were significantly decreased as well and needed no further adequate expansions or modifications.

The carbamate recycle to the synthesis increased proportional with the plant capacity and thus the existing high-pressure carbamate pumps were upgraded in capacity in order to convey the total amount of carbamate to the synthesis section that is operated at a lower pressure than originally in the conventional urea plant design.

- **Synthesis section**

The synthesis section in the traditional conventional total recycle plant comprises only one urea autoclave. Since the synthesis in the revamping concept is changed into a CO_2 stripping synthesis section the existing vacated urea autoclaves from both conventional lines were reused to optimize the investments. Besides these two autoclaves, a newly built pool reactor was added to the design in order to meet the required reaction volume and thus obtaining an adequate large CO_2 conversion. A part of the urea solution leaving the reaction zone in the synthesis is further processed in the existing two medium pressure recirculation sections and the remaining part is sent to a newly installed CO_2 stripper operating at the similar pressure as the pressure in the reaction zone in the synthesis section. As a consequence only a part of the urea solution leaving the reaction zone is treated in the CO_2 stripper and consequently the stripper size is much smaller as would be expected for the entire plant capacity. The CO_2 stripper is designed to obtain a sufficient large stripping efficiency so that the urea solution can be further purified in the newly installed downstream low-pressure recirculation section operating on a pressure of approximately 4 bar absolute. The synthesis section circulation loop, necessary to keep the pressure in all involved high pressure equipment similar, is controlled by gravity in order to avoid any rotating parts in this loop as driving force. The height relations in the synthesis section is for reasons of gravity flow of utmost importance and an impression of the synthesis lay out is shown in the next figure.

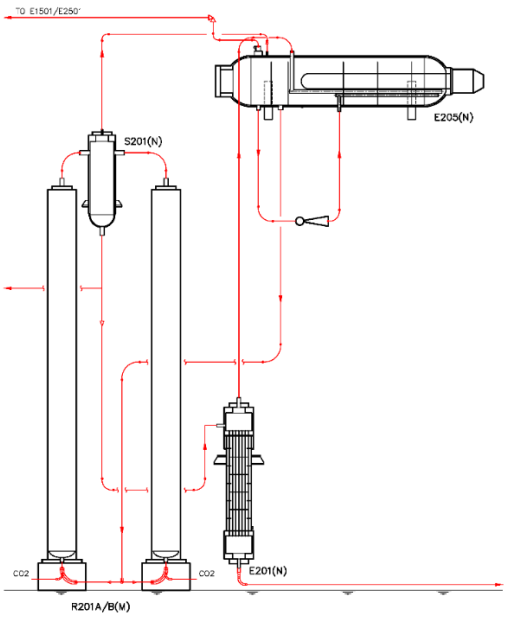

Figure 2: Synthesis gravity loop lay-out

The existing two reactors are located at grade level as it was supposed for the CO_2 stripper as well. The driving force for the gravity flow is obtained by the density difference between the stripped gas from the stripper and the liquid density of the urea solution. The newly installed pool reactor is installed at a height

such that the static and dynamic resistances are compensated to make a gravity loop at full plant load possible.

The installed pool reactor comprises a condensation part followed by an adiabatic reaction part and an inline scrubber in which the released non-condensed ammonia and carbon dioxide is scrubbed from the inert with carbamate from the medium pressure recovery sections before the inert vapor is further treated in the existing medium pressure recirculation sections.

The advantage of the integration of the scrubber functionality in the pool reactor is an innovative design of Stamicarbon, which results in the redundancy of a dedicated high-pressure scrubber and thus saving on CAPEX and maintenance cost.

In between the scrubber part and the adiabatic part of the pool reactor an overflow compartment is installed. From this overflow compartment the urea/ carbamate solution flows under gravity to the existing two autoclaves. The formed concentrated carbamate descending the scrubber part is conveyed to the condenser part of the pool reactor by using a high pressure ammonia ejector as a driving force.

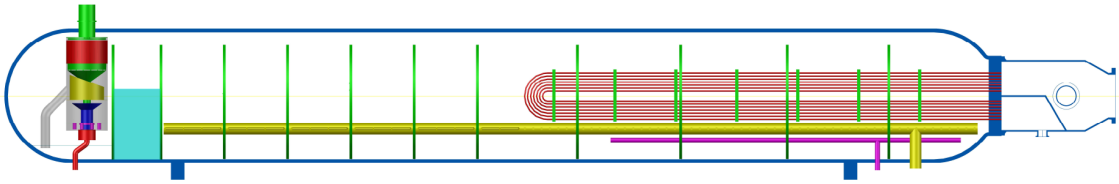

Figure 3: Combined pool reactor

The combined pool reactor was part of the LAUNCH MELT™ Compact Design urea synthesis section that was presented in the Stamicarbon Urea symposium in 2008.

