Research and Development on Rainmaking Technology
to support Royal Rainmaking Operation

Thailand Institute of Scientific and Technological Research (TISTR)

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TISTR

A state enterprise under the Ministry of Science and Technology (MOST)

Vision

A leading organization in the integration of science, technology and innovation for the creation of a sustainable innovation-based society

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TISTR RESEARCH & SERVICE GROUPS

กลุ่มสายงานหลักทางด้านการวิจัย พัฒนา และการบริการของ วว. ประกอบด้วย 3 กลุ่มอุตสาหกรรม ได้แก่

Bio-Industries
วิจัยและพัฒนาด้านอุตสากรรมชีวภาพ

Sustainable Development
วิจัยและพัฒนาด้านพัฒนาอย่างยั่งยืน

Industrial Services
บริการอุตสาหกรรม

- InnoAg — Expert Center of Innovati Agriculture
- InnoFood — Expert Center of Innovati Health Food
- InnoHerb — Expert Center of Innovati Herbal Products
- InnoEN — Expert Center of Innovati Clean Energy and Environment
- InnoMat — Expert Center of Innovat Materials
- InnoRobot — Expert Center of Innovati Industrial Robotics and Automation
- BRC — Biodiversity Research Centre
- RTTC — Railway Transportation System Testing Centre
- MPAD — Material Properties Analysis and
- MTC — Industrial Metrology and Testing Service Centre
- TPC — Thai Packaging Centre
- OCB — Office of Certification Body

TISTR Recent Project

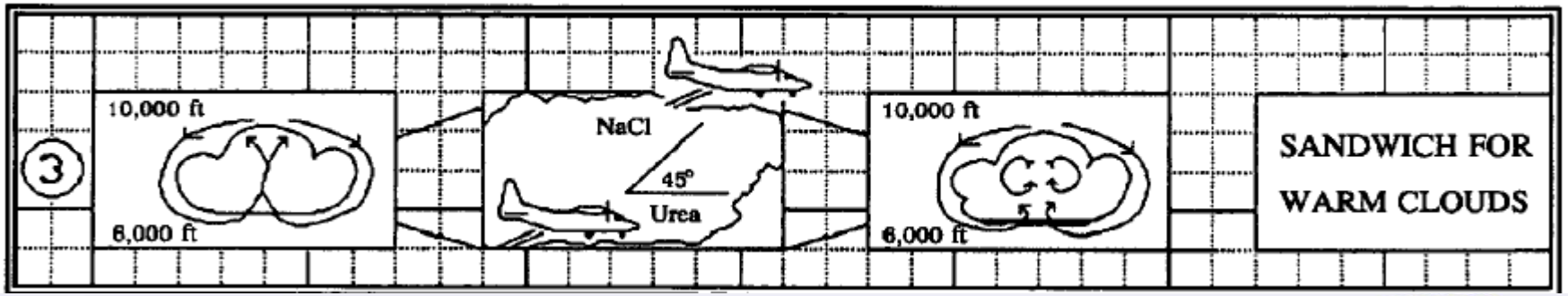
1. Development of grinding and spreading system for rainmaking substances

2. Pilot Research Project on Alternative Substances for Rain Enhancement Operation

1 Development of grinding and spreading system for rainmaking substances

Urea

- **Attacking Step of royal rainmaking operation**
- **To increase number of big raindrops and decrease the in-cloud temperature due to endothermic reaction**



Urea

- Commercial urea is usually in granular (2-5 mm)or prill (1-3 mm)form and it have to be grind before using.
- Urea are grinded daily before the attacking step of royal rainmaking operation
- At present, No stock of grinded urea due to the serious caking problem resulting in formation of lumps of urea.

