Dr Milby - Halloway File Cabinet

PLAINTIFF'S EXHIBIT
UC-876

File: TALC Pigments

IX-B-11c

Report on Substitution of PLATY TALC For Asbestos-Containing Magnesium Silicates in Paint Formulations.

Memo re dust exposure measuring

A23164

Cyprus Industrial Minerals Company
An Affiliate of Cyprus Minerals Company

7000 South Yosemite Street
Post Office Box 3299
Englewood, Colorado 80155
303-740-5000

~~(1) UCAR~~ — this is one of several materials that we recently agreed to ask for up-dated MSDS sheets — they have not changed their story (look very non-hazardous).

April 6, 1987

UCAR
Emulsion Systems
410 Gregson Drive
Cary, North Carolina 27511

~~(2) CITC~~ — Please note that talc

Attention: Deborah Bailey

(2) Deborah Bailey — Silc has a

Dear Ms. Bailey:

In response to your request, enclosed are Material Safety Data Sheets for our Mistron Vapor, Mistron Monomix, Beaverwhite 200 and Beaverwhite 325 talcs. The CAS Registry number for these products is 14807-96-6.

Please contact us if we can be of further assistance.

limit of 2 mg/m³ of respirable dust as recommended by ACGIH. Since it does have a specified TLV by ACGIH it is an OSHA Hazardous material by definition. If someone had a concern on dust, we would have to measure the respirable dust exposure. Based on this MSDS, I do not think this changes our HF Scratings.

Sincerely,

Richard J. Zazenski/mc

Richard J. Zazenski
Vice President
Quality Assurance/Product Safety

RJZ/mc

Enclosures

WPM

CYPRUS

A23165

MATERIAL SAFETY DATA SHEET

Cyprus Minerals Company

HMIS

Health	1
Flammability	0
Reactivity	0
Personal Protection	E

I. IDENTIFICATION

Product Name: MISTRON VAPOR

Chemical Name: TALC; HYDROUS MAGNESIUM SILICATE | Chemical Family: SILICATES

Formula: $3MgO \cdot 4SiO_2 \cdot H_2O$

II. INGREDIENTS

Mineral or Chemical Name(s)	Weight %	CAS #
TALC - A NATURAL HYDROUS MAGNESIUM SILICATE MINERAL	90-99%	14807-96-6
DOLOMITE - A NATURAL MAGNESIUM CALCIUM CARBONATE MINERAL	less than 5%	None
CALCITE - A NATURAL CALCIUM CARBONATE MINERAL	less than 5%	1317-65-3
CHLORITE - A NATURAL HYDROUS MAGNESIUM ALUMINUM SILICATE MINERAL	less than 5%	None
QUARTZ - A NATURAL CRYSTALLINE SILICA MINERAL	less than 1%	14808-60-7

III. PHYSICAL DATA

Boiling Point: NOT APPLICABLE | Freezing Point: NOT APPLICABLE

Vapor Pressure: NOT APPLICABLE | Vapor Density: NOT APPLICABLE

Evaporation Rate: NOT APPLICABLE | % Volatile: NOT APPLICABLE

Specific Gravity (water = 1): 2.7 - 2.8 | Solubility in Water: NEGLIGIBLE | pH: 7.5 - 9.5

Appearance and Odor: A WHITE POWDER WITH AN EARTHY ODOR

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: NOT APPLICABLE | Flammable Limits: NOT APPLICABLE

Extinguishing Media: NOT APPLICABLE

Special Fire Fighting Procedures: NOT APPLICABLE

Unusual Fire and Explosion Hazards: NOT APPLICABLE

V. HEALTH HAZARD DATA

Threshold Limit Value: 2 mg/M^3 RESPIRABLE DUST OVER AN 8 HOUR EXPOSURE PERIOD.

Possible Effects of a Single Overexposure	
Inhalation	ACUTE ACCIDENTAL EXPOSURE WOULD BE NON-SPECIFIC AND SIMILAR TO THE INHALATION OF ANY DUST. SUCH SYMPTOMS MIGHT INCLUDE COUGHING, WHEEZING, DIFFICULT BREATHING AND UPPER RESPIRATORY TRACT IRRITATION.
Skin Contact	NO ADVERSE EFFECTS ARE KNOWN AS A CONSEQUENCE OF APPLICATION TO UNBROKEN SKIN.
Eye Contact	AS WITH ANY PARTICULATE MATERIAL, TALC CAN CAUSE TEMPORARY DISCOMFORT AND IRRITATION IF ACCIDENTALLY INTRODUCED INTO THE EYE.
Ingestion	NO KNOWN HAZARD.

