

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 homoge 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

- Ground stabilization in shield construction, tunnel segment backfill, subways, water supply and sewerage mains, dams, levees, liquefaction prevention work, building foundation reinforcement etc.
- 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

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

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

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

Physical Properties

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

¹Denka 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 ²			
①	DENKA ES	75	474	Optional	Ordinary cement	300	405	-	For general grouting
②		100	465			400	373		For high-pressure grouting
③		75	474	Optional	Fine particle cement ³	300	401	-	For general grouting
④		200	431			300	401		For tunnel auxiliary construction methods
⑤		200	431	Optional	Ultra-fine particle cement ⁴	300	400	As appropriate	For tunnel auxiliary construction methods

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

³Denka Colloidal Cement

⁴Denka Colloidal Super

Please contact Denka for further details.

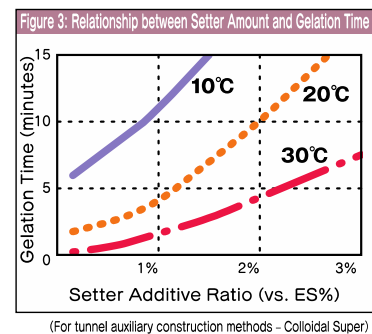
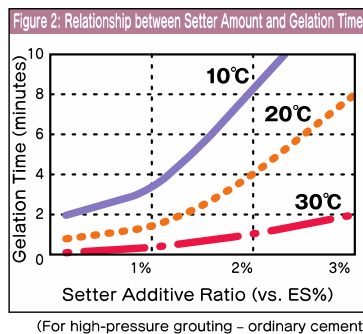
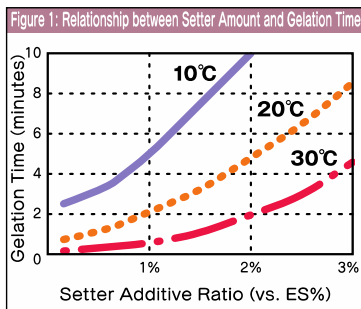
- When preparing Liquid A, follow strictly the order as below (setter before ES).



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.



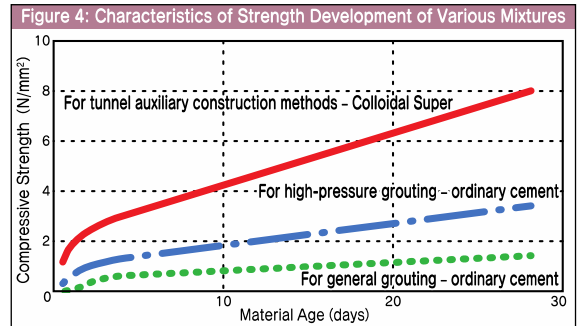
Be sure to add the Denka Setter first. Liquid A (ES) will harden even on its own.

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

Denka

Uniaxial Compressive Strength of Homogel

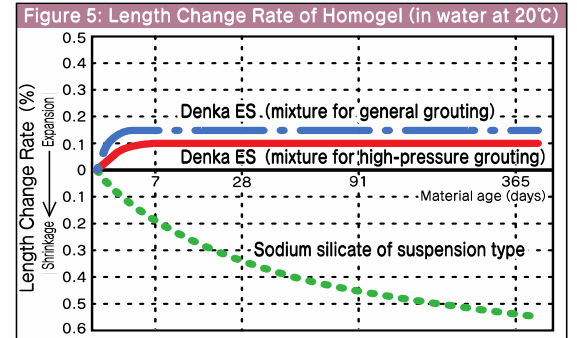
- Depends on several factors including the water quality, water temperature, cement brand, and storage conditions. Confirm before use.



* (After demolding at a material age of 1 day, cure underwater at 20°C)
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Durability (Long-Term Stability)

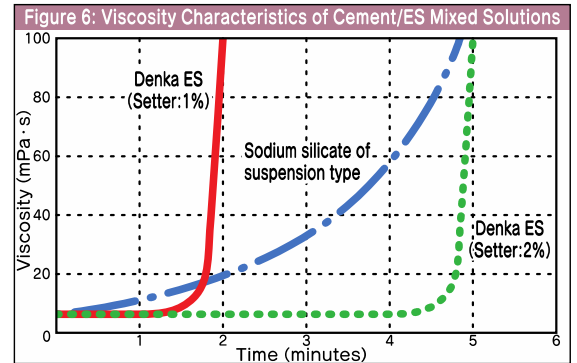
- No volume shrinkage under wet conditions, affording long-term stability.



* Curing (seal until a material age of 1 day, then place underwater), base length (after demolding)
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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%)
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Applications



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

The information contained in this brochure provides general advice for potential customers of DENKA about the basic properties and characteristics of various DENKA products (hereafter referred to as "the Product Information"). DENKA makes no warranty or representation as to the entire accuracy or completeness of the Product Information in this brochure. Nothing in this brochure will be deemed to create any express or implied warranty or obligation of DENKA with respect to the Product Information or its use, including, but not limited to, any warranty of merchantability, fitness for a particular purpose, or infringement of any intellectual property rights. Each user of the Product Information and DENKA products assumes their own responsibility to properly determine the manner and suitability of use of the Product Information and DENKA products in its own operations. The user should exercise proper care in considering the Material Safety Data Sheet, Product Information and any other technical information provided by DENKA, including descriptions of the conditions of use, warnings, and other cautionary instructions. DENKA reserves the right to change the Product Information from time to time at its discretion and without notice.

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