

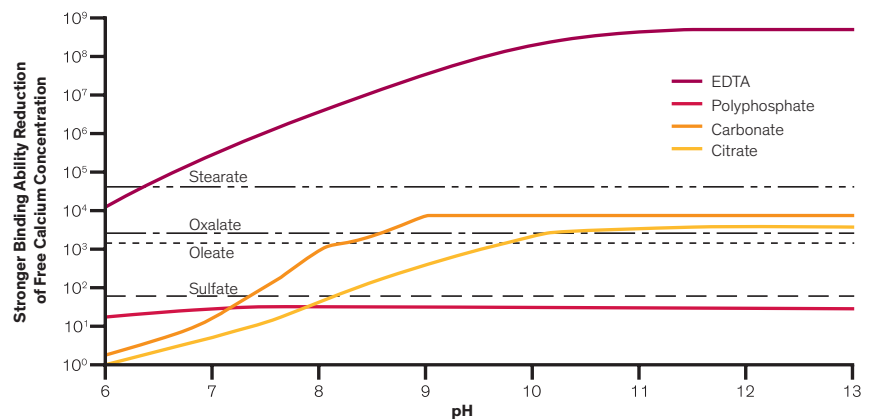
Cleaning Formulation Applications for Dow Chelating Agents



Dow chelating agents combine excellent metal ion binding with relative ease of formulation. They are an integral and cost-effective part of most cleaning formulations. In comparison to many other chelators, Dow chelating agents have the strength to out-compete common soils for metal ions. (See Figure 1). This strength means performance. Additionally, Dow chelating agents have excellent water solubility under most conditions and are compatible with other potential formulation ingredients.

In a cleaning product formulation, Dow chelating agents generally provide two benefits.

Figure 1: Calcium Binding Strength of Several Chelants vs. Several Soils



Conditions: 1:2 calcium ligand molar ratio; 25°C; 0.1 ionic strength; 10² M calcium concentration

First, Dow chelating agents boost cleaning performance by loosening soils and dissolving scale. Most soil deposits are made up of a significant portion of metallic salts—metal ion salts of organics (such as soap scum) or insoluble salts (such as calcium carbonate). Using Dow chelating agents in a cleaning formulation helps loosen, break up, and dissolve these insolubles. See the product selection guide in Figure 2.

The second benefit is that Dow chelating agents may protect the quality and prevent degradation of the product. Degradation of color, fragrance, ingredients, and clarity are often the result of, or are catalyzed by, trace ions, such as iron, copper, and manganese. Oxidative

degradation of colors and fragrance is common and is strongly catalyzed by iron and other polyvalent metals. Only Dow chelating agents possess the strength to control these ions to the degree necessary to prevent degradation. Insoluble salts of iron may also form sediments on the bottom of a container. In most instances, Dow chelating agents can prevent such sediment. See the product selection guide in Figure 2.

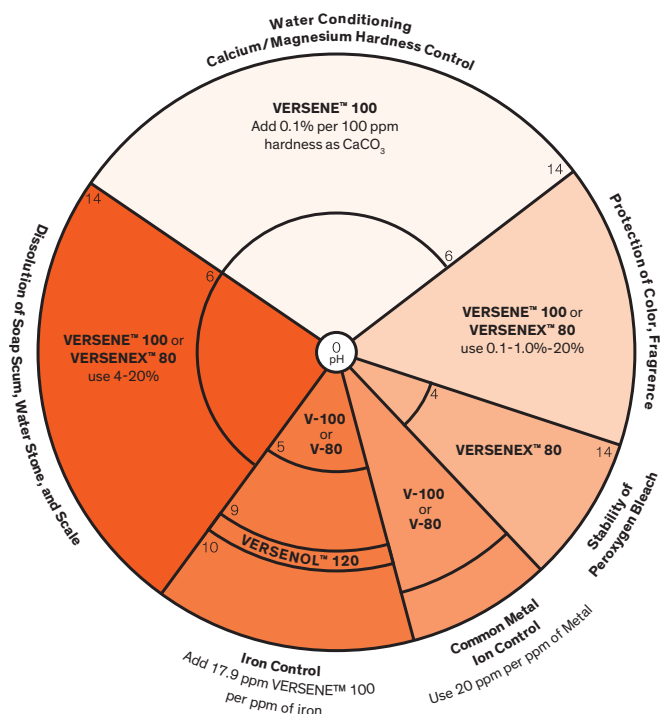
Hard Surface Cleaners

In hard surface cleaning formulations, the combination of a Dow chelating agent, a surfactant to loosen the soil from the surface, and a solvent to soften organic soils or to couple the organic portion of the soil into solutions, forms

the functional base of most products. The versatility of Dow chelating agents may simplify the complex development process faced by the formulation chemist. Unlike the formulator's burden of selecting, formulating, and testing a wide variety of surfactants and solvents, VERSENE™ 100 will suffice in most applications. The affinity for hardness ions in alkaline solution, although lower than that of other chelating agents, is sufficiently high to be effective in this application. Where special salts, forms, and purities of Dow chelating agents are desired, The Dow Chemical Company makes a product to suit nearly all needs.

For general guidance regarding starting levels for formulating cleaning products with Dow chelating agents, consult Figure 2. Contact Dow for specific product information.

Figure 2: Formulation Guide for Using VERSENE Chelating Agents in Cleaning Applications



Formulation Notes

Dow chelating agents are highly soluble in neutral to basic solutions, but solubility is poor in highly acid solutions. Solubility of the acid form in water is approximately 0.05%. The acid product must be neutralized with base to make it soluble in aqueous solutions. VERSENE™ 120 is the exception to this statement. The acid form of VERSENE™ 120 is formed in-situ in acidic formulations. Solubility is approximately up to 5% in water.

Improved solubility can be achieved at slightly acid pH by using ammonium salts of Dow chelants rather than the sodium salts. Diammonium and tetraammonium products are available.

Dow chelating agents are only sparingly soluble, at best, in organic solutions.

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