

# DENKA ES

## Rapid Hardening Cement-Based Soil Stabilizing Accelerator

### Description

**DENKA ES** is an environmentally-friendly, durable cement-based rapid hardening accelerator.

### Features

- Low alkalinity allows for rapid hardening when mixed with cement milk.
- Superior homogel strength and durability as compared to sodium silicate-based grouting materials
- Adjustable gelling time with DENKA SETTER
- Ettringite produced by hydration reactions absorb and immobilize hexavalent chromium in the soil
- Very fine (permeation grouting possible by mixing **DENKA ES** with ultra-fine particle cement)

### Applications

- Tunnels
- River banks
- Soil stabilization

### Packaging

- 20kg paper bags

### Shelf Life

- 8 months from production date
- Determine the production date by reference to the lot number. A lot number of "1AXXX" corresponds to production in Jan 2001; "2BXXX" to Feb 2002 and so on.

### Technical Information (Typical Values)

#### Chemical Analysis

Item	Denka ES	Ordinary cement
Ig-loss	0.6	2.0
Insol	0.5	0.1
SiO <sub>2</sub>	1.8	21.3
Al <sub>2</sub> O <sub>3</sub>	20.1	5.1
Fe <sub>2</sub> O <sub>3</sub>	0.3	2.9
CaO	44.1	64.2
MgO	0.3	1.0
SO <sub>3</sub>	30.3	1.9

\*Test methods are in accordance with JIS-R-5202.



## Physical Properties

Material name	Designation	Appearance	Density (g/cm <sup>3</sup> )	Fineness (cm <sup>2</sup> /g)	Packaging (kg/bag)
<b>Denka ES</b>	Rapid hardening material	White powder	2.90	6000	20
Denka Setter <sup>1</sup>	Setting retarder	White powder	2.10	-	10

<sup>1</sup>Denka Setter is available in general-use (D-100) and high temperature-use (D-300) types.

## Standard Mix Proportions (Arbitrary Data)

- **Denka ES** can be used in combination with various types of cement (ordinary cement, fine particle cement, ultra-fine particle cement etc.).

Mixture No.	Liquid A (kg/500 liters)			Liquid B (kg/500 liters)			Notes	
	Rapid hardening material	Mixing water	Setter	Primary material	Mixing water	Dispersant <sup>2</sup>		
①	75	474		300	405		For general grouting	
②	100	465	Optional	Ordinary cement	400	—	For high-pressure grouting	
③	<b>DENKA ES</b>	75	474	Optional	Fine particle cement <sup>3</sup>	300	401	For general grouting
④		200	431		Ultra-fine particle cement <sup>4</sup>	300	401	For tunnel auxiliary construction methods
⑤		200	431	Optional		300	400	As appropriate

<sup>2</sup>Denka FT-500 (amount for standard use: 0.5 to 3%/C)

<sup>3</sup>Denka Colloidal Cement

<sup>4</sup>Denka Colloidal Super

Please contact Denka for further details.

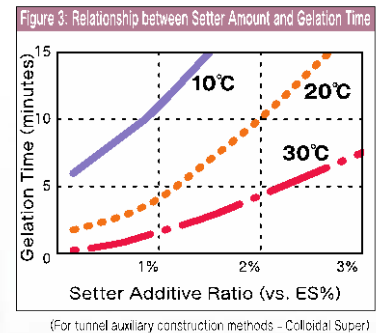
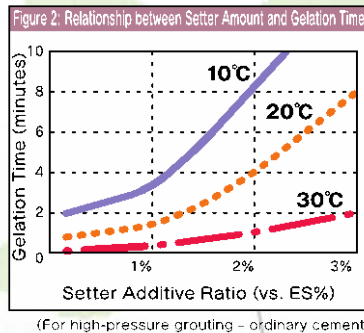
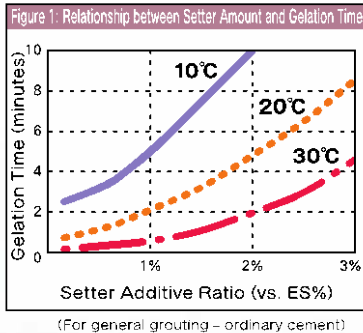
- When preparing Liquid A, follow strictly the order as below (setter before ES).



## Physical Properties (Typical Values)

### Gelation Time (Denka Setter D-100: general-use)

- Gelation time varies depending on the cement brand, so check before use.
- As gelation (hydration reactions) begins upon mixing, the longer the mixture is left alone, the shorter the workability time of the mixture.