Cyprus Industrial Minerals Company/Talc Division
Box 3419, Englewood, CO 80155/(303) 740-5440

A23166

Possible Effects of Repeated Overexposure
THERE ARE REPORTS THAT A RELATIVELY MILD PNEUMONOCONIOSIS CAN DEVELOP OVER 10-40 YEARS OF OCCUPATIONAL EXPOSURE TO MIXED DUSTS CONTAINING TALC. THE PULMONARY DISEASE WHICH DEVELOPS AFTER SUCH PROLONGED EXPOSURE MAY EXIST WITH OR WITHOUT IMPAIRMENT IN LUNG FUNCTION. PROLONGED INHALATION MAY PROVOKE A FIBROTIC RESPONSE SIMPLY BECAUSE OF THE INSOLUBLE NATURE OF THE MINERAL TALC.

Emergency and First Aid Procedures	
Inhalation	REMOVE TO FRESH AIR. IF BREATHING IS DIFFICULT, GIVE OXYGEN AND CALL A PHYSICIAN.
Skin Contact	OF NO GENERAL CONCERN. BROKEN SKIN CAN BE CLEANSED WITH SOAP AND WATER.
Eye Contact	FOR ACUTE EXPOSURE, FLUSH WITH WATER. IF IRRITATION OR DISCOMFORT PERSISTS, CALL A PHYSICIAN.
Ingestion	NO TREATMENT NECESSARY.

Notes to Physician
THERE ARE NO SPECIFIC ANTIDOTES TO ACUTE OVEREXPOSURE. TREATMENT SHOULD BE DIRECTED AT THE CONTROL OF THE SYMPTOMS AND THE CLINICAL CONDITION. INDIVIDUALS WITH ACTIVE PULMONARY DISEASE SHOULD NOT BE ASSIGNED TO A HEAVY TALC DUST ENVIRONMENT.

VI. REACTIVITY DATA

Stability: TALC IS STABILE AND INERT	Incompatibility: NONE
Hazardous Decomposition Products: NONE	
Hazardous Polymerization: NONE	
Conditions to Avoid: NONE	

VII. SPILL OR LEAK PROCEDURES

Steps to be Taken if Material is Released or Spilled	VACUUM CLEAN OR WET SWEEP SPILLAGE
Waste Disposal Method	WASTE SHOULD BE DISPOSED OF IN CLOSED CONTAINERS TO PREVENT DUST

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection	NIOSH APPROVED DUST RESPIRATORS FOR EXPOSURE TO POTENTIALLY HIGH TALC DUST ENVIRONMENTS		
Ventilation	LOCAL EXHAUST VENTILATION RECOMMENDED		
Protective Gloves	NOT REQUIRED	Eye Protection	SAFETY GLASSES
Other Protective Equipment	NOT REQUIRED		

IX. SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storage

- AS WITH ALL POWDERS, LIMIT THE CREATION AND INHALATION OF DUST
- WET FLOORS MAY BECOME EXTREMELY SLIPPERY WHEN TALC IS PRESENT

X. ADDITIONAL INFORMATION

EMERGENCY TELEPHONE NUMBERS

Medical: (303) 740-5440

Technical: (303) 740-5700

A23167

FEDERAL HAZARD CLASSIFICATION NUMBERS

- DOT Hazard Classification - Talc not listed
- RCRA Hazardous Waste No. - Talc not listed
- CERCLA (Superfund) Reportable Quantity - Talc not listed

54-1003T (10-85) Back - Prepared by the Cyprus Industrial Minerals Product Stewardship Committee

HMIS	
Health	1
Flammability	0
Reactivity	0
Personal Protection	E

MATERIAL SAFETY DATA SHEET

Cyprus Minerals Company

I. IDENTIFICATION

Product Name: BEAVERWHITE 325

Chemical Name: TALC; HYDROUS MAGNESIUM SILICATE | Chemical Family: SILICATES

Formula: $3MgO \cdot 4SiO_2 \cdot H_2O$

II. INGREDIENTS

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Box 3419, Englewood, CO 80155/(303) 740-5440

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Hazardous Decomposition Products: NONE	
Hazardous Polymerization: NONE	
Conditions to Avoid: NONE	