Since the newly installed stripper and pool reactor is fabricated in the Safurex® Infinity construction material the applied oxygen in the carbon dioxide feed to the urea synthesis is as low as 0.3 volume % which is necessary to keep the existing (non-Safurex®) synthesis parts, fabricated in the usual stainless steel materials, passive.

3.2.2. Medium pressure recovery section

A part of the urea solution leaving the existing autoclaves in the synthesis section is further processed in the two existing medium pressure recovery sections. Since the N/C molar ratio in the synthesis section is decreased from originally 4 mol/mol to approximately 2.85 mol/mol in the revamped process, the amount of free ammonia in the urea solution feed to these medium pressure recovery systems is decreased resulting in a required capacity decrease for the existing ammonia recovery system to fulfill the complete plant capacity.

The ammonia and carbon dioxide containing vapor leaving the decomposers in the existing medium pressure recovery section are condensed in a newly installed pre-evaporator. In this pre-evaporator the released heat of condensation is used to further concentrate the urea solution that has left the low pressure recovery sections. The formed carbamate is conveyed via the washing columns by the existing upgraded high-pressure carbamate pumps to the synthesis section. The ammonia containing non-condensed vapor is sent likewise to the existing washing columns.

The washing columns separate the excess of ammonia from the water/ carbamate phase. The ammonia vapor leaving these washing columns containing small amounts of water and traces of carbon dioxide is condensed. The formed liquid ammonia together with the ammonia from battery limit is used as driving force for the high pressure ammonia ejector that conveys the carbamate formed in the scrubber part of the pool reactor to the condenser part of the pool reactor.

3.2.3. Low pressure recovery section

Downstream the existing medium-pressure sections the urea solution is further treated in the existing low-pressure recovery sections. Hardly any modifications were done in these two low pressure recirculation sections.

The urea solution leaving the high-pressure stripper in the synthesis section is further purified in a newly installed low pressure recirculation section. A part of the urea solution leaving this section is sent together with the urea solution leaving the existing low-pressure recirculation sections to the newly installed pre-evaporator to concentrate the urea solution further where after the pre-concentrated urea solution is collected in the urea solution tank. Another part of the urea solution (formaldehyde free) leaving the newly installed low-pressure recovery section can be subjected to a newly installed sub-atmospheric flash tank where after also this concentrated formaldehyde free urea solution is collected in a separate urea solution tank where after it is sent to the newly installed evaporation section dedicated for the melamine.

The urea solution leaving the urea solution tank is partly used as feedstock for the existing UAN section and the remainder is sent to the existing evaporation sections.

3.2.4 Evaporation section

Originally, the two existing evaporation sections were designed to concentrate the urea solution to a concentration of 99.7 % by weight because the urea melt was used to produce urea prills as an end product. After the revamping project the urea solution should be concentrated to a concentration of approximately only 98.5 % by weight because this solution is used for producing urea granules in a Stamicarbon urea granulation unit.

This concentration difference in combination with the newly installed pre-evaporator increased the production capacity of existing urea evaporation sections sufficiently so that no major modifications in these sections were necessary.

A part of the urea solution, which is free from formaldehyde, leaving the urea solution tank is concentrated in a newly installed two stage evaporation and condensation section in order to obtain a urea melt with a concentration of 99.7 % by weight that is used as a feedstock for the existing melamine plant.

3.2.5 Waste water treatment section

The original existing treatment of the process condensate leaving the condensation sections in the evaporation sections comprised a desorber, a hydrolyser and a reflux condenser. Nowadays the emission values for ammonia and urea are more strict and therefore modifications in this section were needed to comply with these stricter environmental regulations.

The internals in the existing desorber and hydrolyser were changed and the hydrolyser was changed from a co-current type to a counter-current type. The waste water treatment section was expanded with a newly installed desorber downstream the hydrolyser that purifies the process condensate leaving the hydrolyser by the application of steam stripping before it is drained to the sewer.

3.3. UREA GRANULATION PROCESS CONCEPT

The granulation section is a complete new section to be comparable with a brown-field project. Azomures decided for the Stamicarbon granulation technology that has operational advantages (long runtimes, due to low frequency of washing intervals) and as a result of the lower formaldehyde additive requirement it has a significant lower product cost.