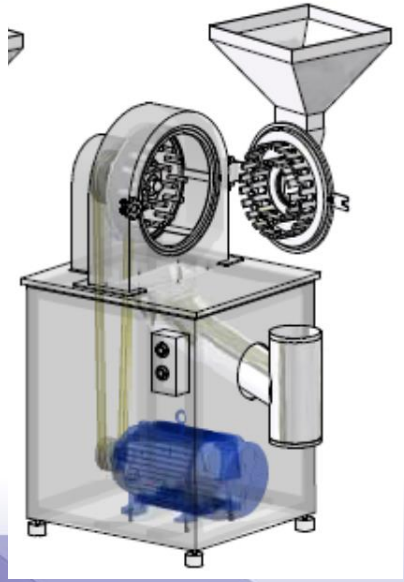
Research & Development

Urea Milling

Urea Storage

Spreader

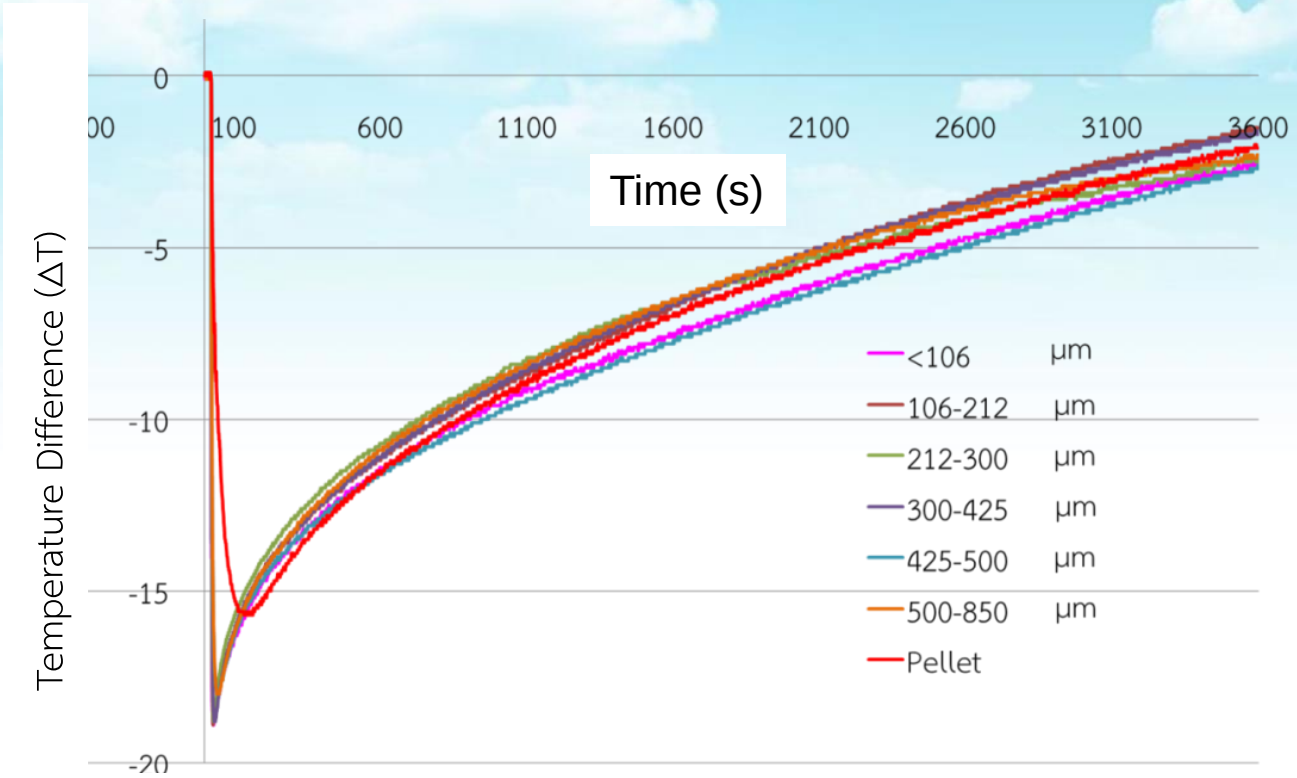
Grinding Machine



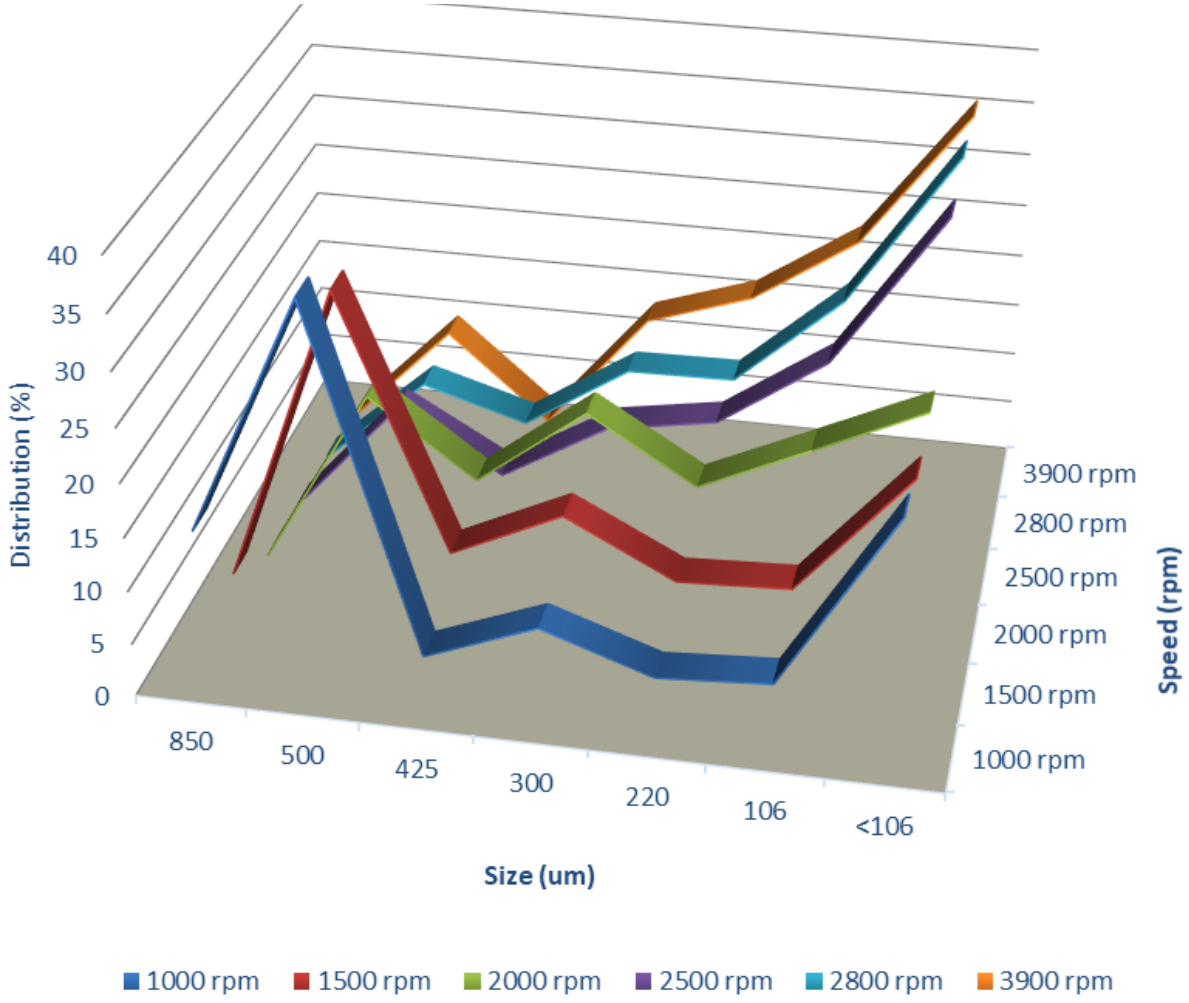
A Pin Mill , a high impact grinder and sufficient to comminute urea by the action of pins that repeatedly move past each other. The increasing of rotating pin disk speed can reduce the size distribution of urea.

What the size of urea particle should be suitable for rainmaking process ?

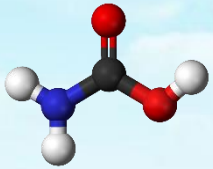
Effect of size of urea on endothermic properties

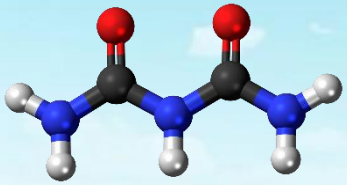


The size distribution of urea after grinding at various spindle speed of pin mill



