NEXTCHEM

UNFOLD
STAMICARBON
15TH SYMPOSIUM 2026

TECHNICAL GRADE UREA GRANULATION

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AGENDA

01 INTRODUCTION

02 TGU TECHNOLOGY BACKGROUND

03 HFC EXPERIENCE & OPERATIONAL CHALLENGES

04 CONCLUSIONS

INTRODUCTION

INTRODUCTION

UNFOLD STAMICARBON 15TH SYMPOSIUM 2026

- **Helwan Fertilizers Company** located in Egypt runs a 1925 MTPD Stamicarbon urea granulation plant.
- In February 2024, HFC informed Stamicarbon that they can produce granules without formaldehyde.
- And indicated that they like to sell those Granules as Technical Grade Urea (TGU). The TGU premium is +100 US$/ton compared to fertilizer grade.
- In May 2024, after a site visit, a collaboration agreement was signed to optimize and commercialize the TGU granules together. A patent was filed.
- In 2025, TGU production by HFC reached 70.000 tons.

30 YEARS OF STAMICARBON LAUNCH® FINISH™ GRANULATION EXPERIENCE

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30+

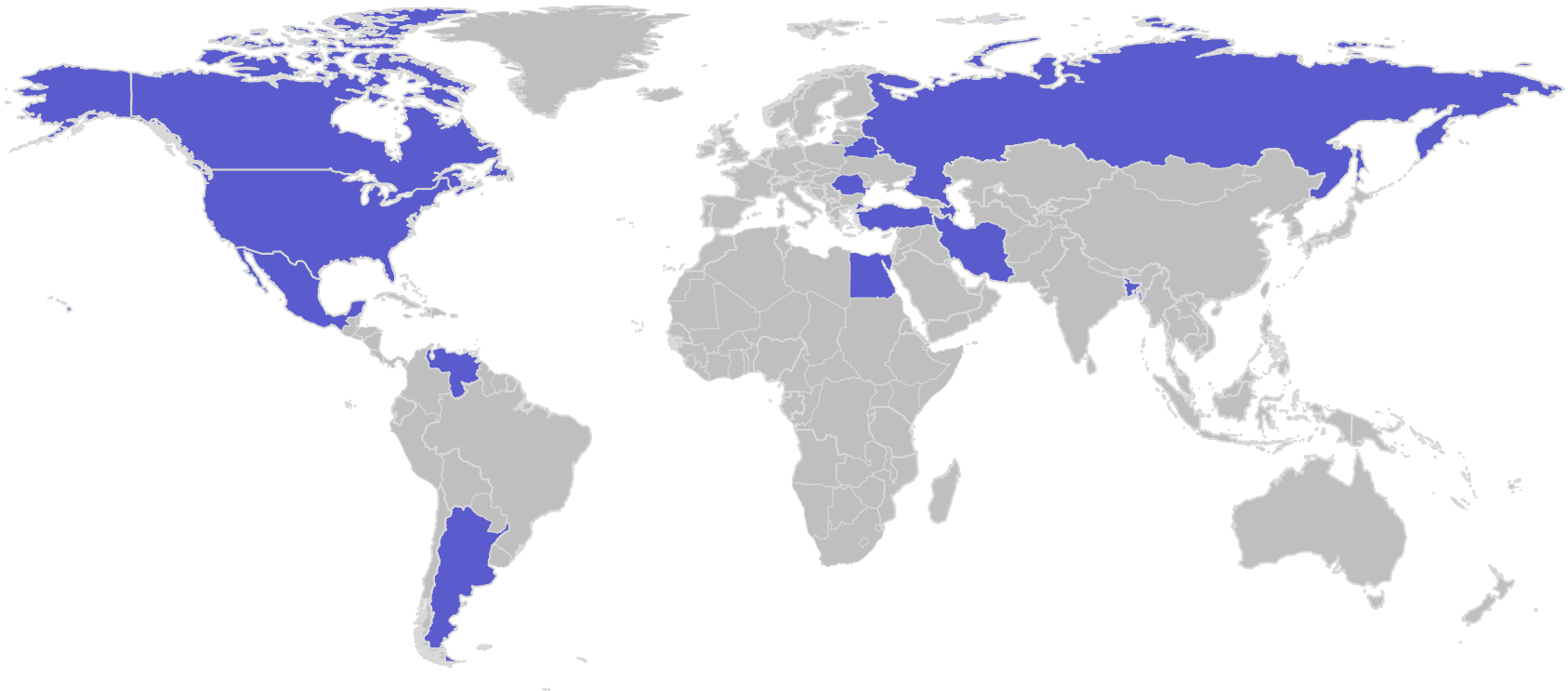
LICENSES SOLD WORLDWIDE

60%

MARKET SHARE IN LAST 5 YEARS*

4000

MTPD – MAX. CAPACITY LICENSED UNTIL TODAY



*Considering awards in the last five years, based on awarded capacity that has reached FID phase