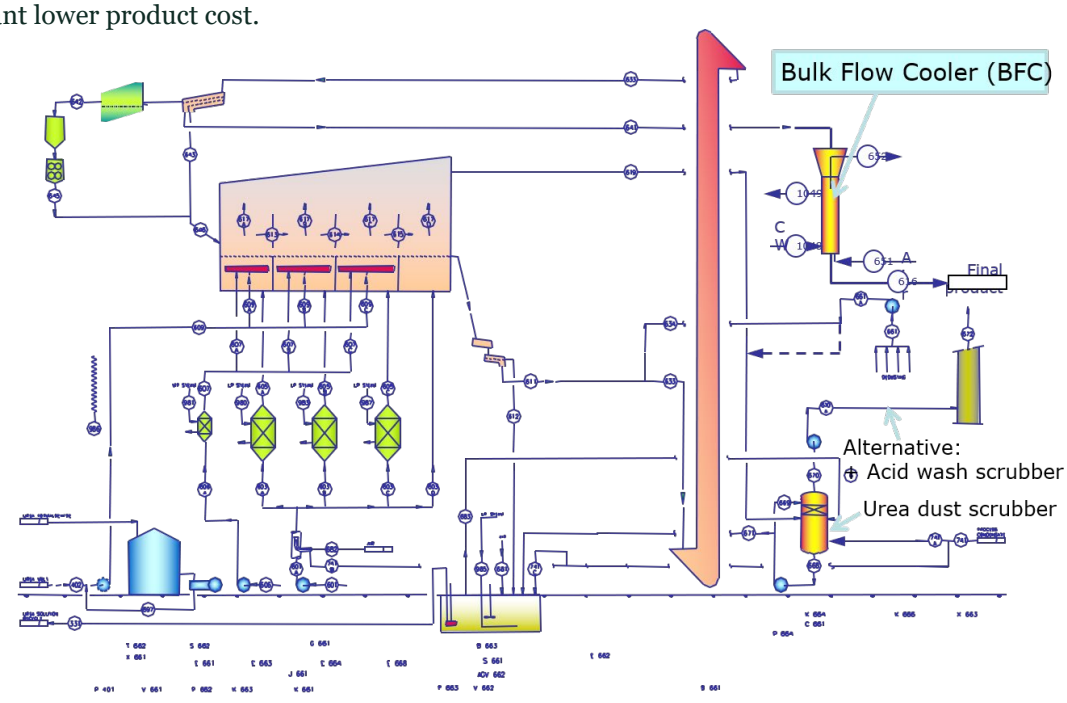

Figure 4: Flow diagram of the applied granulation section in Azomures

4. PROJECT AND OPERATIONAL EXPERIENCES

4.1. PLANT LAYOUT

One objective of the project was to minimize the required shut-down period necessary to implement the necessary modifications. That led to the decision to build the new sections and involved critical equipment in a standalone structure close to the existing autoclaves in the existing plant units.

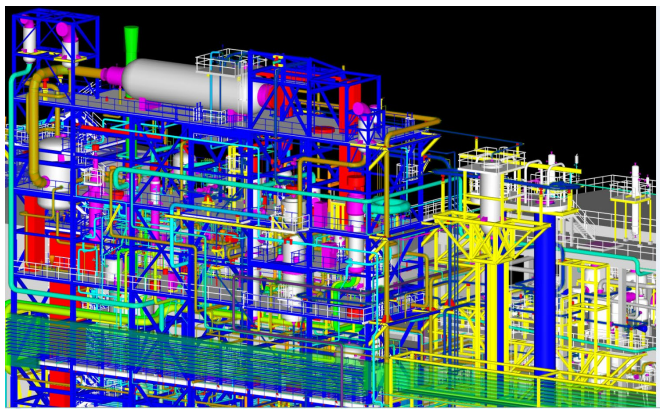

Figure 5: 3D model of the standalone high pressure structure

Following the example of the 3D model resulted in the realization of newly standalone high-pressure structure.

Figure 6: Standalone high-pressure structure

The location of the granulation unit was only possible at a relative large distance from the urea melt plant (about 200 meter) and that distance made the project challenging to obtain the required biuret content in the granulated end product. An impression about the distance between the melt plant and the granulation section is given in the next figure from which the picture is taken from the granulation building and the newly build structure is seen.

Figure 7: Impression of the distance between the granulation unit and urea melt plant

4.2. UREA SYNTHESIS SECTION

During the P&ID check at site it appeared that the high-pressure stripper was located at a higher elevation in the newly built structure as what was foreseen in the design. This made that the height between the stripper entrance and the pool reactor was smaller than foreseen in the design and consequently reduced the necessary required driving force for obtaining the synthesis gravity loop at full design plant capacity.

When the plant was commissioned it was confirmed that the design plant capacity could not be achieved due to the combination of the reduced driving force and leaking of the baffles in the overflow compartment of the pool reactor. The issue with the leaking baffles was solved in the plant stop that followed and gave a tremendous improvement in the urea concentration in the urea solution leaving the pool reactor.