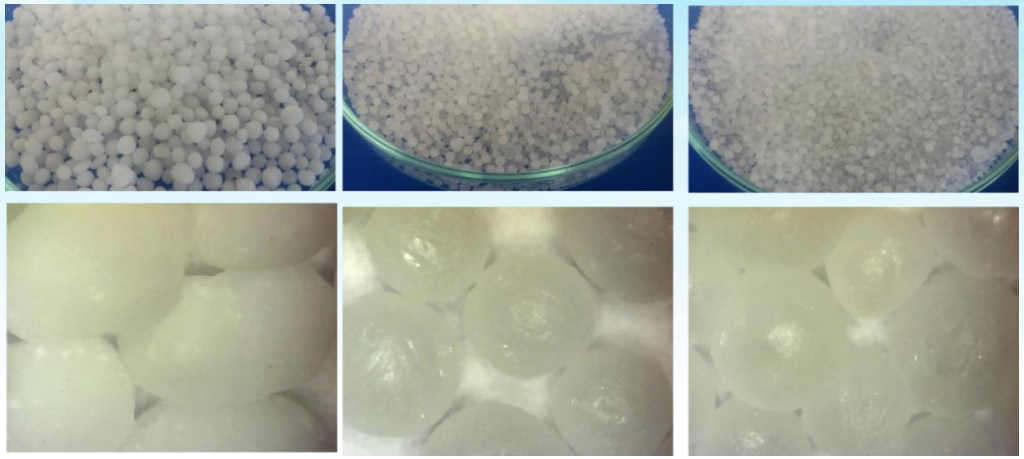
Urea particle properties





	Urea N*(%)	Biuret (%)	Moisture (%)
Before grinding	46.6	0.9	0.3
After grinding	46.8	0.9	0.3

