

Tech Notes

Magic Clay and Other Texturizing Ingredients

Kim Cervino

Why do we say magic clay? Well, there are no rabbits in this hat. In fact there are no animals involved in deriving this category of ingredients; clays and organoclays. What we are referring to as magic is the clay derived from the smectite family of octahedral-shaped particles, Bentonite (INCI name: Bentonite) and its synthetic Hectorite cousin, SMS (INCI name: sodium magnesium silicate).¹ Bentonite in its quarterized and activated form can be dispersed with numerous categories of ingredients to create gels for inventive approaches to modifying a formula. These clay products represent a plethora of naturally derived and synthetic options for achieving new textures, enhanced formula stability, superior active delivery and elite application.

The term Bentonite is derived from its first commercial mining at Fort Benton, Wyoming USA. Bentonite Clay is derived from deposits of weathered volcanic ash. Recognized for its healing benefits, it has been used for centuries by indigenous cultures. In ancient Ayurvedic treatments it has been used to draw toxins out of the body and aid in wound healing. Native Americans called it "Ed-Wah-Kee" meaning "The-Mud-That Heals."² This American "healing clay" is a rare calcium Bentonite called Pascalite which is rich in minerals. It is uniquely sourced from a deposit which was formed thirty million years ago in Wyoming. Today Pascalite or calcium montmorillonite is used as an alternative treatment for stomach or intestinal distress, open wounds, acne, mineral restoration and more. The healing qualities of this clay are derived from its mineral wealth as well as its adsorptive and absorptive qualities.

Another more common Bentonite, Sodium Montmorillonite, can deliver sebum absorption, barrier protection, and enhanced active delivery (as a result of the dynamics of its dispersion upon application). It is best known for the thixotropic rheology it delivers to a formulation. By modifying the flow characteristics of the formula one can control leaking, dripping, smoothness and enhance application. Put simply, a thixotropic product will decrease in viscosity in response to shear and exhibit a delayed recovery. Thus the product will flow under shear and in the case of a lotion for instance, it will remain thin during application and eventually resume its original viscosity. Bentonite has traditionally been used in APDO roll-on products for this reason and for its ability to keep actives suspended and thus homogenous for best efficacy. The thickening imparted from Bentonite is independent of temperature, thus enhancing the finished product's thermostability. It is this thixotropy, thermo-stability, and particle (colorant, active, aesthetics) suspension that have employed Bentonite in the Household and Industrial, Food and Personal Care Industry for decades.

A less easily dispersed Smectite sibling of Bentonite called Hectorite can be synthesized to yield a pure, more efficient and pseudoplastic thickener-sodium magnesium silicate. This synthetic clay, SMS can efficiently (and inexpensively) form translucent gels which can suspend dense matter and atomize in aerosols and pump sprays. The importance of this pseudoplasticity is that it will not exhibit a delay in viscosity recovery. Thus the product will flow in the presence of shear greater than its yield value and recover fast enough to apply immediately. It is also thermo-stable and like Bentonite can often be used to temper the stability of a formula that has failed freeze-thaw aging or is teetering on separation.

The ease of dispersion and efficient swelling of Bentonite and SMS have proven them champions in the rheological arena. Enhanced active delivery is also among the benefits

that these ingredients can bring to lotions, creams and other formulations. For treatment products a major concern for efficacy is even application of the product. A great example of this is in SPF active delivery. The FDA test for determining SPF requires a 2mg/cm² applied thickness to evaluate if the product will deliver the full SPF protection claimed to a consumer. However, most consumers do not apply 2mg/cm² when they use a sunscreen. Formulas which are applied too thin or unevenly will not deliver proper protection. It has been shown that one half of the standard film thickness will generate 60% or less than the claimed SPF to the consumer. To improve the SPF of a formula "leveling agents", such as Bentonite, can be added to enhance the evenness of an application and control it's spreading.

In a spreading test of commercial sunscreen products performed by SPF Consulting Labs Inc, in Pompano Beach, Florida, top choices of leveling agents were compared in oil in water, water in oil and gel sunscreen formulas. The results showed that in gel sunscreens Bentonite performed better than other "leveling agents" including: ZnO₂, TiO₂, Sericite, Boron Nitride, Talc and Silica. In oil in water formulas Bentonite outperformed the same list with the exception of silica which showed the best film thickness results. In water in oil Bentonite performed on par with ZnO₂ and TiO₂ with best results at 5% added.³ Bentonite's adsorptive properties are another positive point in an application where perspiration will dilute the activity of an applied formula. Furthermore, its network of dispersed particles prevents the reagglomeration of micronized TiO₂ and ZnO₂. Thus it is an optimal choice for designing the spreading of sunscreen and other treatment products.

Bentonite organoclays offer the same enhanced spreadability and thermostability as the simple clay. Organoclays are activated quarternized clays designed for compatibility with ingredients of different degrees of polarity.⁴ These organoclays can be dispersed with a variety of ingredients to yield an unlimited number of variations of feel, slip, tack, cushion and waterproofing. Through expert dispersion technology and high process energy many combinations of organoclay with silicones, oils, esters, petroleum derived products and other film formers can be created.

In Color Cosmetic formulations organoclays are a prime choice because of their innate ability to keep pigments suspended (and reduce the appearance of creasing) and for the superior application their presence yields the consumer. They are also typically chosen for prevention of syneresis, heat stability, smudge resistance, and of course, rheology control. Bentonite organoclays are increasingly recognized for their role in sunscreens and other treatment products. Ivy Block, a product made for the prevention of poison ivy utilizes quarternized Bentonite as a skin barrier. For formulators that enjoy experimenting and creating something out of the ordinary, Bentonite organoclays offer great versatility.

Through modifying the water phase or oil phase, these clays and organoclays offer a road less traveled, but with an elite destination. Although they have been used in other industries for decades, they are just starting to be recognized as the power players that they could be in many formulas. Not only are they multifaceted, but they are often a very cost effective solution to common formula problems. The fact that they have been used for centuries for healing and treatment is a testament of their reliability.

Footnotes:

1. "Advancement of Natural and Synthetic Clays in Personal Care Applications"; Cosmetics and Toiletries Manufacture Worldwide; Tom Murphy and Anthony J. Sawyer, Süd Chemie Inc. (2004)
2. "Healing Clay-Healing Earth"; www.shirleys-wellness-cafe.com/clay.htm (2005)
3. "Controlling the Spreading of Sunscreen Products"; Christopher D. Vaughan, Susan

Porter and Sherine Bichara; SPF Consulting Labs, Cosmetics and Toiletries, Vol. 118 No. 10/October (2003)

4. "Hydrophilic Bentonites and Synthetic Hectorite"; Süd Chemie Inc, www.sudchemie.com (2005)

About the Author...

Kim Cervino received a BA in Biology from Rutgers University, New Brunswick in 1992 and an MBA in Marketing in 2000 from Rutgers School of Business, Newark. Her experience includes seven years of Research and Development for global formulations in Oral Care and Personal Care at Colgate-Palmolive Company. She is a member of the New York Society of Cosmetic Chemists, the American Chemical Society and Cosmetic Executive Women. Ms. Cervino currently manages Marketing and Sales for Paradigm Science Inc, headquartered in Milford, New Jersey.