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X. ADDITIONAL INFORMATION

EMERGENCY TELEPHONE NUMBERS

Medical: (303) 740-5440

Technical: (303) 740-5700

A23160

FEDERAL HAZARD CLASSIFICATION NUMBERS

- DOT Hazard Classification - Talc not listed
- RCRA Hazardous Waste No. - Talc not listed
- CERCLA (Superfund) Reportable Quantity - Talc not listed

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ACL Doc 16087 · Page 6 of 21 asbestosclaims.law/library/16087/6

SUBSTITUTION OF PLATY TALC
FOR ASBESTOS-CONTAINING MAGNESIUM SILICATES
IN PAINT FORMULATIONS

Health hazards associated with the use of commercial talcs contaminated with asbestos, notably the tremolite variety of asbestos, have many paint manufacturing companies looking for alternative solutions to the expensive installation of special handling equipment and troublesome procedures now required by law. As we view the problem, we can see only one simple alternative -- to switch to a purer talc, guaranteed essentially (less than 1%) free of asbestos-type contaminants. UNITED SIERRA markets a variety of asbestos-free talc extender pigments which can eliminate problems associated with the use of asbestos-contaminated products.

The purpose of this bulletin is to provide a guide for the substitution of our pure, platy talcs for so-called "fibrous talc" extender pigments in present use which contain up to 60% of asbestos contamination and as little as 20% talc. We will attempt to demonstrate the effect of the proposed substitution on the formulating variables of pigment volume concentration (PVC), critical pigment volume concentration (CPVC), the effect on factors related to the degree and stability of pigment dispersion, such as ease of manufacture, rheology, and shelf stability, and the effect on key paint physical properties.

For clarity during the remainder of this bulletin, we will refer to our purer, platier talcs simply as "talc", and to the asbestos-contaminated, so-called "fibrous talcs" or "tremolitic talcs" as "magnesium silicates" in acknowledgement of the latter variety's somewhat inconsistent mixture of several magnesium silicate minerals.

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DISCUSSION

The Occupational Safety and Health Administration (OSHA) has defined asbestos to include the minerals "chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite," and has outlined strict procedures which must be followed by manufacturers using products contaminated with these minerals.1

Unfortunately, many extender pigments in common use by the paint industry are contaminated to varying degrees with asbestos, particularly the tremolite and anthophyllite varieties. The National Paint and Coatings Association has issued Safety and Health Bulletin No. 10 to explain the effects of the legislation to its membership.

Table I compares representative mineral analyses of UNITED SIERRA's Montana and California talcs with paint-grade New York magnesium silicates and asbestos-contaminated California talcs commonly used by the paint industry. The table shows that among commerical talcs and other magnesium silicate extenders often called "talc", there is a wide variation of mineral purity, with certain products containing mostly asbestos!

Figure I compares electron photomicrographs of the pure, platy talcs from which UNITED SIERRA products are manufactured, with an asbestos-contaminated California talc. Note that the UNITED SIERRA talc contains no fibrous or needle-like asbestos-form particles.

But, how do these wide variations affect a paint formulation when one grade or type is substituted for another? The answer lies with the three basic pigment properties: particle shape, purity, and uniformity.

Particle shape differences between two pigments are quite important. When a substitution of predominantly platy particles is made for a blend of fibrous and platy particles or for a product which is predominantly fibrous, an exact duplication of paint properties cannot be expected. Extender particle shape influences the pigment packing characteristics of a paint formula and, therefore, may induce changes in film properties.

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TABLE I

Mineral Analyses of UNITED SIERRA Paint-Grade Talcs Compared to Asbestos-Contaminated Competitive California Talcs and New York Magnesium Silicates

	UNITED SIERRA		COMPETITIVE	
	Montana	California	California	New York
Talc	94-99	80-85	50-80	20-70
Tremolite (asbestos)	ND	<1	2-35	15-40
Anthophyllite (asbestos)	ND	ND	ND	5-15
Serpentines*	ND	ND	ND	10-30
Dolomite	0-2	4-6	1-10	0-2
Calcite	0-2	3-8	1-10	0-2
Chlorite	0-5	0-2	0-2	ND
Mica	ND	2-5	3-8	0-1
Montmorillonite	ND	0-5	0-5	0-5
Quartz	0-1	0-1	0-1	0-1

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ND - Means not generally detected in products from these localities.

* - Serpentines principally include chrysotile, lizardite and antigorite. Chrysotile has been defined as asbestos by OSHA.