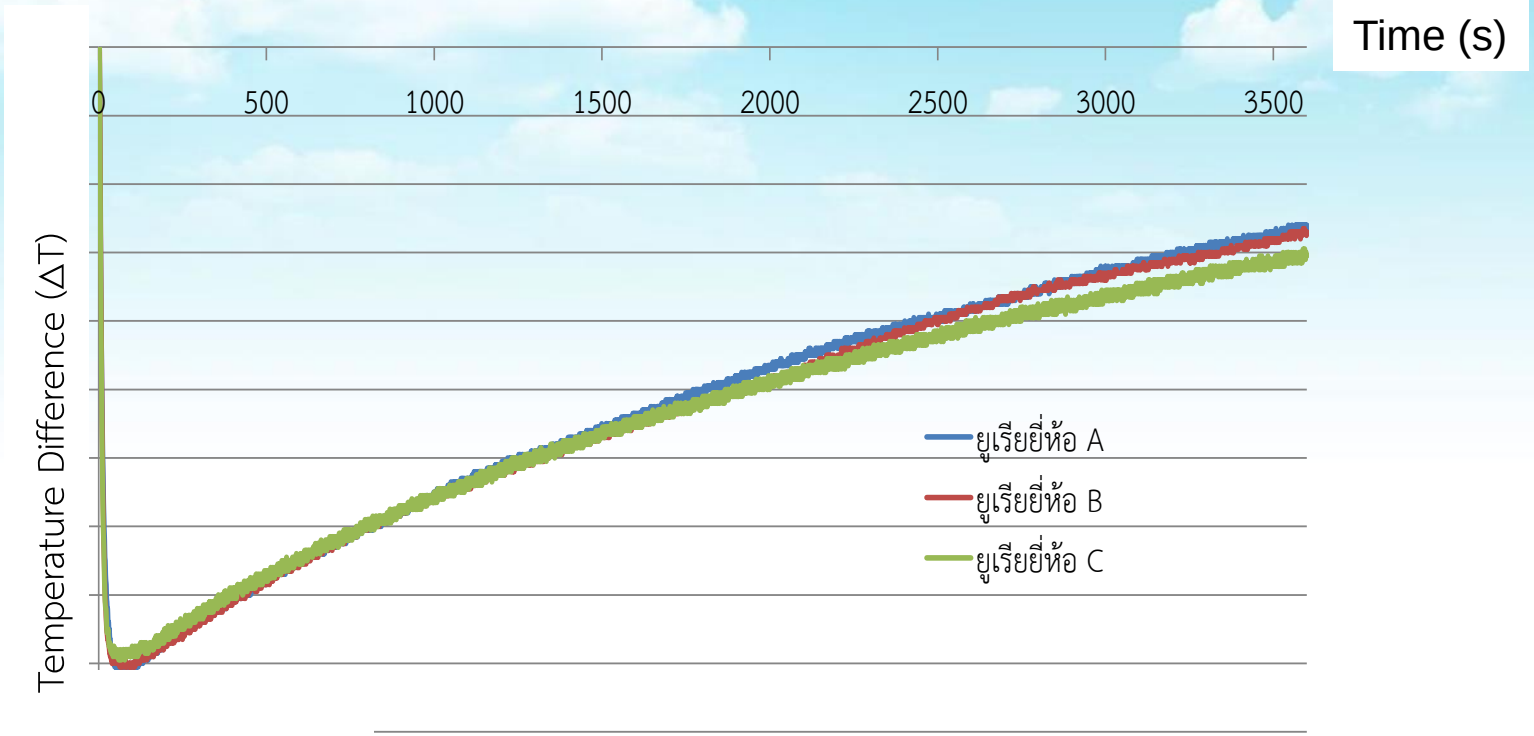
Specification of Urea

Brand	A	B	C
			
	Granular	Prill	Prill
Size	2-5	1-3	1-3
Moisture Content (BG)	0.3-0.5max	0.1-0.3 max	0.1-0.2max
Moisture Content (A)G	0.3-0.4max	0.1-0.2 max	0.1-0.2max
External Anticaking	Yes	No Information	No Information

BG= Before Grinding

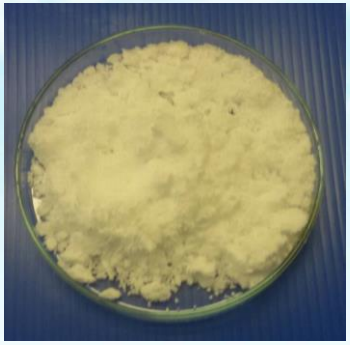
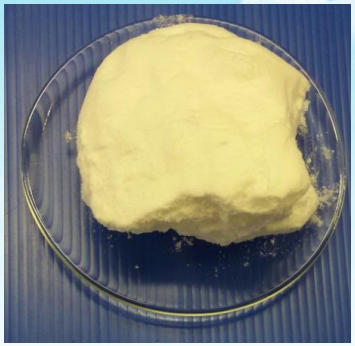
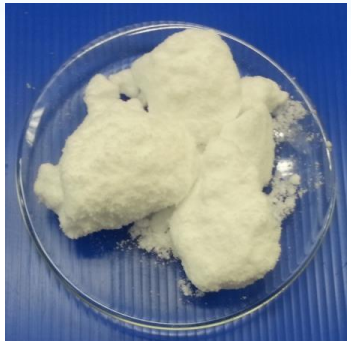
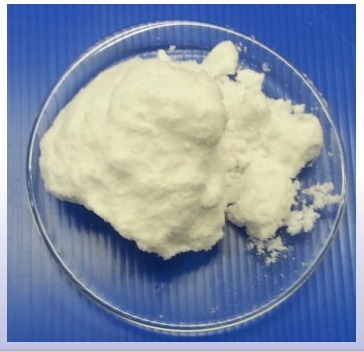
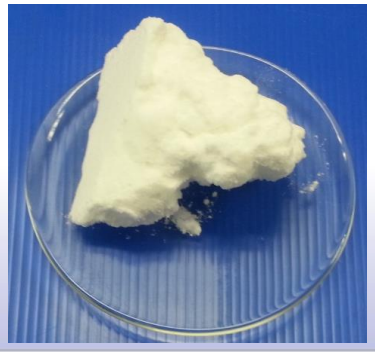
AG = After Grinding

Temperature Difference (ΔT)

