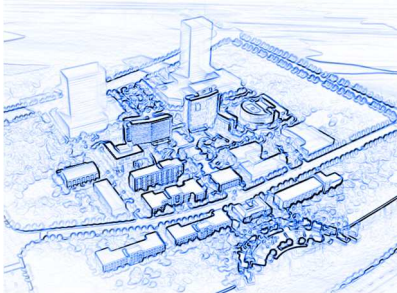




## **Brief Introduction of Slow/Controlled Release Fertilizer Industry of China & Related Standards**



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China National Technical Committee for Standardization of Fertilizer & Soil Conditioner (CNTCS of F&SC)



## **Outlines**

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**2. Slow/Controlled Release Fertilizer Industry in China**

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## Introduction to SRICI & CNTCS of F&SC

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- **Shanghai Research Institute of Chemical Industry (SRICI)**

Founded in Sep. 1956

Key Research Institute of China Chemical Industry

Founder and Frontier of China Fertilizer Industry



- **China National Technical Committee for Standardization of Fertilizer & Soil Conditioner (CNTCS of F&SC), i.e., SAC/TC 105**

Standardization Administration of the People's Republic of China/Technical Committee 105 (SAC/TC 105)

Corresponding to ISO/TC134

Founded in 1988, the 5th Committee up to now

Chairman & Secretary-general---- both from Shanghai Research Institute of Chemical Industry

ISO/TC134 WG1 Convener: **Prof. Gang LIU**



## Slow/Controlled Release Fertilizer Industry in China

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**China: one of the most important countries among the world on slow/controlled release fertilizer production and application**

The consumption of China accounted for 1/2 of the world (2012)

Yield/sale of slow/controlled release fertilizer in China=1,350,000t, including:

- Polymer-sulfur double coated fertilizer=550,000t
- Sulfur coated fertilizer=500,000t
- Polymer coated fertilizer=200,000t
- Urea formaldehyde fertilizer=100,000t

**>30 research institutes in China engaged in slow/controlled release fertilizer research**

**>70 enterprises & units engaged in the industrialization, production and extension of slow/controlled release fertilizer in China**

Including: Shangdong Kingenta Ecological Engineering Co., Ltd, Shanghai Hanfeng Slow-Release Fertilizer Co., Ltd, Shikefeng Chemical Industry Co., Ltd, etc.

**7 national & industrial standards in the field of slow/controlled release fertilizer established in China**



## China's Standards on Related Fields

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### 6 product standards & 1 standard of rapid-detection method in the field of slow/controlled release fertilizer in China

- GB/T 23348-2009 National Standard of <Slow Release Fertilizer>
- HG/T 3997-2008 Chemical Industry Standard of <Sulfur Coated Urea>
- HG/T 4135-2010 Chemical Industry Standard of <Stabilized Fertilizer>
- HG/T 4137-2010 Chemical Industry Standard of <Urea Aldehyde Slow Release Fertilizer>
- HG/T 4215-2011 Chemical Industry Standard of <Controlled Release Fertilizer>
- HG/T 4216-2011 Chemical Industry Standard of <Fast Methods to Determine the Longevity and Release Rate of Slow/Controlled Release Fertilizers>
- HG/T 4217-2011 Chemical Industry Standard of <Inorganic Material Coated Compound Fertilizer (Complex Fertilizer)>



## GB/T 23348-2009 National Standard of <Slow Release Fertilizer>

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- **Slow Release Fertilizer:** The available nutrient content of fertilizer could be slowly released over time via chemical or physical reaction within the nutrient
- **Partial Slow Release Fertilizer:** Fertilizer containing a nutrient with partial slow release characteristics, which is made by blending slow release fertilizer and conventional fertilizer, to make some nutrient content have the character of slow release
- The products shall be divided, by key categories, into: **slow release nitrogenous fertilizer, slow release potash fertilizer, slow release compound fertilizer, slow release complex fertilizer, slow release bulk blending fertilizer (BB fertilizer), etc**
- The slow release performance characterized by several factors: **nutrient release period, initial release rate of nutrient, 28d cumulative release rate of nutrient, cumulative release rate of nutrient during nutrient release period, slow release nutrient content, etc**