The issue with the reduced gravity driving force in the synthesis loop causing too high levels in the downstream liquid/gas separator at full plant capacity and was difficult to solve since it was impossible to lower the elevation of the stripper to grade level and thus another solution should have been found. To compensate the loss of static resistance, a resistance was created in the vapor line between the liquid/vapor separator and the pool reactor.

By creating a resistance on that spot, the pressure in the existing autoclaves was somewhat increased as compared to the pressures in the pool reactor and thus also the high-pressure stripper. At first the resistance in this vapor line was created by an orifice but later this orifice was replaced by a butterfly valve that is controlling the required resistance so that a liquid level is present at all desired operational plant capacities in the gas/ liquid separator upstream the two autoclaves. The controllable butterfly valve makes the operation of the synthesis section extremely stable.

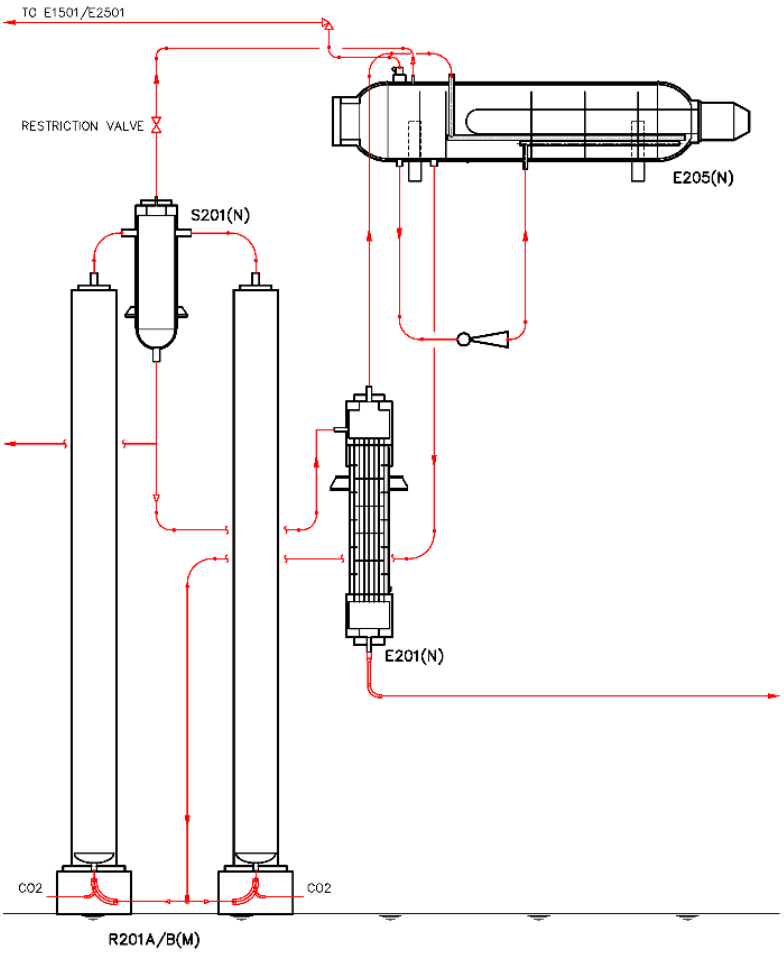

Figure 8: Synthesis lay-out in the current operational condition

After both issues were solved and implemented the urea synthesis section was stable and easy to operate. In an ammonia to carbon dioxide molar ratio (N/C) range from 2.8 and 3.2 mol/ mol all operational conditions (UAN and melamine production supply) in a plant capacity range from 600 to 1500 metric tons per day of urea could be met.

5. PROCESS PERFORMANCES

A plant performance demonstration test has been executed but during a certain period of time the plant ran at limited capacities of only 70 % due to feedstock shortage (issues in the ammonia plant). The actual performance figures presented in the next table are total average values over the time that the performance demonstration test took place and that includes also the period of time that the plant was operated at the mentioned limited capacity.

ITEM	UNIT	GUARANTEE	ACTUAL AVERAGE
Plant capacity	MTPD	≥1425	1358[1]
Ammonia consumption	kg/t	≤ 567	564
CO2 consumption	kg/t	≤ 735	732
Steam (24 bara, 320 C)	kg/t	≤ 960+28	1078
Urea dust from granulation scrubber	mg/Nm^3	≤ 25	3.9
Ammonia from granulation scrubber	mg/Nm^3	≤ 15	14.2

[1] Subject to restriction of ammonia availability

Table 2: Plant performance

The product from the new granulation plant met all the product quality requirements as per specifications of the Rumanian market as it is illustrated in the next table.