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FIGURE I

Electron Photomicrographs of UNITED SIERRA Talc Compared to Asbestos-Contaminated Talc

Asbestos-Contaminated Talc

UNITED SIERRA Talc

A23173

Talc purity is also very important. When a product containing 95% pure talc is substituted for one containing much less pure talc plus several other minerals, the more hydrophobic nature of the talc particle, the overall change in the surface characteristics of the pigmentation must be considered as a possible cause of changes in paint properties.

Similarly, the batch-to-batch uniformity of a paint formula is directly related to the shipment-to-shipment uniformity of raw materials. There is much less chance of non-uniformity in a product containing 90 or 95% pure talc than in a product containing major amounts of several minerals.

It must be emphasized, however, that the possible changes in paint properties that may occur because of our proposed extender substitution are (1) likely to be of small magnitude, (2) will be related to the degree of dissimilarity of the two products, and (3) will also depend on characteristics of a particular paint formulation such as PVC and extender loading.

We will now show some of the changes in paint properties which may occur as the result of this substitution and how the application of a few basic principles of paint technology will minimize or prevent such changes.

Effect on Formulation Parameters

One of the first differences a paint formulator may encounter when substituting a platy extender for a fibrous one is a change in the oil absorption of the total formula pigmentation. Oil absorption may be defined as the amount of oil which just saturates a bed of pigment particles, completely enveloping each particle and completely filling the voids between particles. It is, therefore, a measure of the void volume of the pigmentation.

Critical pigment volume concentration (CPVC) has been defined as the particular pigment volume concentration "... in a pigment-vehicle system at which just sufficient binder is present to fill completely the voids left between the pigment particles incorporated in the film after volatilization of thinner .... commensurate with the degree of dispersion of the system."[2]

Comparing the definitions of oil absorption and CPVC we can easily see that they are related and can say that a change in the oil absorption or void volume of a formula's pigmentation will result in a change in the CPVC of the paint system. As a matter of fact, some paint technologists convert oil absorption values of pigments to the pigment volume concentration relationship and call the value obtained the

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pigmentation CPVC, which they accept as a basic pigment property,[3] although realizing that pigmentation CPVC is not necessarily the same as paint CPVC because of the difficulty of determining "true" oil absorption or void volume and because of differences in dispersing ability among paint binders. For example, latex emulsions always yield a considerably lower CPVC than solution binders, but both are proportional to the pigmentation CPVC.

Since the CPVC of a pigment/vehicle system is related to drastic changes in many important paint properties, it may be easily understood that a change in pigmentation void volume, or CPVC, while holding paint PVC constant may seriously affect paint properties, particularly if a paint is formulated close to critical PVC (which it often is!).

Figure II illustrates how a change may be made in formulation PVC to maintain some hypothetical paint property to compensate for a change in pigmentation CPVC resulting from an extender substitution.

There are three well known, though rarely used, methods of adjusting paint PVC to compensate for a change in pigmentation void volume -- the "Equal Free Binder" method, based on changes in paint viscosity and only applicable to solvent-less paints below CPVC, the equal "Saturation Value" method,[4] which lacks a theoretical basis, and the equal "Porosity Index" method,[5] which has a theoretical as well as empirical basis, is pigment oriented, but is applicable only to paints formulated above CPVC.

We would like to propose a fourth method which also has a theoretical as well as empirical basis and is pigment-oriented (because we are speaking of pigment substitutions) and which is useful for pigment substitutions in any type of paint system above or below CPVC provided substitutions are made on an equal volume of pigment basis and binder type is not changed. This may be accomplished by using the simple formula:

$$PVC_2 = \frac{PVC_1 \cdot CPVC_2 \ (1-CPVC_1)}{PVC_1 \ (CPVC_2-CPVC_1) + CPVC_1 \ (1-CPVC_2)}$$

Where: PVC_1 = Original formulation PVC.

PVC_2 = Adjusted formulation PVC (Assuming there is no change in degree of pigment dispersion).

$CPVC_1$ = Original pigmentation CPVC based on oil absorption or other methods of measuring void volume.

$CPVC_2$ = CPVC of substitute pigmentation based on the same method.