## Requirements on Slow Release Fertilizer

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Items	Values	
	High Concentration	Middle Concentration
Mass ratio of total nutrient (N + P <sub>2</sub> O <sub>5</sub> + K <sub>2</sub> O) /% ≥	40	30
Mass ratio of water-soluble P to effective P /% ≥	60	50
Mass ratio of water /% ≤	2.0	2.5
Particle size (1.00mm ~ 4.75mm or 3.35 ~ 5.60mm) /% ≥	90	
Nutrient release period /month =	Declaration	
Initial release rate of nutrient /% ≤	15	
Cumulate release rate of nutrient in 28 days /% ≤	80	
Cumulate release rate of nutrient during nutrient release period /% ≥	80	



## HG/T 3997-2008 Chemical Industry Standard of <Sulfur Coated Urea>

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- **Sulfur Coated Urea:** A slow controlled fertilizer with sulfur as the main material coating urea particles, to realize slow release of nitrogen
- Applicable to the **slow/controlled release fertilizer with sulfur as the main material coating urea particles to realize slow release of nitrogen**, and also applicable to the **slow/controlled release fertilizer containing sulfur coated urea**
- The controlled-release performance characterized by factors as: **initial release rate of nutrient, seven days dissolution rate, controlled-release nitrogen nutrient content, etc**



## Requirements on Sulfur Coated Urea

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Items	Values		
	Type I	Type II	Type III
Mass fraction of total nitrogen (N) /% $\geq$	37.0	34.0	31.0
Initial release rate of nutrient /% $\leq$	27	15	10
Seven day dissolution rate (TVA, SDDR method) /% $\leq$	35	25	15
Mass fraction of sulfur (S) /% $\geq$	10.0	15.0	20.0
Mass fraction of biuret /% $\leq$		1.5	
Mass ratio of water /% $\leq$		1.0	
Particle size (1.00mm ~ 4.75mm or 3.35 ~ 5.60mm) /% $\geq$		90	



## HG/T 4135-2010 Chemical Industry Standard of <Stabilized Fertilizer>

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- **Stabilized Fertilizer:** a kind of nitrogen fertilizer (including those binary and tertiary nitrogen fertilizer as well as straight nitrogen fertilizer) which longevity could be extended by adding urease inhibitor and (or) nitrification inhibitor; The urease inhibitor in the soil can help prevent the hydrolysis of urea, while the nitrification inhibitor could suppress the nitrification process of ammonium nitrogen.
- Applicable to those **Stabilized Fertilizers which contain nitrogen (amide-nitrogen/ammonium nitrogen) produced by adding urease inhibitor and/or nitrification inhibitor.** (For those fertilizer produced by adding urease inhibitor, urea must be contained)
- The controlled-release performance characterized by several factors: **urea residual difference rate & nitrification inhibition rate**



## Requirements on Stabilized Fertilizer

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Item	Stabilized Fertilizers type 1 (containing urease inhibitor only)	Stabilized Fertilizers type 2 (containing nitrification inhibitor only)	Stabilized Fertilizers type 3 (containing both urease inhibitor and nitrification inhibitor)
urea residual difference rate /% $\geq$	25	/	25
nitrification inhibition rate /% $\geq$	/	6	6



## HG/T 4137-2010 Chemical Industry Standard of <Urea Aldehyde Slow Release Fertilizer>

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- **Urea Aldehyde Slow Release Fertilizer**: one kind of organic slightly soluble nitrogen slow release fertilizers obtained by urea and aldehydes reacting under certain conditions
- Applicable to organic slightly-soluble nitrogen slow release fertilizer obtained by urea and aldehydes reacting under certain conditions. Main products include **urea formaldehyde/methylene urea (UF/MU)**, **isobutylidene diurea (IBDU)** and **crotonylidene diurea (CDU)**, as well as **compound fertilizer or bulk blending (BB) fertilizer which containing urea aldehyde slow release fertilizer**
- The controlled-release performance characterized by several factors: **cold water insoluble nitrogen (CWIN)**, **hot water insoluble nitrogen (HWIN)**, **slow available nitrogen (SAN)**, **activity index (AI)**, %