ITEM	UNIT	Specification as per Rumanian market	ACTUAL AVERAGE
Biuret content	wt.%	≤ 1.20	1.0
Formaldehyde	wt.%	≤ 0.3	0.27
Water	wt.%	≤ 0.3	0.15
Free ammonia	wt. ppm	≤ 25	5.8
Borden test		≥ 6	7.7
Product 2-4 mm	wt.%	≥ 92.5	88.5
Product 1-2 mm	wt.%	≤ 1	0.7
Crushing strength (3,5 mm)	kg	≥3.5	4.3

Table 3: Product quality

5.1. PLANT CAPACITY

As already mentioned the plant capacity was in a period of time during the performance demonstration period restricted due to the shortage of ammonia feedstock. During a short time when the performance test was executed (about one shift), the plant produced above 1500 MTPD product without any upsets in any section in the plant. Thus at such plant capacity the plant demonstrated its capabilities.
As recalled the given actual value in the table 2 refers to the average plant capacity over the total time that the performance demonstration took place. That concludes that the plant capacity for a respectable period of time during the performance demonstration test was below the guaranteed design value of 1425 metric tons per day. Nowadays the plant runs stable around the design value of 1425 metric tons per day

5.2. STEAM CONSUMPTION

The observed steam consumption during the performance demonstration test period exceeded the guaranteed value. The high steam consumption could be explained by the following reasons.

1. The foreseen steam expander V903 was during the performance demonstration test not in operation.
2. The steam demand in the granulation was at the time of the performance demonstration test high.
3. The high pressure steam demand on the hydrolyser in the waste water treatment section was significantly higher due to the by-passing of the existing hydrolyser heat exchanger.
4. Significant steam losses in the melt as well as the granulation unit caused by steam leakages.

If the above reasons of failure have been lifted, the steam consumption of the plant was during the performance demonstration test below the guaranteed value. This is further explained in the next sub-chapters.

5.2.1 Steam Expander V903

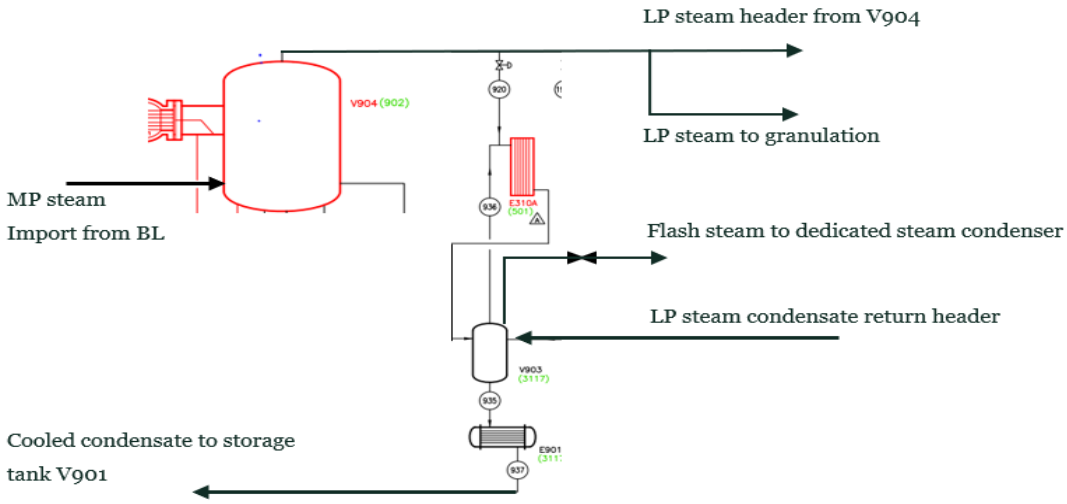

Figure 9: Steam expander V903

The purpose of the steam expander V903 in the design in Azomures was to make optimal use of the heat in the steam condensate leaving the steam part of the pre-evaporator. The steam condensate leaving this pre-evaporator part flashes in V903 and the liberated steam is re-used as heat source together with low-pressure steam for this pre-evaporator part. Since this expander was not in operation during the performance demonstration test period the estimated steam loss was in the order of magnitude of 35 kg/ton.

5.2.2 High pressure steam demand waste water treatment section

The hydrolyser heat exchanger in the waste water treatment section E803 was badly leaking in combination with heavily (oil) fouling and therefore not in operation during the performance demonstration test period.

This had its performance consequences for the high-pressure steam consumption on the hydrolyser C803 as well as for the performance of the emission values in the sewered waste water what is further addressed in chapter 5.4.