A23175

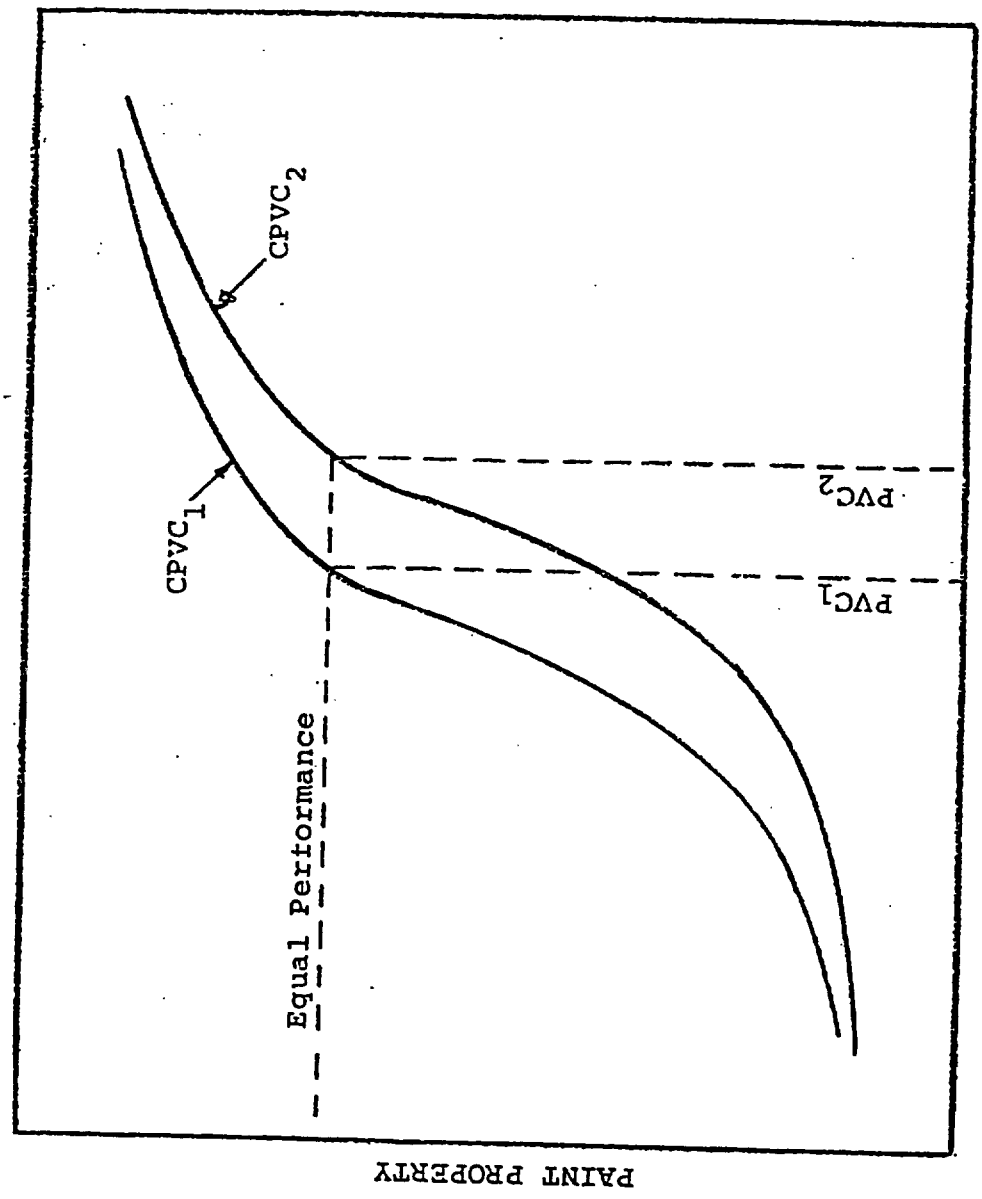


FIGURE II

Adjusting Paint PVC to Compensate for a Change in Pigmentation CPVC

A23179

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Since this is a new formula, a derivation is shown in the appendix. Using this method, the only differences between the two paints using different pigmentations should be related to basic pigment properties such as refractive index, particle size, shape, distribution, dispersion, surface idiosyncrasies, and chemical reactivity -- the variable of pigment adsorptivity has been eliminated.

For example, a paint formulator wishes to substitute a platy Montana talc for a fibrous New York magnesium silicate and finds that the void volume of his total pigment combination has decreased the pigmentation CPVC from 60% to 55%. Using the formula he finds that he must decrease the PVC of his formula from 55% to 50% by adding binder solids. Only then is he ready to evaluate the true effect of his extender substitution on formulation cost and on paint properties. A simplified paint formula is given below to illustrate the effect on other formulation parameters:

	Parts By Volume	
	Original Formula	New Formula
Pigment	33.0	33.0
Binder Solids	27.0	33.0
Solvent	35.0	35.0
Additives	5.0	5.0
TOTAL	100.0	106.0
PVC	55%	50%
Volume Solids	60%	62.3%

Note that only the volume of binder changed between the two formulas. As PVC was decreased from 55% to 50%, volume solids and formulation volume both increased slightly.