STAMICARBON GRANULATION

PROPRIETARY NOZZLE

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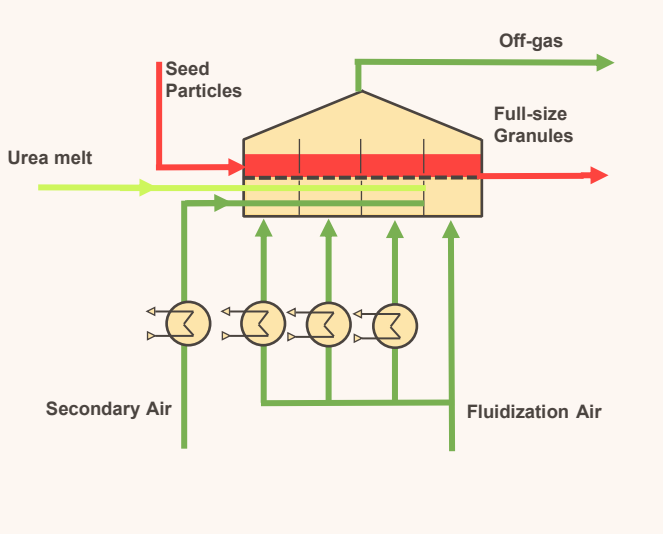
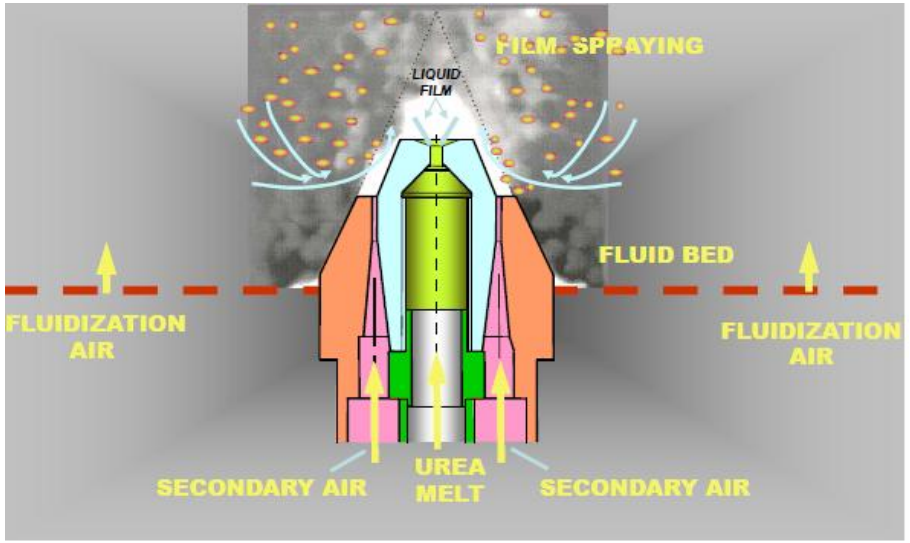
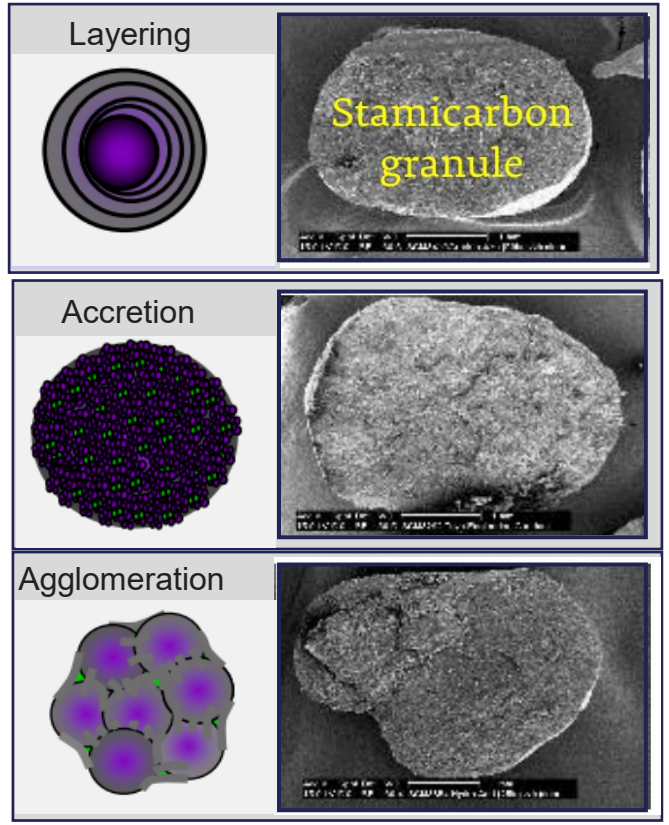
PROPERTIES OF STAMICARBON FILM SPRAYING NOZZLE:

- Large reduction in
  - formaldehyde consumption and
  - urea dust formation

  compared to other technologies, resulting in lower OPEX costs
- Long running times (averaging 90 days), unmatched on the market, due to less dust formation owing to the applied film spraying nozzles







STAMICARBON GRANULATION FINAL PRODUCT QUALITY

UNFOLD STAMICARBON
15TH SYMPOSIUM 2026

	UNIT	EXPECTED VALUES
Nitrogen	wt %	≥ 46.3
Biuret	wt %	≤ 0.9
Water	wt %	≤ 0.2
Formaldehyde	wt %	≤ 0.3
Free ammonia	ppm	≤ 50
Temperature	°C	≤ 50
d_{50}	mm	3.0
Crushing strength (granule of 3.15 mm)	kgf	≥ 4.5
Fraction of product between 2 – 4 mm		≥ 0.95
Fraction of product < 1 mm		≤ 0.02
Washing interval	*Avg days*	*90*

1.3M€/year in savings!

Compared to competitors with a concentration of 0.5wt% assuming: a 3000 MTPD production, UF85 quality (60% formaldehyde), cost of 400 €/ton UF85.

02

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TGU TECHNOLOGY BACKGROUND

TGU TECHNOLOGY BACKGROUND

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Component	Unit	DEF-32 specification	TGU granules specification
Urea	wt%	31.8 – 33.2	99 min.
Biuret	wt%	0.3 max.	0.9 max.
Formaldehyde	ppm	5 max.	15 max.

FGU: Fertilizer Grade Urea
TGU: Technical Grade Urea

→ If >0.85wt% in **FGU**, biuret reduction tool is required.

→ It requires complete shut-off of formaldehyde dosing and isolation of the wet recycle containing formaldehyde (initially).

With shuting-off of the formaldehyde dosing, the problems happen:

- Crushing strength of granules decreases;
- Caking tendency of granules increases;
- Increase in dust formation in the granulation plant.

Solution →

Increase urea melt concentration

- Drawbacks are partially offset to acceptable levels;
- However, as urea concentration increases, biuret formation will be enhanced.

