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TECHNICAL BULLETIN

Importance of correctly Curing Concrete

Curing is the process of controlling the rate and extent of moisture loss from concrete during cement hydration. If concrete is not allowed to cure correctly, the ultimate strength and durability can be affected, or shrinkage cracking may occur. By using the correct products and processes, concrete will be properly hydrated and shrinkage cracking can be eliminated.

WHAT IS CEMENT HYDRATION?

Cement hydration is the process of the water and cement particles coming together, reacting to initiate the growth of crystals that bind aggregates together.

Hydration of cement takes time, meaning concrete can take up to 28 days to reach the mix design strength. During this time the concrete will be subject to changing ambient conditions, temperature and relative humidity, which will affect the rate of water evaporation from the surface. Rapid surface moisture evaporation due to windy, hot or humid weather can cause early surface crusting and plastic shrinkage cracking to occur.

A number of things must be considered when curing concrete.

CORRECT WATER RATIO

Using the correct water ratio is important to ensure the concrete develops the appropriate strength. Adding too much water, or not enough, will not only affect the workability of the mix, it will affect the concrete's dry characteristics.

Additional water should not be added as a finishing aid, adding too much water can weaken the concrete's strength.

Bagged cement products: always follow the water ratio shown on the product bag.
Ready mixed concrete: do not add more water on site.

USE OF ALIPHATIC ALCOHOLS

Aliphatic alcohols such as Concure AV can be sprayed onto the surface of freshly laid concrete during placement to give superior finishing properties during unfavourable weather conditions. When applied to freshly laid concrete surfaces, aliphatic alcohol retards or reduces water evaporation by up to 80%* during the critical stages of the initial set. Aliphatic alcohols will help to retard water evaporation from freshly laid concrete surfaces to reduce and often eliminate the formation of shrinkage cracks in plastic concrete.

Aliphatic alcohols are not concrete curing compounds, their use does not replace the curing process. However, they are grouped within the Concure range as they are used during the curing process.

*Actual % of evaporation reduction depends on the ambient conditions at the time of testing as it is influenced by temperature, humidity and wind speed.

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CURING CONCRETE

To properly cure concrete, moisture must be maintained in the concrete long enough to complete the cement hydration process. If concrete is not cured effectively it will generally result in a considerably reduced design strength.

Failure to properly cure concrete can result in;

- **surface dusting** – ineffective hydration causes a poor wearing surface due to the cement matrix not bonding properly to the fine aggregate particles
- **high porosity** – too many voids are created in the concrete due to the moisture not being contained for effective and efficient cement hydration
- **plastic shrinkage cracks** – seen when the rate of evaporation of moisture from the surface exceeds the rate of bleed.
- **decreased strength, durability and abrasion resistance** – inefficient cement hydration causes increased voids, increased permeability and a weak concrete surface layer which can result in reduced bond strength of any applied topping.

WAYS TO CURE CONCRETE

There are a number of typical methods used to cure concrete each with pros and cons.

Water ponding using mist spray, wet hessian or wet sand

- ✓ very efficient if maintained - ensures 100% water retention
- ✗ messy
- ✗ renders the area unusable for days
- ✗ high maintenance

Plastic sheeting

- ✓ very efficient if maintained - ensures high water retention
- ✓ good option for columns after formwork is removed
- ✗ floors are unusable during curing period
- ✗ high maintenance
- ✗ can result in “staining” of the concrete

Curing compounds

- ✓ easy to apply by spray or roller
- ✓ cost effective
- ✓ floors can be used within days
- ✓ some are considered sealers as well as curing compounds
- ✗ need to ensure they are applied at the right time