Effect of Substitution on Paint Properties

Pure, platy talc, because of its unique surface characteristics, when substituted for another mineral extender, may require special attention to proper wetting, dispersing, and stabilizing in a paint system. It is easy to understand that a wetting/dispersing/stabilizing system which works well for one pigment combination will not necessarily work well for another. Therefore, substitution of a product containing pure talc for one containing much less talc may require changes in the wetting/dispersing/stabilizing system of a paint. This holds true for organic solvent-based, as well as aqueous paints.

A23177

Although it is often stated that talc wets out and disperses well in organic solvent-based paints, our work has indicated that an incomplete or unstable dispersion may result in such paints containing high levels of pure talc. Various cationic surface active agents such as Lecithin LV (Naftone), Arquad 2HT (Armour), and Cargill Q2HT may be added to improve the dispersion.

The symptoms of incomplete or unstable talc dispersion in solvent paints are:

(1) the millbase requires much additional resin or solvent or exhibits unusual flow properties,

(2) "ropy" paint consistency and high brush drag,

(3) deterioration of film properties,

(4) the formation of thick skins even when using an anti-skinning agent.

For example, when BEAVERWHITE 325 was directly substituted for Nytal 300 (which is about 1/3 talc) in a TT-P-25 exterior bodied linseed oil primer at 40% PVC, 61% volume solids, 83% weight solids, and containing 3.5 pounds of talc or magnesium silicate per gallon of paint, all these symptoms were noted. Addition of a cationic surface active agent eliminated the problems so that any differences between the three paints were proportional to the oil absorption, or pigmentation CPVC. Figure III compares Hercules Rheograms of the three paints with the BEAVERWHITE 325 paint containing cationic surfactant -- the results are dramatic.

We believe the complex rheological behavior of the paint containing no cationic additive to be a symptom of shear-induced flocculation resulting from an improperly stabilized dispersion. The frictional forces associated with shearing disrupt the dispersive buffer layer of vehicle surrounding each particle at rest, pigment attractive forces take over and flocculation results. Cationic additives lower the talc/vehicle interfacial tension, promoting greater shear stability.

Similar phenomena occur in latex paints, particularly at high PVC's and high levels of pure talc, when necessary adjustments in the wetting/dispersing/stabilizing system are not made. The most obvious symptoms of poor or incomplete talc dispersion in latex paints are:

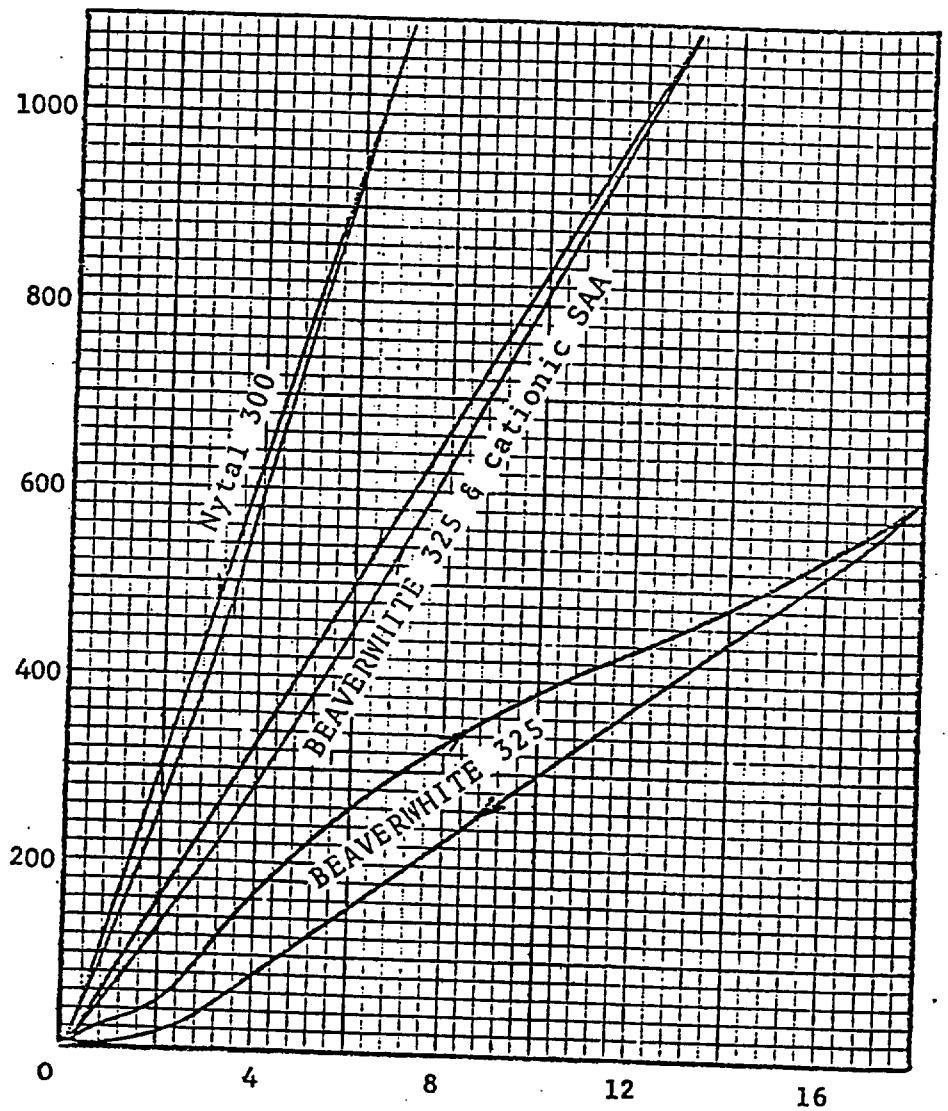
(1) unusual millbase rheology requiring unusually high amounts of water,