TGU TECHNOLOGY BACKGROUND

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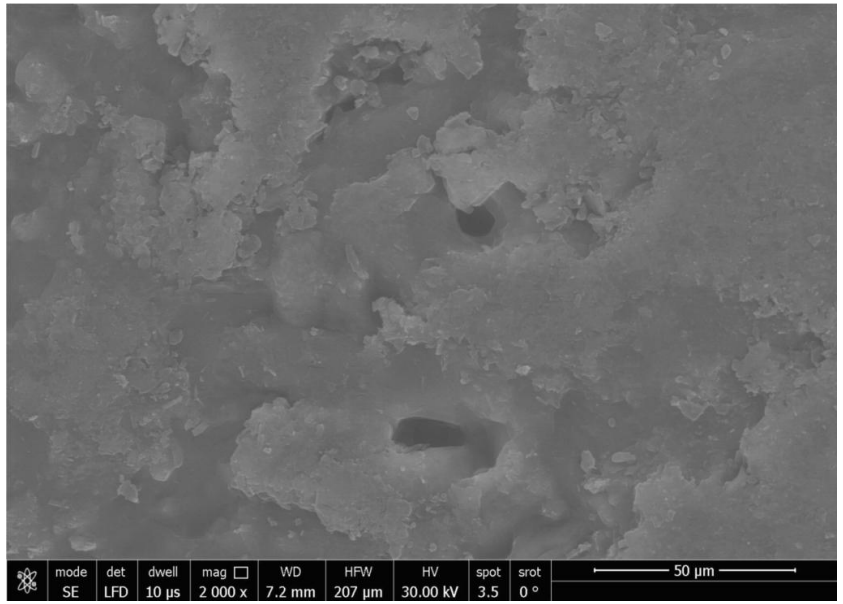
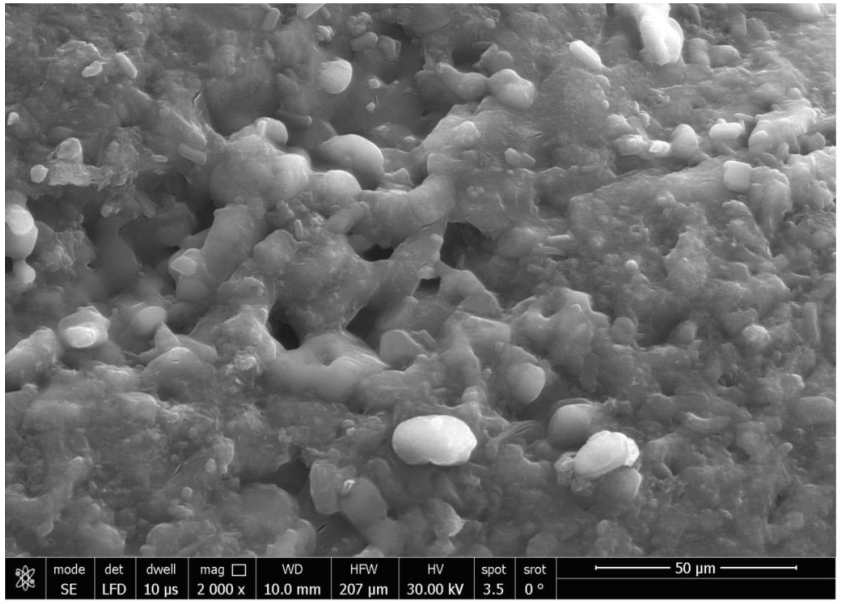


Urea granule with formaldehyde (**FGU**)



Urea granule without formaldehyde (**TGU**)

GRANULES FROM A FGU RUN HAVE A SMOOTHER SURFACE THAN THE ONES FROM A TGU RUN

Possible consequences in a TGU run:

- Less robust mechanical structure of the granule, leading to lower crushing strength;
- Higher specific surface area, leading to higher caking tendency;

TGU TECHNOLOGY BACKGROUND

FINAL PRODUCT QUALITY CRITICAL POINTS

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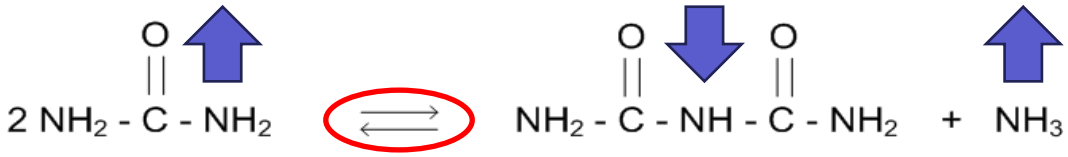
Formaldehyde

- In urea granulation processes, formaldehyde is used as a process aid. Removing it from the process results in lower crushing strength and increases the amount of abrasion dust.

Biuret



- Since the biuret formation reaction yields ammonia and is a reaction in equilibrium, an increasing ammonia concentration will shift the equilibrium toward the side of reactants, such as urea.
- **Biuret reduction tool** works by injecting a precise amount of ammonia at the lowest point of the line between the first and second evaporator.

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HFC EXPERIENCE & OPERATIONAL CHALLENGES

HELWAN FERTILIZERS COMPANY'S EXPERIENCE WITH TGU PRODUCTION

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BACKGROUND & CHALLENGES

The Role of Formaldehyde

*Used as **Granulation Additive** to enhance process efficiency and product quality. It provides the necessary structure and strength for standard fertilizer grade granules.*

> *"Stopping the injection results in significant operational Challenges and certain physical property deviations."*

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KEY OPERATIONAL CHALLENGES:

- Minimizing the changeover time between the FGU & TGU runs.
- Ensure the operational excellence of the granulation unit during TGU production.

Optimization:

*Showcase measures adopted by the **Stamicarbon** and **HFC** teams to optimize conditions and ensure compliance with TGU requirements.*

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1ST OPERATIONAL CHALLENGE:

Reducing transition time during switching process from fgu to tgu

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PRODUCTION PHASES

Phase 1
Fertilizer Grade Urea Production

Phase 2
Transition Process Formaldehyde Removal

Phase 3
Technical Grade Urea Production

Stopping of Formaldehyde Injection

Safe Threshold Formaldehyde < 15 ppm

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TRANSITION PHASE

Constraint:

Early trials revealed: formaldehyde reduction in the final product was slow, lasting more than 24 hours.

