



## Reducing Processing Energy and Improving Performance of Cement Systems

WITH DOW™ AMINES

AMINE





## **DOW™ AMINES OFFER BETTER ECONOMICS WITHOUT SACRIFICING PERFORMANCE**

DOW™ Amines offer many ways to improve production economics, lower raw material costs, and improve the final properties of cement systems. While they increase production efficiency for all types of cement systems, DOW Amines make even greater contributions in improving compressive strengths. In conventional Portland cement systems, significantly higher early strengths and 28-day strengths can be achieved. In pozzolanic mixes, much higher levels of fly ash or slag can be incorporated while achieving strengths equal to conventional Portland systems.



### **Amine Products to Improve Grinding and Finished Properties**

Dow offers three ethanolamine products that serve primarily as grinding aids – Triethanolamine (TEA) 99%, TEA Commercial Grade, and DOW™ Amine SD, a grade with a minimum 85% TEA. These products effectively coat cement particles to prevent agglomeration and increase grinding efficiency.

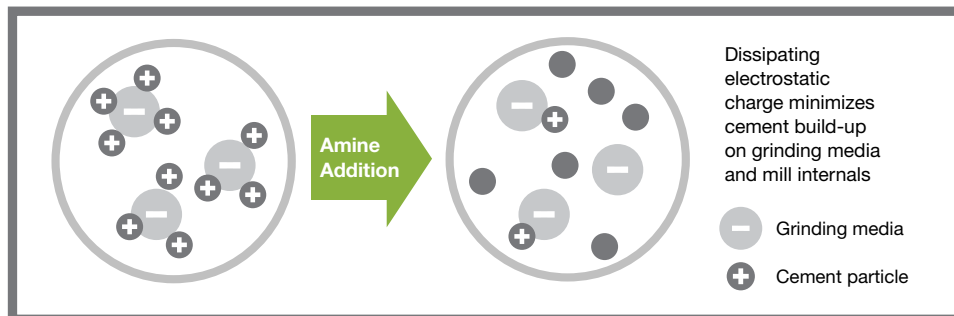
For accelerating setting time and improving compressive strength, Dow offers Triisopropanolamine and Diisopropanolamine. These materials participate in the cement particle hydration reactions and significantly improve the reaction rate, which leads to faster setting and improved compressive strengths.

Dow also offers formulated blends under the brand name ENERCEM™, which helps cement manufacturers improve cement performance and profitability as well as smoothly increase production rates.

Dow's dedicated technology representatives and technical services help customers find products and solutions based on customer needs for optimum performance. DOW Amines offer a range of value propositions to allow the customer to adapt to changing market situations and needs.



**Figure 1 – Amine addition improves grinding efficiency**



### Reduced Mixing and Grinding Costs

Addition of DOW™ Amines can help improve production rates in the grinding mill by up to 10 to 15 percent, along with increased compressive strength of cement. They improve the mechanical efficiency of mixing and grinding by reducing energy requirements.

DOW Amines also interfere with surface charge on cement particles to eliminate clumping and improve free flow of the cement powder.

In a cement ball mill, intense impact and friction generate electrostatic charges that cause agglomeration of cement particles on the oppositely charged grinding media and the mill internals (Figure 1). This results in a drop in the efficiency of the grinding media. Addition of Ethanolamines as well as Isopropanolamines help in the dissipation of electrostatic charge by selective adsorption on the cement particles, thus keeping the grinding media free from cement particles.

DOW Amines can also reduce the requirement of cement Specific Surface Area (SSA) required for effective hydration, thus reducing grinding costs. With amine addition, it is possible to grind to a larger particle size without impairing final strength.

### Increase Compressive Strength and Reduce Setting Time

Used in Portland cements, triisopropanolamine (TIPA) accelerates cementitious reactions and strength development. The performance improvements can be remarkable. Table 1 provides data for three typical cement systems, where one-day compressive strengths improved by 10 to 30%, and 28-day strengths improved 7 to 15%. Setting times were also favorably accelerated.