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FIGURE III

Hercules Rheograms of TT-P-25 Paints

Containing BEAVERWHITE 325 or Nytal 300



A23179

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(2) extreme thixotropy or gelling upon addition of the latex,

(3) unusually high equilibrated viscosity.

(4) poor shelf, freeze/thaw and heat stability,

(5) deterioration of resistance properties.

These symptoms can be easily overcome using the correct level of a nonionic surface active agent, Pluronic L62D or equivalent, in place of now unnecessary nonionic surfactants which may be present. The level of polyanionic dispersant in the formula need not be altered.

To determine the correct level of the surface active agents we have recommended, a pasty, high solids mixture of talc in water or a formula's solvent system is titrated with surfactant. The change in viscosity of the mixture is measured. It will change from a paste to a low viscosity slurry. The amount of surfactant which yields a minimum viscosity establishes a starting point level to be used in the paint. This level may then be incrementally reduced to determine the best level consistent with good dispersion, stability, ease of production, and paint physical properties.

Thus far we have discussed paint properties in general terms as functions of CPVC and degree of dispersion. Now we will examine the effect of substituting pure platy talcs for impure, fibrous magnesium silicates, assuming that differences in oil absorption have been compensated for by adjusting the formulation PVC and assuming that good talc wetting/dispersing stabilizing has been achieved.

Exterior Durability:

Talc and other magnesium silicates have long been standard ingredients in exterior house paints for wood and masonry and in exterior metal primers. Their efficiency has been attributed to the film reinforcing ability of their fibrous particles so that cracking and checking did not develop as readily as with other extenders when applied over dimensionally unstable wood, and to the water impermeability imparted by their irregularly packed platy particles to help retard rusting over steel. However, we know now that the platy particles of pure talc provide as much or more reinforcing ability than fibrous magnesium silicates.

A23180

The ability of the talc surface to preferentially absorb various organic materials provides a strong adhesive bond between talc and polymer. We also know that the water impermeability imparted by talc is not just the result of packing into a maze-like configuration, but also because of this strong adhesive talc/polymer bond and the hydrophobic nature of the talc particle.

Additionally, the lack of abrasiveness of pure talc compared to fibrous magnesium silicates will not contribute to mill wear. Iron contamination from mill wear may seriously deteriorate exterior durability.[6,7]

Although no definite trends have been established, aside from mill wear effects, we can safely state that only minor, if any, differences in exterior durability will result from the proper substitution of talc for other magnesium silicate extenders of similar particle size and particle size distribution. However, any such substitution should be backed up by actual exposure testing.

Hiding Power and Tinting Strength:

Only minor changes in hiding power and tinting strength could be expected as a result of the proper substitution of talc for other magnesium silicates unless one product is a slightly better prime pigment extender than the other. This may be minimized by choosing a talc of similar particle size and distribution to the magnesium silicate. Care should also be taken to choose a talc having similar color characteristics when wet out in the user's vehicle to avoid shifts in the undertone of tinted paints.