Impact:

High volumes of off-spec product.

Significant challenges for downstream operations

Challenge:

Minimizing transition time – Lowest off-spec product

Efficient TGU production

> ***"Switching to TGU requires a complete system clearing to meet high-purity specs"***

Transition Phase

> 24 hours

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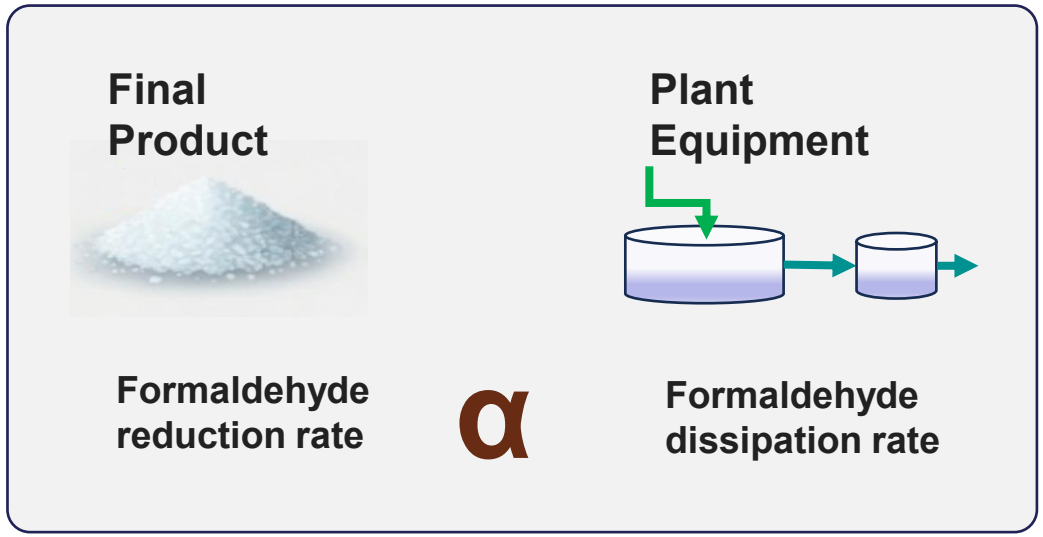
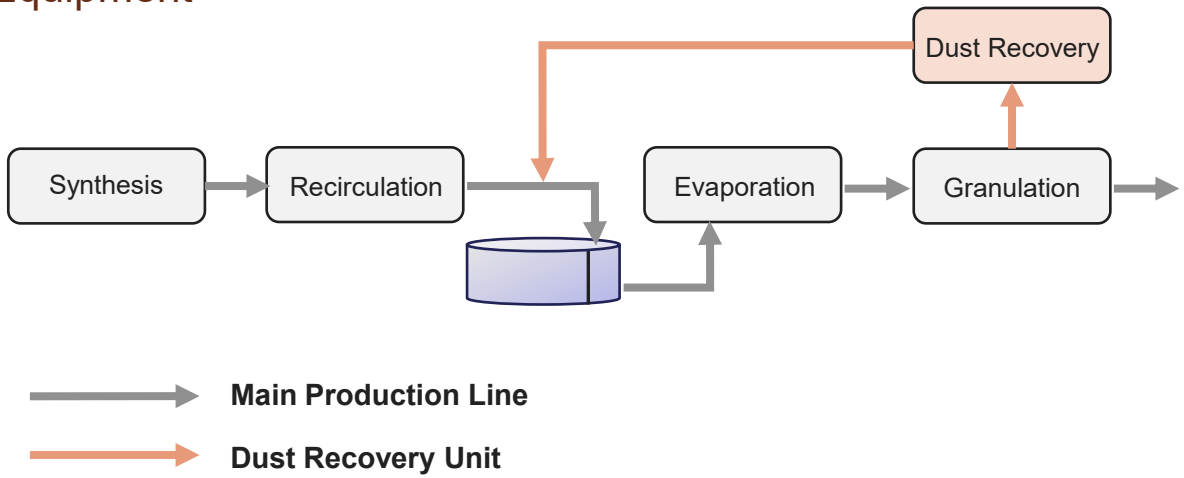
PROCESS DYNAMICS



Target of The Study:
Study the Dissipation profiles to Pinpoint the Rate Limiting Equipment