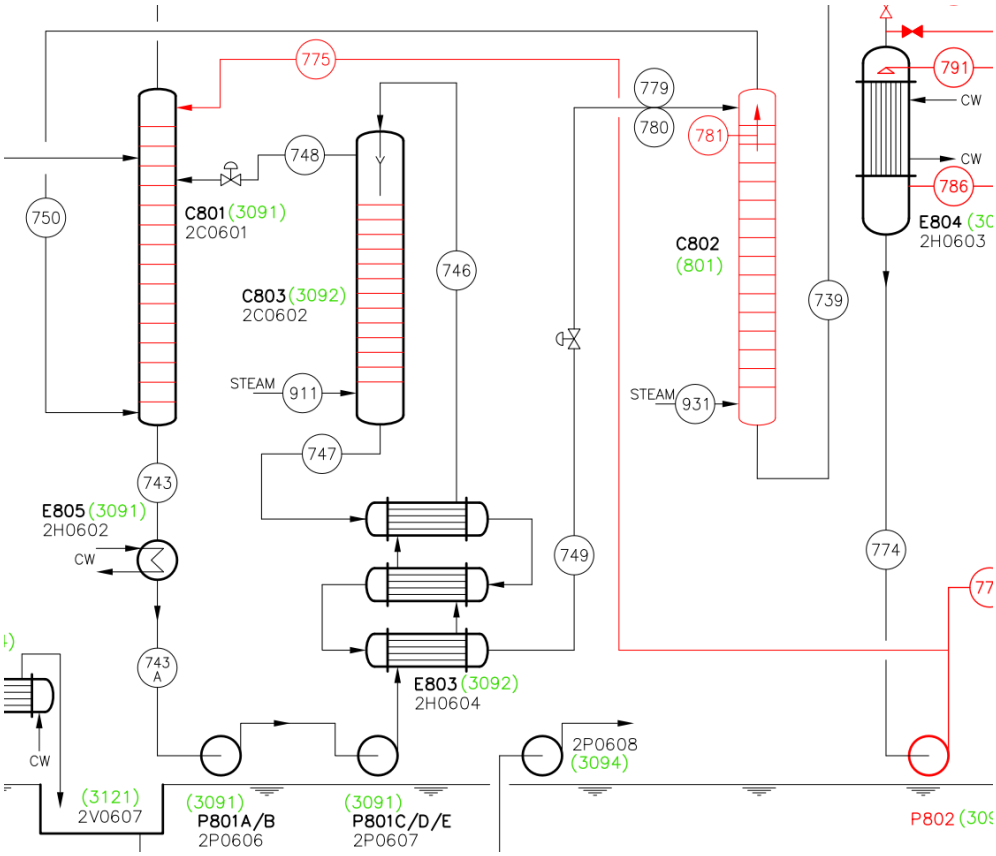

Figure 10 : Flow diagram of the waste water treatment section

The non-availability of the hydrolyser heat exchanger during the test period raised the steam consumption of the plant by a calculated value of approximately 80 kg/ton.

5.2.3 Steam losses by leaking

In the granulation unit as well as in the urea melt quite some steam leakages were observed and that lead to a higher low-pressure steam demand and consequently a higher steam consumption on the stripper because the stripping efficiency on the high-pressure stripper needed to be operated somewhat higher as foreseen in the design in order to avoid high-pressure steam import on the low-pressure steam drum in the plant.

5.3. BIURET CONTENT GRANULATED END-PRODUCT

As recalled the given actual value for biuret in the table 2 is an average biuret value over the period of time that the performance demonstration test took place. During that test period, the plant capacity was running

at plant capacities far below design and of course the biuret content in the end-product samples showed high biuret contents due to increased retention times.