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CURING COMPOUNDS

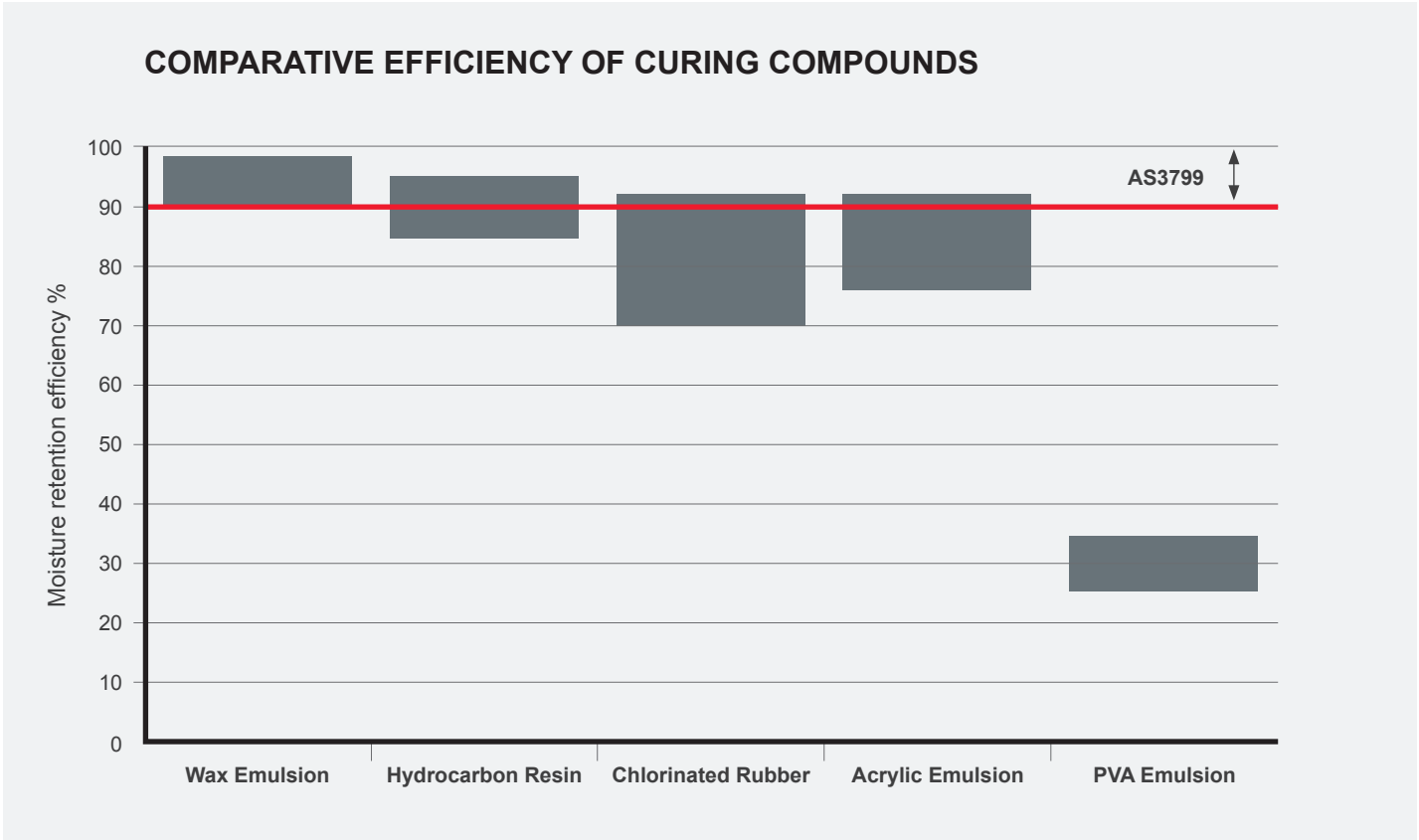
Concrete curing compounds are liquids that are applied to the surface of freshly finished concrete, they form an impervious film over the concrete surface to help retard moisture loss. Curing compounds must meet the requirements of AS3799 Liquid Membrane-Forming Curing Compounds for Concrete.

TYPES OF CURING COMPOUNDS

There are different types of curing compounds available - wax emulsions, hydrocarbon resins, chlorinated rubber, acrylic emulsions and PVA emulsions. The technology of the curing compound affects its ability to retain moisture.

Curing compounds are classified according to the requirements of AS3799. To comply with AS3799, curing compounds must retain >90% of the original water in concrete over a 72 hour test (Curing Efficiency), not all available technologies will achieve this. The graph below compares the moisture retention ability of different types of curing compounds - the red line indicates 90% moisture retention efficiency.