Gloss and Sheen:

When substitutions are made which involve a change in the particle shape of the extender, gloss and sheen differences are quite likely, depending on the type of paint vehicle, the PVC, and the extender loading. We have noted that platy talcs have a greater ability to lower gloss and sheen of organic solvent-based paints below paint CPVC, but little difference above CPVC or in latex paints.

Abrasion Resistance:

The abrasion resistance of a paint is a function of the hardness and packing configuration of its pigments, as well as the paint PVC and pigmentation CPVC. Therefore, we have

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noticed a slight lowering of abrasion resistance when soft talc is substituted for hard magnesium silicates. The difference seems to decrease as paint PVC increases. This is somewhat compensated for, however, by the lower mill wear experienced with soft talc, and the subsequent insurance against possible deterioration of exterior durability.

Pigment Settling:

The lack of hard settling encountered with talcs and other magnesium silicates has been attributed to the "brush-heap" packing of the fibrous particles as they settle. However, completely fiber-free talcs also exhibit this ease of redispersion because they also tend to settle into a loosely packed mass.

Application Properties, Ease of Manufacture, Shelf Stability:

There should be no differences in these properties as a result of substitution with talc provided the paint is properly formulated to achieve satisfactory wetting/dispersion/stabilization. As was mentioned previously, changes in these properties are indicative that additional attention must be given to the surfactant content of the paint to achieve adequate and stable pigment dispersion.

SUMMARY

We have shown that substituting a pure, platy talc for a fibrous magnesium silicate can be an uncomplicated procedure, provided that two fundamental rules of paint formulating technology are followed: (1) adjustment of paint PVC to compensate for changes in the absorptivity or void volume of the pigmentation, and, (2) paying particular attention to the wetting/dispersing/stabilizing ingredients of the paint formula. If these two rules are followed, only minor changes in paint properties are to be expected, mostly as a result of particle shape differences.

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APPENDIX

(1) $PVC = \frac{P}{P+V}$ where: PVC = pigment volume concentration
P = volume of pigment
V = volume of vehicle solids

(2) $CPVC = \frac{P}{P+C}$ where: CPVC = pigmentation critical PVC
C = void volume of pigmentation, P, obtained from oil absorption or other measurements.

(3) rearranging (1) and (2), $V = P \cdot \frac{(1-PVC)}{PVC}$ and $C = P \cdot \frac{(1-CPVC)}{CPVC}$

The percent excess binder or deficiency of binder in a pigment/binder system relative to the amount needed to just satisfy the pigmentation void volume is given by $\frac{V-C}{C} \times 100$. Substitution of an equal volume of one pigment for another may change the percent excess of or deficiency of binder. Therefore, to maintain equality we write:

(4) $$\frac{V_1-C_1}{C_1} = \frac{V_2-C_2}{C_2}$$

Substituting formulas (3) into formula (4) we obtain:

(5) $$\frac{P\frac{(1-PVC_1)}{PVC_1} - P\frac{(1-CPVC_1)}{CPVC_1}}{P\frac{(1-CPVC_1)}{CPVC_1}} = \frac{P\frac{(1-PVC_2)}{PVC_2} - P\frac{(1-CPVC_2)}{CPVC_2}}{P\frac{(1-CPVC_2)}{CPVC_2}}$$

(6) $$PVC_2 = \frac{PVC_1 \cdot CPVC_2\ (1-CPVC_1)}{PVC_1\ (CPVC_2-CPVC_1)+CPVC_1(1-CPVC_2)}$$

To show that formula (6) is valid for paint systems where pigmentation CPVC paint $\neq$ paint CPVC, such as with emulsion paints, we can say that for such a system, the volume of available vehicle solids, Va, is

(7) $$Va = P \cdot \frac{(1-PVC)}{PVC}\ (x)$$

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Where x may be thought of as the binding power index of the vehicle. Formula (5) then becomes:

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$$\frac{\frac{(1-PVC_1)}{PVC_1}(x) - \frac{(1-CPVC_1)}{CPVC_1}}{\frac{(1-CPVC_1)}{CPVC_1}} = \frac{\frac{(1-PVC_2)}{PVC_2}(x) - \frac{(1-CPVC_2)}{CPVC_2}}{\frac{(1-CPVC_2)}{CPVC_2}}$$

However, solving for PVC_2 cancels the "x", showing that the formula is valid for systems where no change is made in vehicle binding ability.

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The data in this brochure are based upon actual experimental work and are believed to be reproducible. However, no guarantee is made that the results as shown will be obtained.

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