# STRENGTH



**Table 1 – Improvement in Compressive Strength and Setting Time with TIPA Addition**

Performance Parameter	Pozzolan Portland Cement System #1 0.02% TIPA	Pozzolan Portland Cement System #2 0.02% ENERCER™ -T6 Formulated Blend	Portland Slag Cement
Compressive Strength			
1 Day	+ 10 to 15%	+ 12 to 34%	+ 25 to 30%
3 Days	+ 5 to 15%	+ 8 to 24%	+ 10 to 15%
7 Days	+ 5 to 10%	+ 10 to 14%	+ 10 to 15%
28 Days	+ 7 to 10%	+ 10 to 14%	+ 10 to 15%
Setting Time			
Initial	- 40%	No Significant	- 15%
Final	- 20%	Change	- 10%

Results may vary depending on clinker composition and other factors

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## Increase Filler Levels without Sacrificing Strength

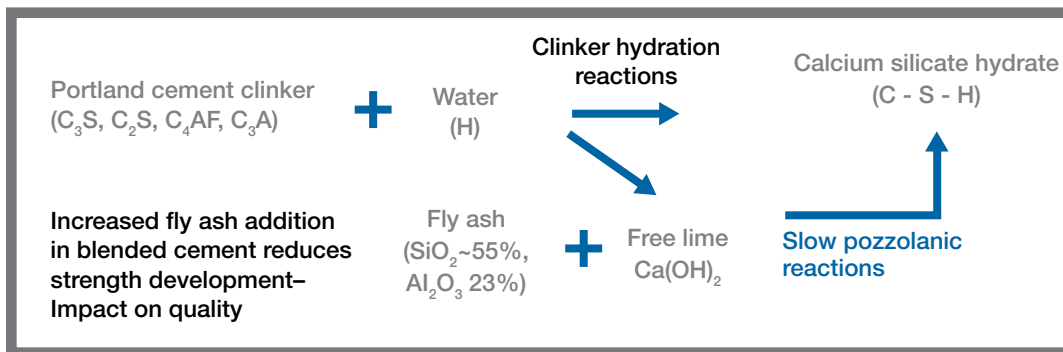
Addition of DOW™ Amines can help increase levels of fly ash, slag, or crushed limestone while maintaining excellent compressive strength. It can reduce raw material costs and make good use of waste materials. The latter point can be especially advantageous where environmental and regulatory incentives exist for recycling fly ash and slag.

Figure 2 compares the reaction routes for conventional Portland cement systems and those with higher levels of fly ash.

However, the addition of DOW Amines improves the rate of hydration of cementitious systems to yield cements with improved setting times and higher compressive strengths, as the data in Table 1 demonstrate.



**Figure 2 – Reaction Routes of Portland and Pozzolanic Cement Systems**





## **QUALITY AMINES FROM DOW YIELD CONSISTENT PERFORMANCE**

Currently the world's largest producer of ethanolamines and isopropanolamines, Dow is well-positioned to supply cement making operations with amine products that meet specifications and perform consistently. Our global manufacturing and distribution assets are backed by years of production experience, state-of-the-art quality, storage and transportation know-how, and technical support. So while customers may face routine daily adjustments for variations in mineral raw materials and processing conditions, DOW™ Amine products offer consistent quality and performance.

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### To Learn More...

To learn more about how DOW™ Amines can improve cement making economics and performance—or to receive product samples—contact the Dow location for your region, listed below.



**U.S., Canada, Mexico:** call: 1-800-447-4369 fax: 1-989-832-1465

**Latin America:** call: (+55) 11-5188-9222 fax: +55-11-5188-9749

**Europe:** call toll-free: +800-3-694-6367\* call: (+32) 3-450-2240 fax: +32 3-450-2815

**Asia-Pacific:** call toll-free: +800 7776-7776\* call: (+60) 3-7958-3392 fax: +60 3 7958 5598

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**[www.dowamines.com](http://www.dowamines.com)**



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