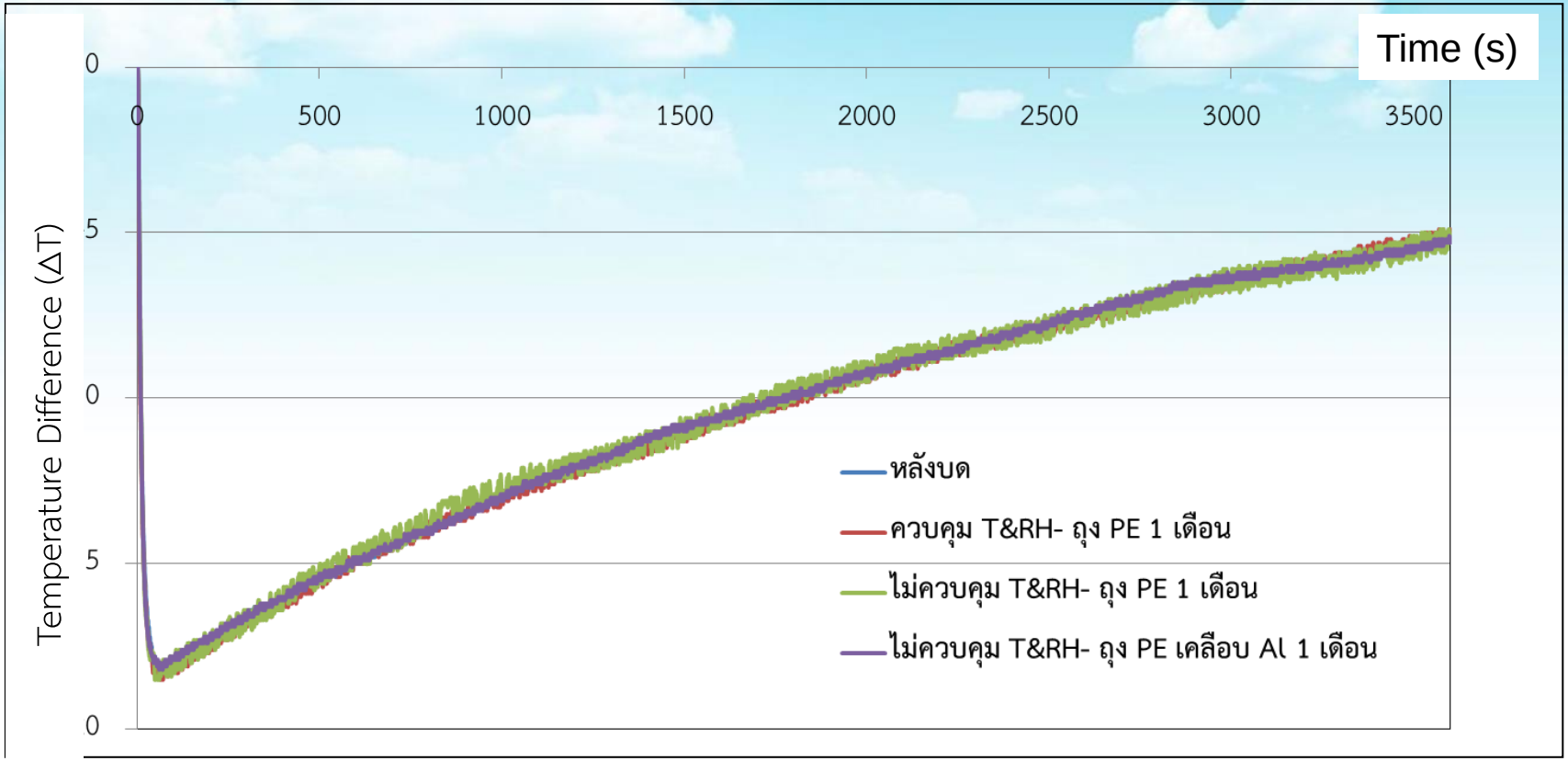


อุณห ปลี่ยนแปลง (˚C)

Storage for 1 month

Brand	A	B	C
PE Bag T and RH control			
PE Bag No T and RH control			
PE coated Al Bag No T and RH control			

Temperature Difference (ΔT)



Brand A

What make urea brand A different ?