Base Line for Dissipation Time Investigation:
Formaldehyde Free Feed Solution

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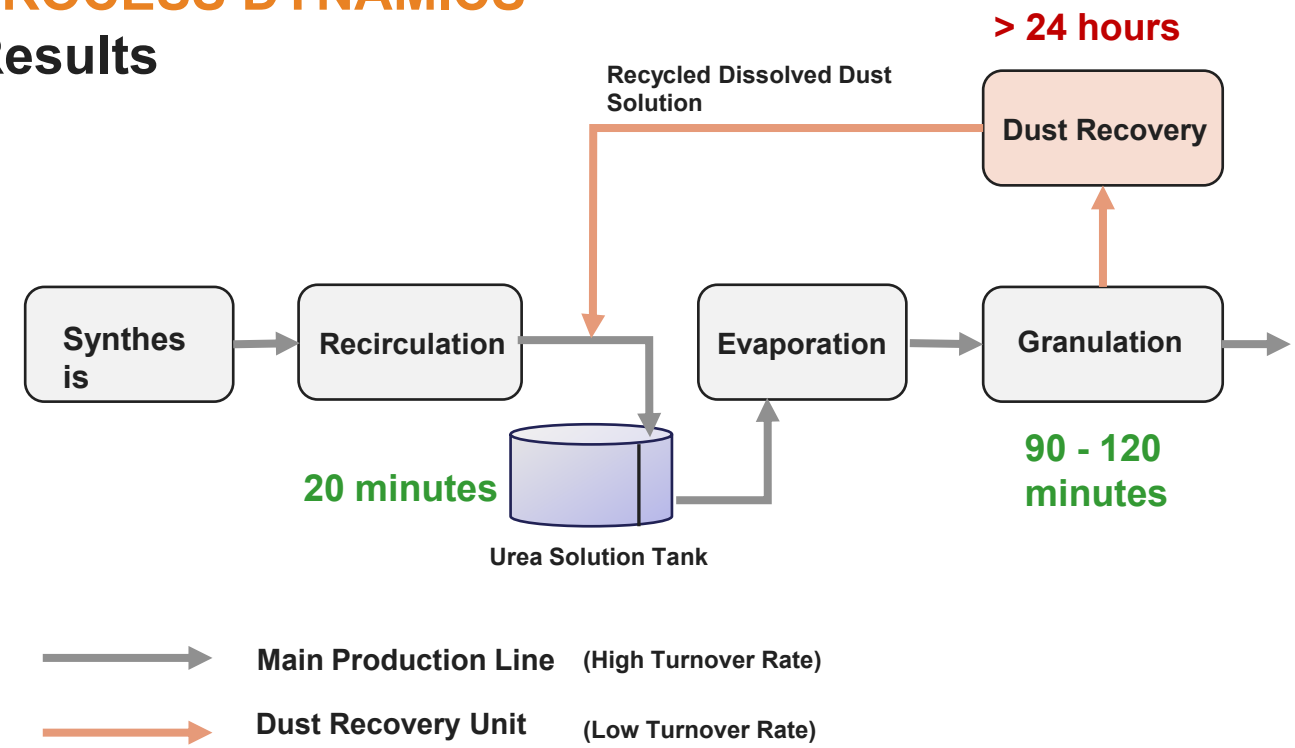
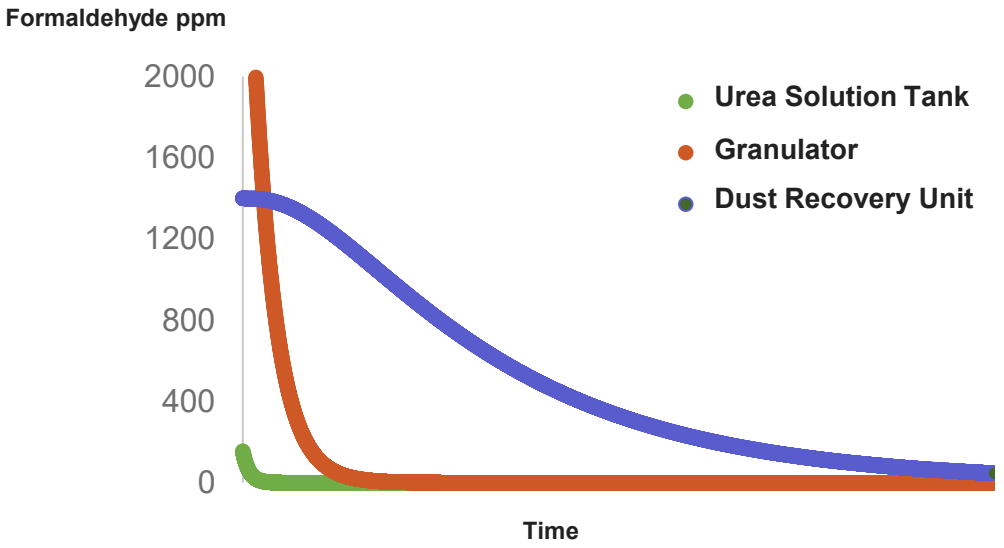
PROCESS DYNAMICS

Results





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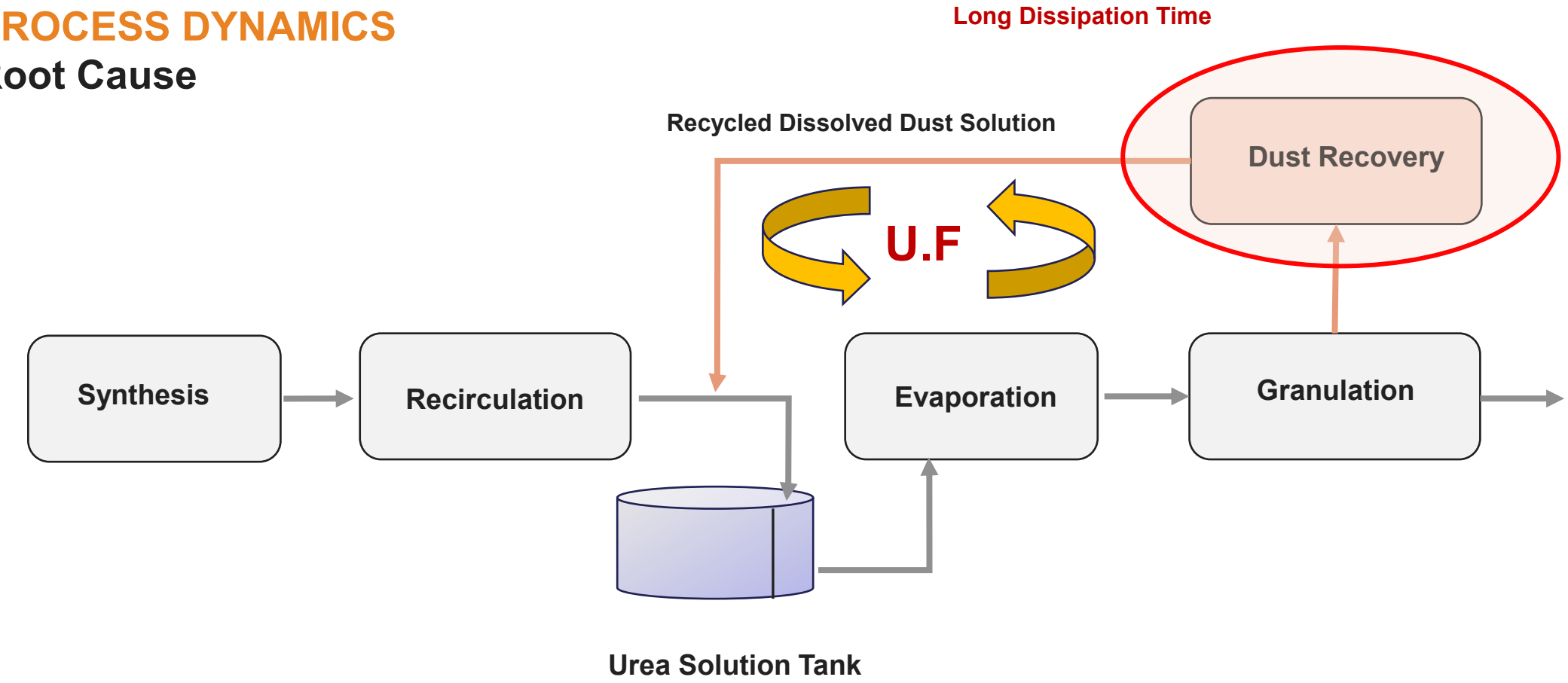
PROCESS DYNAMICS