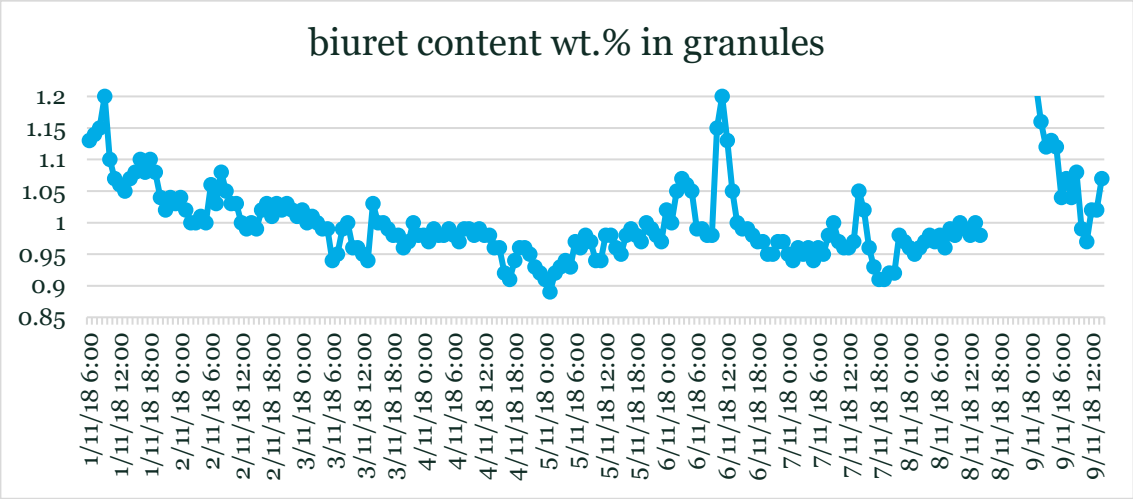

Figure 11: Impression of the biuret content in the granulated end-product

The peak values in the observed biuret are caused by the low plant capacities. The results show that the product quality with respect to the biuret specification as per Rumanian market even by the relative long retention time caused by the long distance between the urea melt unit and the urea granulation unit, is met. Moreover after rejecting the peak values the achieved biuret content is most of the time below 1.0 % by weight which is in the Rumanian market a premium product quality.

Further optimization possibilities regarding the reduction of the biuret formation is included in the design. The long distance made the design to decide to choose for a urea melt pump with a relative high pump head in order to shorten the time period of the melt in the pump discharge line.
To minimize the biuret formation in the discharge of the urea melt pumps from both evaporation sections at the different plant capacity, the discharge lines of the present urea melt pumps were connected as illustrated in the next figure

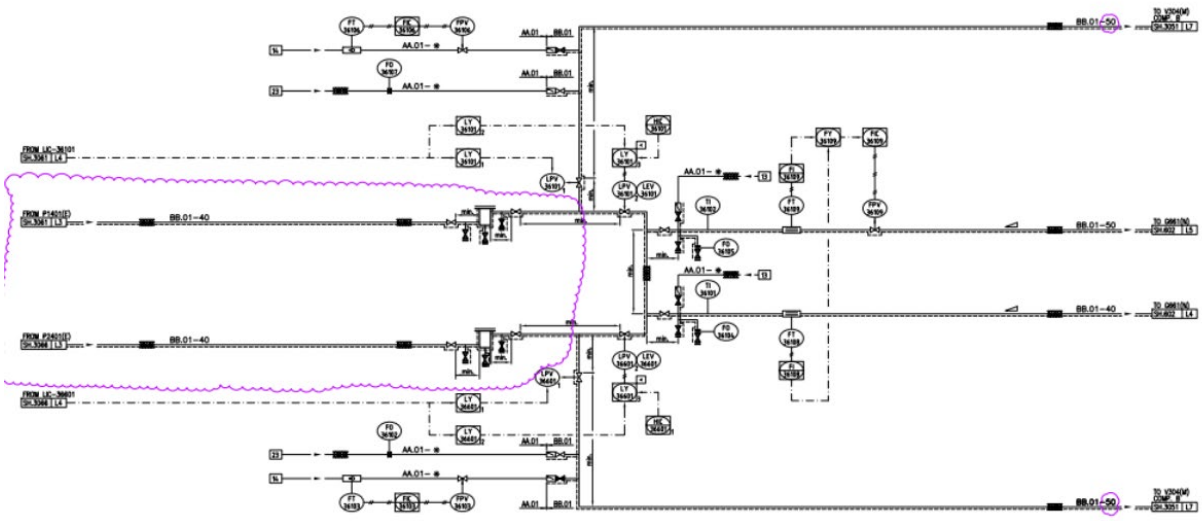

Figure 12: Urea melt discharge lines from urea melt pumps

The urea melt can be discharged to the granulation section by one common melt discharge line at plant capacities lower than design and both melt discharge lines are being used at design plant capacities. This optimization gives the possibility to reduce the biuret content in the granule end-product even further to below 0.9 % by weight at full plant capacity and gives the possibility that the biuret content remains within the required specification limits even at reduced granulation plant capacities.

5.4. UREA AND AMMONIA EMISSION VALUES IN THE WASTE WATER

During the performance demonstration test the flow of process condensate to this waste water treatment section appeared to be about 25 % more than what was foreseen in the design of the revamped plant. The cause of these high amounts of process condensate was water entrance from external sources inside and outside the Battery Limit of the plant.

Next from the increased load to the waste water treatment section, the hydrolyser heat exchanger was by-passed due to badly leakages in this equipment in combination with heavy (oil) fouling as mentioned in section 5.2.2 in this report. As a consequence the process condensate supplied to the hydrolyser was relatively cold .

To compensate, the supplied high-pressure steam to this hydrolyser was much more as foreseen in the design which has its consequences for the steam consumption of the plant as well as for the performance of the hydrolyser. Considerable more life steam injection into the hydrolyser led to more gas volume in this column and thus a reduced retention in the column.