1. Anti caking agent on the urea surface (External anti caking)
2. Internal conditioner (Internal anti caking)

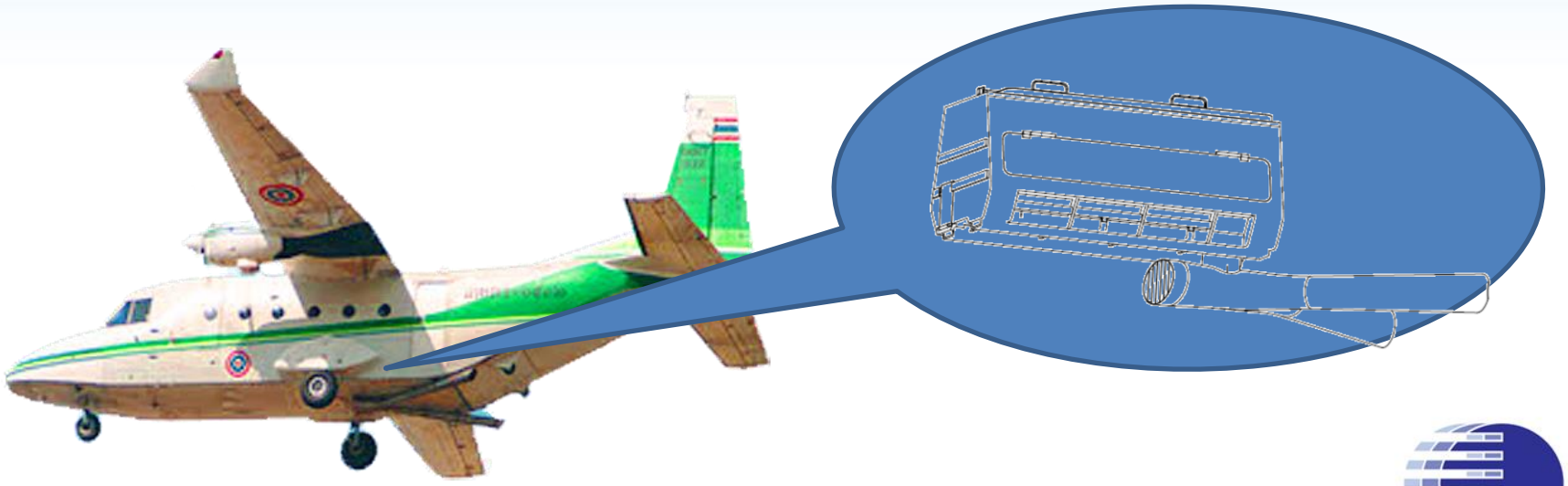
For the granular urea, the internal conditioner are usually added in urea during processing as hardener to improve storage and anticaking properties.

Urea	Crushing Strength/granule (N)
Brand A	28
Brand B	0.007
Brand	4

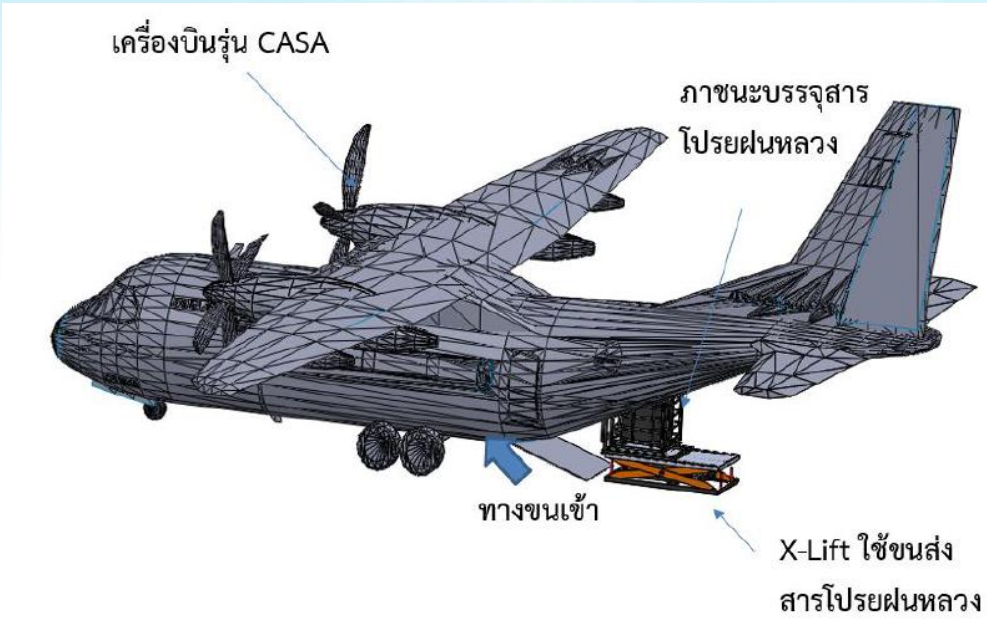
Crushing or static strength is an important specification of urea. Higher crushing strength can improve the storage properties and can prevent the serious caking problem.