Root Cause



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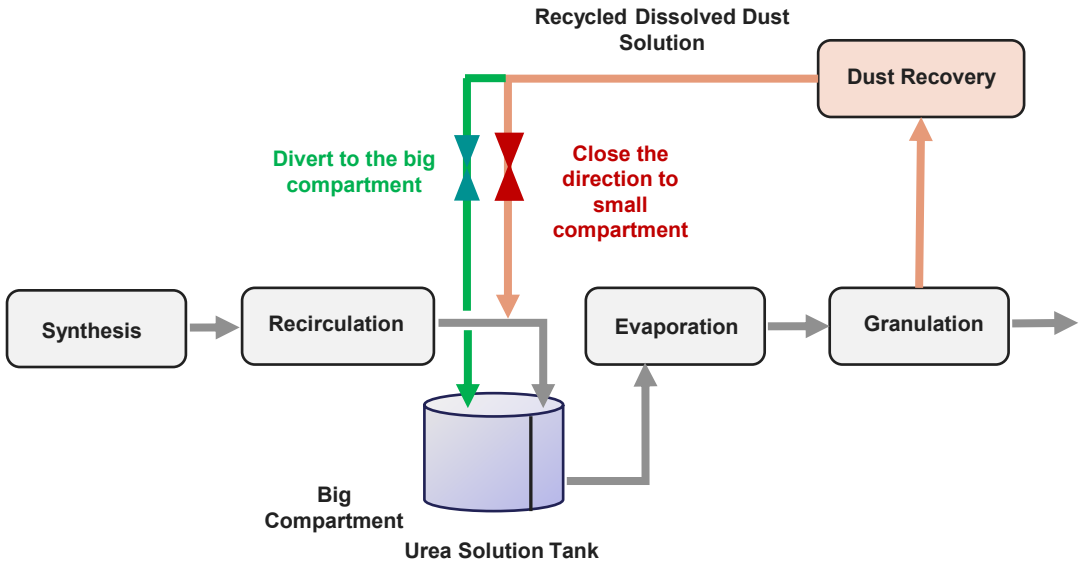
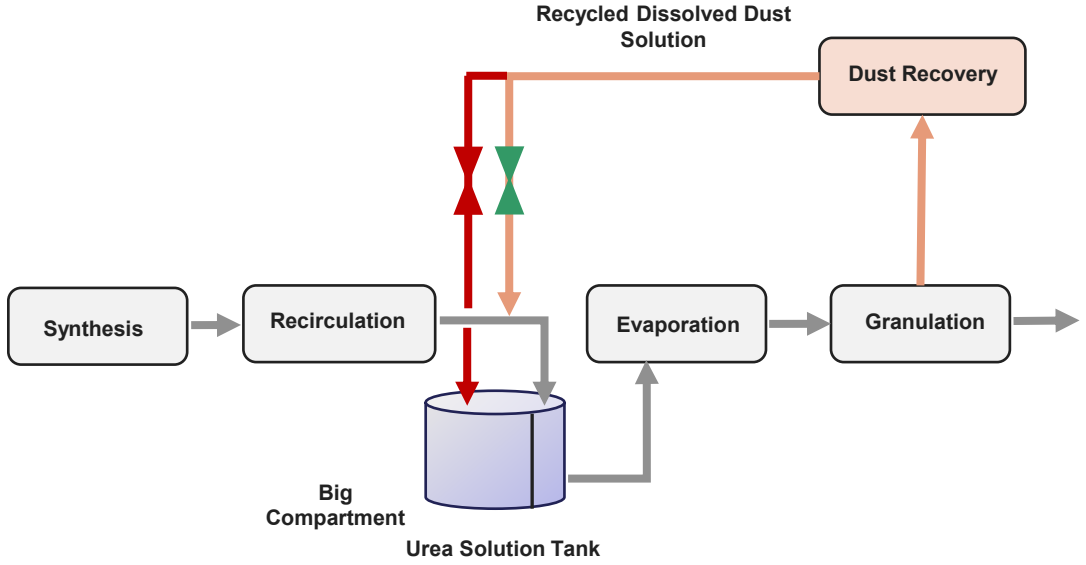
SOLUTION

1- Divert the recycled solution to standby capacity



2- Reintroduce the recycled solution
(Formaldehyde Level < 50 ppm)



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IMPROVEMENTS

Transition Phase: Reduced from 24 hours to 2 hours

Off-Spec Product: Minimized to the lowest possible amount.

> "The resulted off-spec amount is easily managed by Blending with FGU"

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2nd OPERATIONAL CHALLENGE:

Minimizing the impacts on Granulation Unit Performance during TGU Production

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GRANULATION RUNNING TIME

HFC has extensive experience with Stamicarbon's granulation technology.

Continuous runs of up to 5 months.