Finally a reduced retention caused by the enormous amount of life steam supply to the hydrolyser and the non-foreseen large load to the waste water treatment in combination with the lower temperature in the column was the cause for the observed large urea content fluctuation in the waste water.

The large and fluctuating process condensate supply to the waste water treatment section and the non-availability of the hydrolyser heat exchanger made that the waste water section is manually operated. Most of the time the urea as well as the ammonia content in the waste water is below the design values (≤ 3 ppm wt. urea and ≤ 3 ppm wt. ammonia) but sudden fluctuations in the process condensate supply caused sudden high peaks in urea and ammonia content in this waste water since the waste water treatment section is on manual control.

These high peak values caused the high average urea content values in the daily average as is illustrated in the next figure

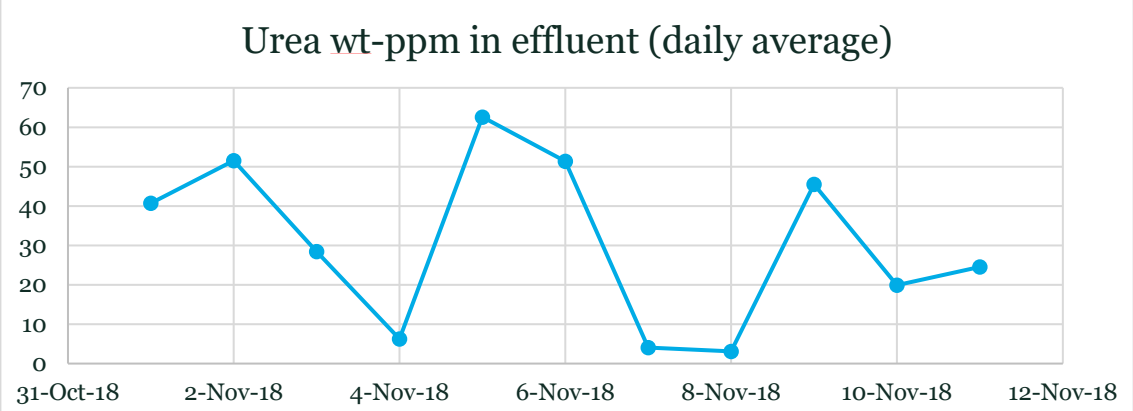

Figure 13: Daily average urea emission value in the waste water

When the water housekeeping in the plant is tuned and thus the fluctuations in the process condensate supply to the waste water treatment section remain into limits and the hydrolyser heat exchanger is cleaned and repaired, the waste water treatment section can be operated on automatic control and thus the urea as well as the ammonia emission values remain continuously below the design values.

6. CONCLUSIONS AND RECOMMENDATIONS

The statement that "Anything can be done and the impossible only requires more money!" is definitely a truism for revamp projects. Anyone attempting a revamp project must determine where the limit is and develop a plan to get there.

Sequencing is perhaps the most critical because revamp means modification of an existing, operating plant and continued production has the highest priority. This means that revamp projects are marathons rather than sprints.

The revamp team must maintain a vision of where they want to be when the project is finished and, ultimately, what constitutes project success. To make complex revamping of urea plants to a success needs the highest

skills from designers, engineers and operators. Therefore licensor, contractor and plant owner need to function as one team.

That such complex revamp projects can be successfully completed, has been demonstrated in Azomures. The urea plant is a spider in a site web. The urea plant serves the existing melamine plant as well as the existing UAN plant from urea feedstock. Besides urea granules are produced. The plant shows stable, ease in operation and has the flexibility to serve all attached units according to their requirements.

Although not all plant objectives were successfully demonstrated in the performance test, there is no reason to believe that the plant is not able to do so when certain repairs are in place. Besides, achieving the required low-biuret content in the granulated end-product shall need continuously attention. The cause is the long distance between the granulation section and the evaporation section in the urea melt plant.

7. SUMMARY

Two conventional total recycle plants, each with a capacity of 450 metric tons per day, were combined into one single urea plant that produces 1425 metric tons per day. This is achieved by converting the two original synthesis sections in one single synthesis section following the example of the LAUNCH MELT™ Compact Design that has been presented in the Stamicarbon urea symposium in 2008.

Besides the increased plant capacity, the revamp project objectives were as follows:
- Decrease of the specific energy consumption
- Product switch from urea prills to urea granules
- Emission reduction

The urea plant produces the urea feedstock for the existing melamine and UAN plants next to the urea granules that is produced in the newly installed Stamicarbon granulation section. This multiproduct requirement made this revamping project unique.

The paper describes the implementation of the design as has been experienced and the achievements made.

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