The Rainmaking Substances Spreader Development

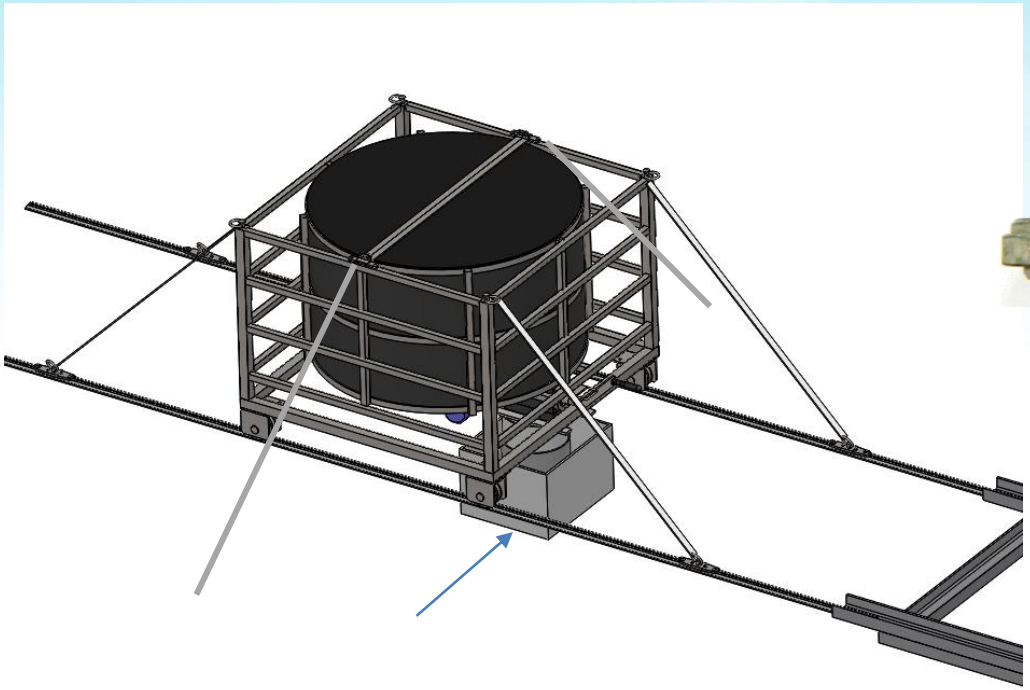
The spreader prototype consist of spreader machine and spreader tube. The machine can control feed rainmaking substance go to target. And spreader tube has designed shape to increase flow rate and to reduce caking while flow through



Concept Discussion



Fixture Design

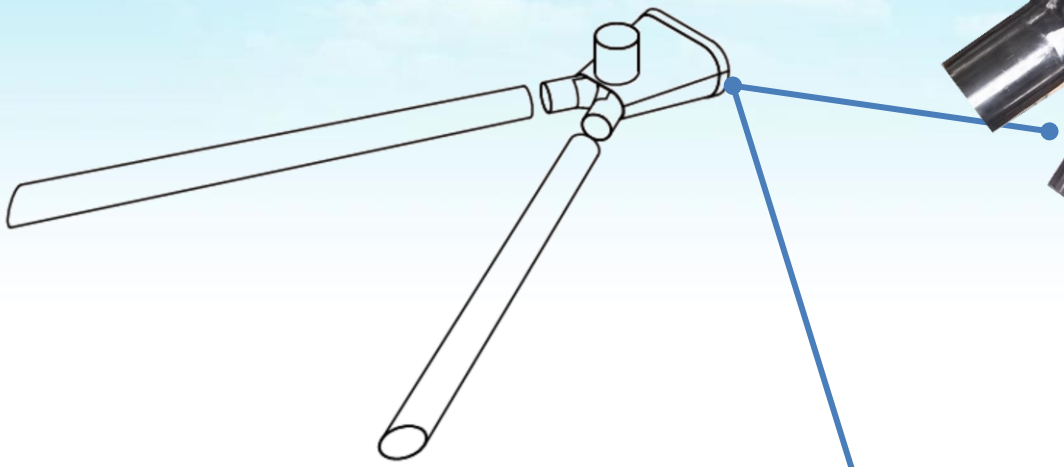


Urea particle spreader

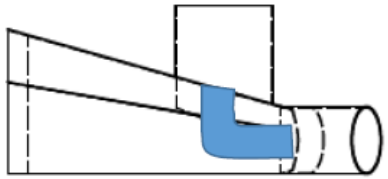
Tank capacity 1,000 kg
Feed rate 2 Ton/hr.
screw Feeder type

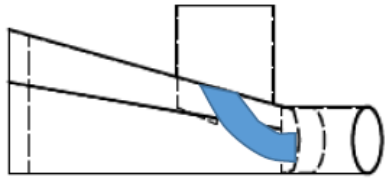
Tank capacity 300 kg
Feed rate 2 Ton/hr.
Impeller Feeder type

spreader tube



Epoxy coating reduce corrosion and clogging





New Design for free flow substances

Thank you

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