The choice of curing compound will depend on your project requirements.



These are typical results for all products in the market

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APPLICATION

When used to cure fresh concrete, the timing of the application of the curing compounds is critical for maximum effectiveness. Curing compounds should be applied to the surface of the concrete after it has been finished, as soon as the free water on the surface has evaporated and there is no water sheen visible. Too early an application dilutes the membrane; too late results in it being absorbed into the concrete, with a consequent failure of the membrane to form.

Pigmented compounds also help ensure complete coverage and are advantageous in helping concrete surfaces reflect rather than absorb heat.

REMOVING CURING COMPOUNDS

Most curing compounds must be removed before the application of any film forming coating. The only exception to this is Concure A99 which does not require removal and enables direct application of some after trades such as acrylic paints and coatings, provided the correct drying times are followed.

Fosroc recommends removing all other curing compounds via mechanical methods such as shot blasting or grinding, not using chemical treatments. Fosroc do not recommend or supply chemical treatments as they are highly hazardous products.

There is no difference in the recommended removal method between different types of curing compounds.

UV DEGRADATION

Some curing compounds such as Concure X90 will degrade with direct UV exposure, but the degradation time depends on factors such as application thickness, exposure time, level of exposure and porosity of the concrete. Keep in mind that not all surfaces may be exposed to direct UV radiation, so there will likely be differing degrees of degradation around the building (eg. columns – not all faces will receive direct UV exposure). UV degradation can take up to 55 days.

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CHOOSING THE RIGHT CURING COMPOUND

Use the following product selector to help choose the right curing solution for your project. Always read the product TDS before making your final choice or contact your Fosroc representative for more information.

Product	Plastic Concrete Finish Aid	Aliphatic Alcohol Evaporative Retarder	Curing Compound	Potable water approved AS4020	Degrades with UV exposure	Roads & large pavements	Bridge decks prior to asphalt	Wax Emulsion	Solvent Based Hydrocarbon	Water Based Hydrocarbon	Solvent Based Chlorinated Rubber	Water Based Acrylic	Bitumen Resin & Hydrocarbon	AS3799 certified	AS3799 Category	Colour
Fosroc Concure AV	■	■													N/A	Violet – dries clear
Fosroc Concure A99			■	■								■		■	Class D, Type 1	Milky white
Fosroc Concure X90			■		■	■				■				■	Class B, Type 1	Clear
Fosroc Concure X90 Dye			■		■	■				■				■	Class B, Type 1 D	Red, Green, Blue
Fosroc Concure CR			■								■			■	Class C, Type 1	Light Honey
Fosroc Concure B90 (MTO)			■				■						■	■	Class Z, Type 3	Black
Fosroc Concure WB30 Clear			■			■		■						■	Class A, Type 1	Clear
Fosroc Concure WB30 White			■			■		■						■	Class A, Type 2	White

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PRODUCT DETAILS

Description	Size	Product code
Concure A99	20 litre	FC600909-20L
	205 litre	FC600909-205L
	1000 litre	FC600909-1000L
Concure AV	20 litre	FC644444-20L
	200 litre	FC644444-200L
Concure B90 (MTO)*	20 litre	FC600805-20L
	200 litre	FC600805-200L
	1000 litre	FC600805-1000L
Concure CR	200 litre	FC662025-200L
Concure WB30	20 litre	FC663050-20L Clear
	200 litre	FC663050-200L Clear
	200 litre	FC664070-200L White
Concure X90	20 litre	FC600804-20L
	205 litre	FC600804-205L
	1000 litre	FC600804-1000L

*Please note, some products are Made-to-Order (MTO). Made-to-Order (MTO) products need to be ordered by contacting Customer Service or your Fosroc representative. Minimum Order Quantities (MOQ), Order Quantity Breaks and Lead Times apply.

AU 1800 812 864
fosroc.com.au

NZ 0800 657 156
fosroc.co.nz

Parchem Construction Supplies Pty Ltd
1956 Dandenong Rd, Clayton, VIC AUS 3168

Distributed in New Zealand by Concrete Plus Ltd
150 Hutt Park Road, Gracefield NZ 5010

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