## Requirements on Urea Aldehyde Slow Release Fertilizer



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Items	Values		
	urea formaldehyde / methylene urea (UF/MU)	isobutylidene diurea (IBDU)	crotonylidene diurea (CDU)
Mass fraction of total nitrogen (TN) /% $\geq$	36.0	28.0	28.0
Mass fraction of urea nitrogen (UN) /% $\leq$	5.0	3.0	3.0
Mass fraction of cold water insoluble nitrogen, CWIN /% $\geq$	14.0	25.0	25.0
Mass fraction of hot water insoluble nitrogen, HWIN /% $\leq$	16.0	/	/
Mass fraction of slow available nitrogen /% $\geq$	8.0	25.0	25.0
Activity index, AI /% $\geq$	40	/	/
Mass ratio of water /% $\leq$	3.0		
Particle size (1.00mm ~ 4.75mm or 3.35 ~ 5.60mm) /% $\geq$	90		

## HG/T 4215-2011 Chemical Industry Standard of <Controlled Release Fertilizer>



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- **Controlled Release Fertilizer:** A fertilizer, of which, the nutrient release rate is well controlled according to the assured rate (%) and duration (d) of release
- **Partial Controlled Release Fertilizer:** Fertilizer containing a nutrient with partial controlled release characteristics, which is made by blending controlled release fertilizer and conventional fertilizer
- Performance characterized by: **stated release longevity of nutrient, initial release rate of nutrient, 28d cumulative release rate of nutrient, cumulative release rate of nutrient during the stated release longevity of nutrient, controlled-release nutrient content, etc**
- The **7d initial release rate of nutrient, 28d cumulative release rate of nutrient** as well as **the period during which stimulated release rate reaching 80%** should be marked on the package. The **nutrient release curve** should be given whenever required by the consumer
- The detailed requirements on controlled release fertilizer is very similar to that of slow release fertilizer



## Other Related Standards on Slow/Controlled Release Fertilizer

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- **HG/T 4216-2011 Chemical Industry Standard of <Fast Methods to Determine the Longevity and Release Rate of Slow/Controlled Release Fertilizers>**

For **polymer coated urea (PCU)**, **polymer-sulfur coated urea (PSCU)** (slow-controlled release urea), the controlled release nutrient determined by the **refractive index method**

For **slow release compound fertilizer (complex fertilizer)**, **slow release blending fertilizer**, **slow release potassium fertilizer**, the controlled release nutrient determined by the **conductivity method**

- **HG/T 4217-2011 Chemical Industry Standard of <Inorganic Material Coated Compound Fertilizer (Complex Fertilizer)>**

**Type I:** Coated by **calcium magnesium phosphate fertilizer** or **calcium hydrophosphate**

**Type II:** Coated by **magnesium ammonium phosphate fertilizer**

Performance characterized by: **kernel coating rate**, **mass ratio of slow-release nitrogen to the total nitrogen**, **mass ratio of slow-release nitrogen (for Type I >40%, for Type II >50%)**, etc



## Future Plans and Prospects

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- **Research & standardization work on “Rapid stimulated test for slow/controlled-release performance within 7 days”**
- **Research & standardization work on the environmental safety (i.e. degradation performance) of coating materials used in slow/controlled-release fertilizers**
- **Establishment of a kind of universal analytic methods on the performance for different kinds of slow/controlled-release fertilizer**
- **Establishment of world-wide acceptable International Standards on slow/controlled-release fertilizer series**

**Thank you for your attention!**