> *"A major concern with TGU production was the potential impact on granulator running time due to the expected high elevated dust levels during granulation process "*

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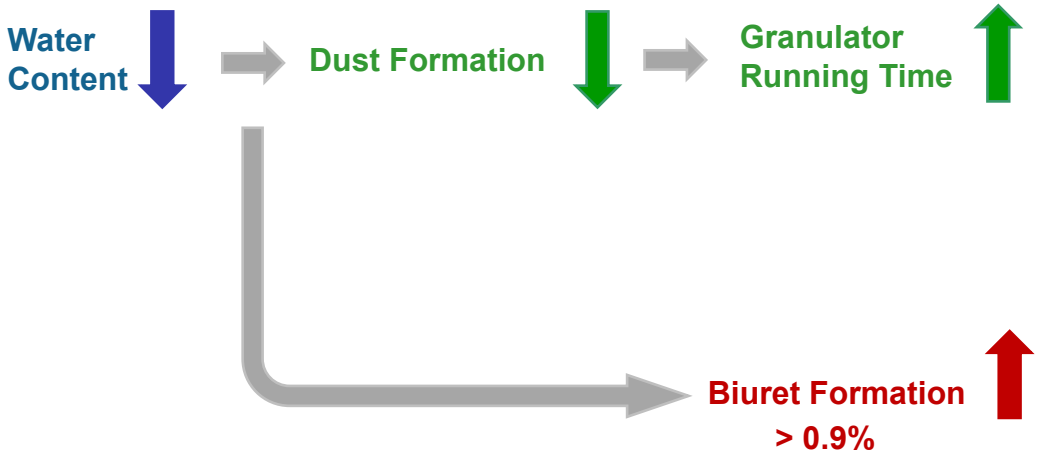
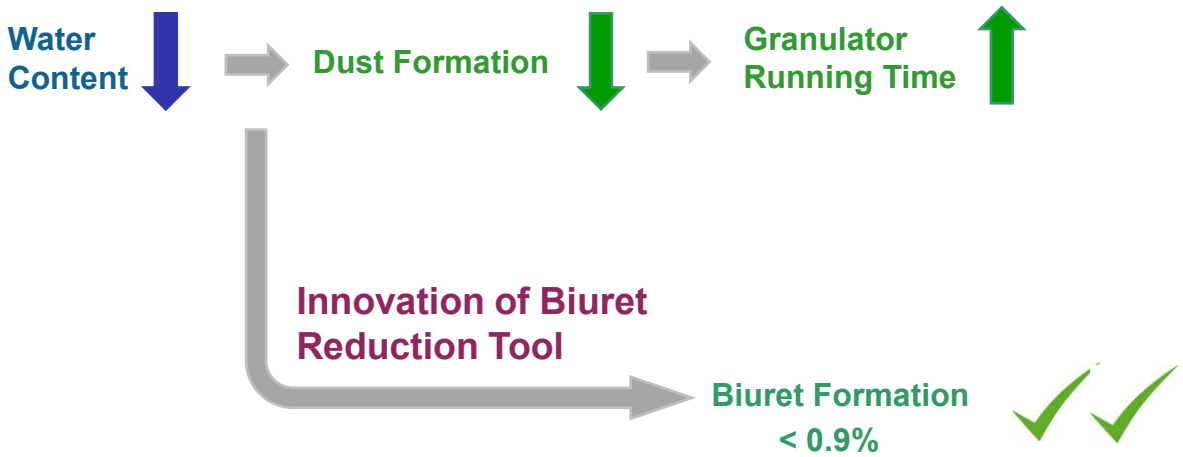
MEASURES TO REDUCE DUST GENERATED DURING GRANULATION PROCES

Reduce Water Content in The Injected Melt



Reduce Water Content in The Injected Melt & Utilize Biuret Reduction Tool



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MEASURES TO REDUCE DUST GENERATED

Optimizing Crusher Performance

- Routine cleaning.
- Adjusting the crusher gap.
- Inspecting dedusting lines.

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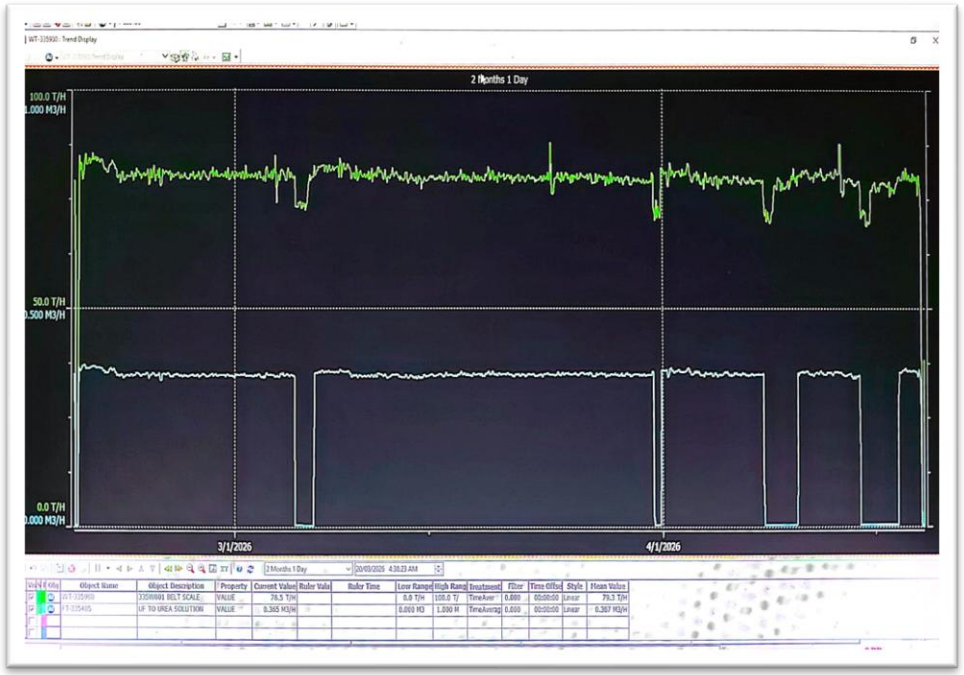
GRANULATOR'S RUNNING TIME WITH TGU PRODUCTION



The first case:

- **55-day** run length, including **three** TGU production cycles
- Total TGU Production of **11,000** tons.

The second case:

- **62-day** run length, including **four** TGU production cycles
- Total TGU Production of **11,000** tons.