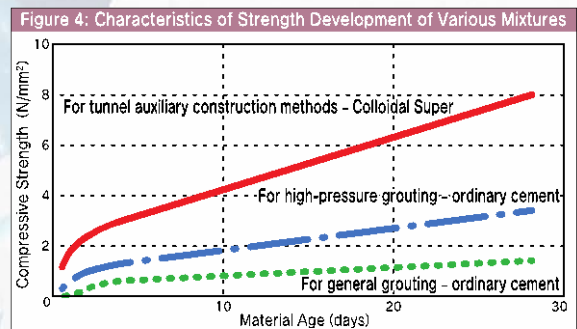


**Be sure to add the Denka Setter bef first. Liquid A (ES) will harden even on its own.**

■ The data provided in this document consists of typical experimental values. Use it for reference purposes only.

### Uniaxial Compressive Strength of Homogel

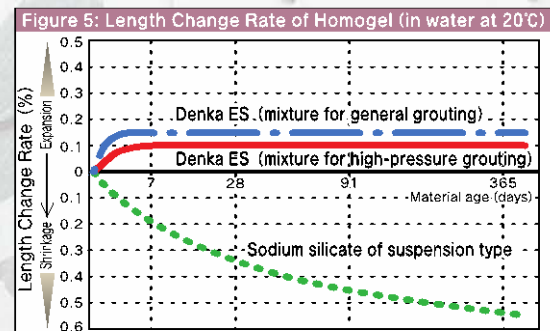
- Depends on several factors including the water quality, water temperature, cement brand, and storage conditions. Confirm before use.



\* (After demolding at a material age of 1 day, cure underwater at 20°C)  
■ The data provided in this document consists of typical experimental values. Use it for reference purposes only.

### Durability (Long-Term Stability)

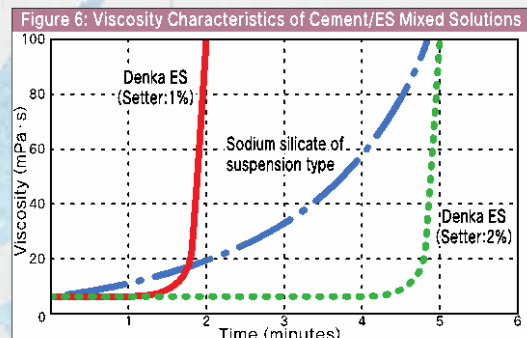
- No volume shrinkage under wet conditions, affording long-term stability.



\* Curing (seal until a material age of 1 day, then place underwater), base length (after demolding)  
■ The data provided in this document consists of typical experimental values. Use it for reference purposes only.

### Solution Viscosity Characteristics

- Viscosity change from mixing to immediately before gelation are minimal, affording superior grouting capabilities.



\* (Mixture for general grouting: ordinary cement, Denka Setter: D-100, 20°C, RH 80%)  
■ The data provided in this document consists of typical experimental values. Use it for reference purposes only.



## Applications

- Ground Stabilization in shield construction, tunnel segment backfill, subways, water supply and sewerage mains, dams, levees, liquefaction prevention work, building foundation reinforcement et
- Water springing, leakage and collapse prevention in tunnel excavation sites, vertical shaft sites, subways, underground water flow cut-offs, water supply and sewerage mains
- Rapid hardening material for cement grouting materials used in tunnel auxiliary construction methods, high-pressure jet stirring construction methods
- Solidification of sewage sludge and slime



Application to Slope Face (Rock Collapse Prevention)



Application to Various Types of Soil Improvement

## Handling Precautions

- Gelation time and strength values are affected by the quality of the water used (recycled water, seawater, water containing organic matter etc.). Physical properties will also differ depending on the brand of cement and storage conditions. Conduct tests in advance to confirm the exact values.
- Gelation time may vary depending on the temperature of the water used and its ratio to the Setter. Conduct tests in advance, or consult with DENKA on these matters.
- When preparing Liquid A, be sure to introduce the Setter before DENKA ES (water → Setter → ES).
- Liquid A (ES) will harden even on its own. If the waiting time to injection extends to 1 hour or longer due to unexpected circumstances, immediately dispose of it.
- Due to the alkaline nature of the product, wear protective equipment (rubber gloves, dust-proof masks, and safety glasses) during handling. If the product comes with contact with the eyes, wash the eyes with clean water for at least 15 minutes and then immediately consult a physician. In case of skin contact as well, wash the exposed area thoroughly with clean water. If inflammation occurs, immediately consult a physician.
- As the product includes rapid hardening components, all products opened should be used within the same day.

## Limitation of Liability

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- DENKA reserves the right to change the Product Information from time to time at its discretion and without notice.

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