OPERATIONAL PROCEDURE:

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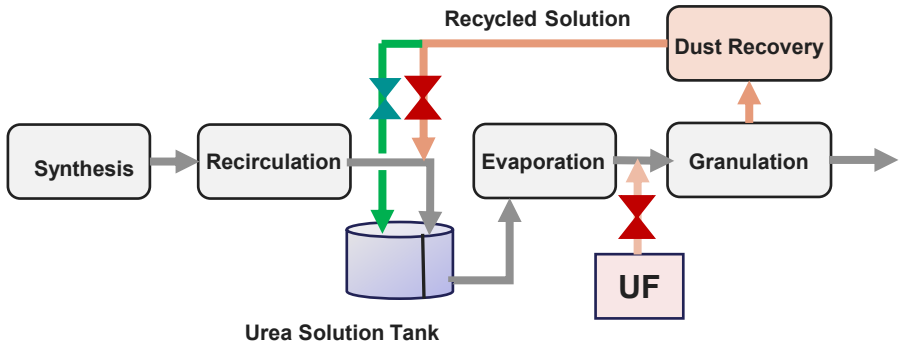
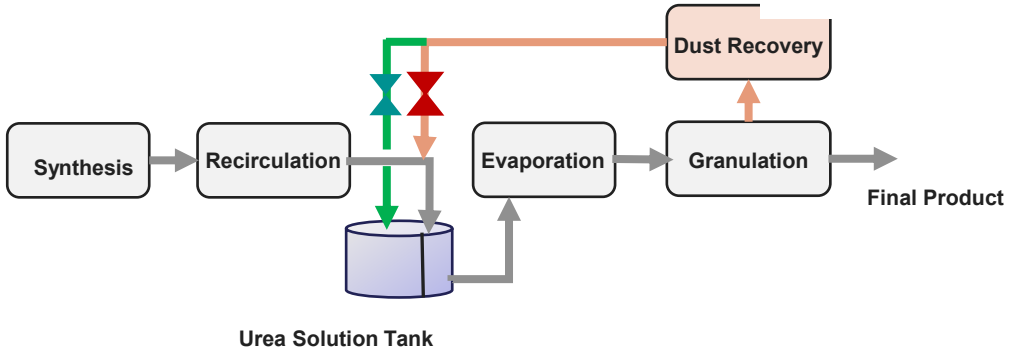
1

- Stop Formaldehyde injection.
- Divert the recycled solution to big compartment of U.S.T.



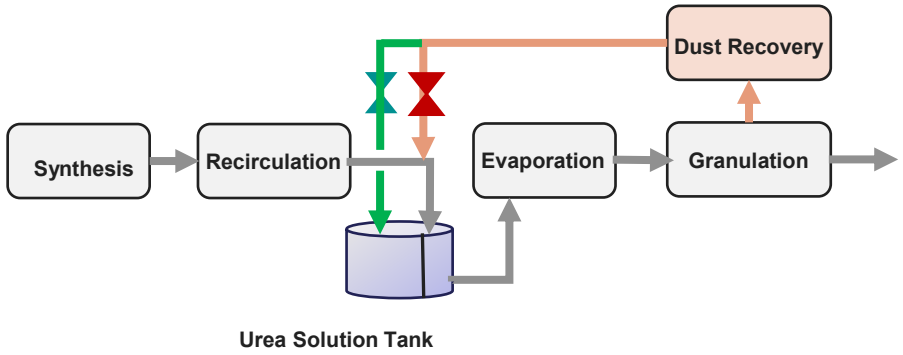
2

- Start Ammonia injection (Biuret Reduction Tool)
- Ensure Melt Concentration is as High as Possib
- Track formaldehyde concentration (Lab Analysis
final product.



3

- Start TGU production once formaldehyde concentration < 15 ppm.



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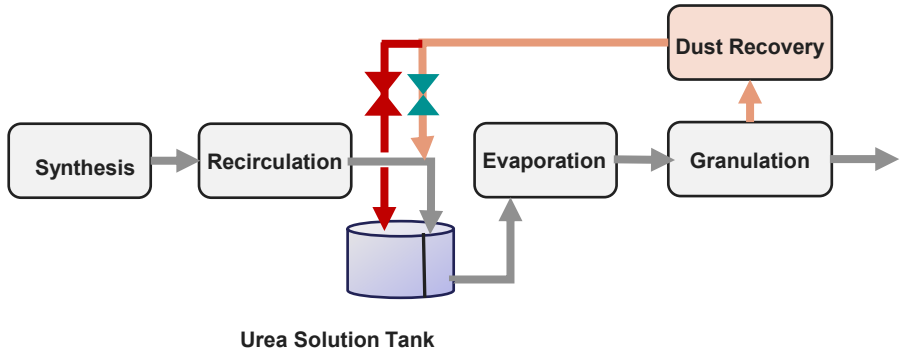
- Reintroduce the recycled solution after Formaldehyde Level drops to a safe level.



CONCLUSIONS

CONCLUSIONS

- ✓ Urea granulation without formaldehyde for TGU production is achievable with Stamicarbon granulation process;
- ✓ Tests and continuous operation at the HFC plant showed that it is possible in a granulation plant to switch between fertilizer grade to technical grade production;
- ✓ After optimization in the switch procedure and TGU operation, final product quality was enhanced and process disorders kept at minimum;
- ✓ This technology is now available to any Stamicarbon granulation client upon consultation, and it is available for both grassroot and revamp projects.

“We believe that the great industrial challenges we face demand exceptional partnerships, where the optimal solution lies in the synergy between the brilliance of design technology and the depth of operational expertise.”

Eng. Hassan Abd El-Aleem

Chairman of the Board of Directors of Helwan Fertilizers Company,

ACKNOWLEDGING KEY CONTRIBUTORS FROM HELWAN FERTILIZERS COMPANY

HELWAN FERTILIZERS CO.
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Technical Affairs Sector Head

Urea Operations Team

TGU SAMPLE

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THANK YOU

QUESTIONS?