JAR ~~SAT~~ ~~WSG~~ - JAR FILE

BUSINESS CONFIDENTIAL

INTERIM REPORT

THREE TITANIUM OXIDE PRODUCTS - FLOW DATA OF THEIR SUSPENSIONS

Author: K. Park

Date: February 20, 1968

Notebook No.: 2270, pp. 21-24

SUMMARY

Flow data of suspensions of three TiO_2 products, Titanox-AT, Suntiox SA-15, and Ti-Pure LW, have been obtained. Data which show the effect of Calgon on degree of dispersion of Titanox suspended in King City water have also been obtained.

In soft water represented by distilled water, the three TiO_2 products were almost equally well dispersed. However, in hard water, containing equivalent amounts of divalent cations such as Ca^{++} and Mg^{++} to that of King City water, all of the TiO_2 products were highly flocculated. Suspensions of Titanox were significantly more flocculated than those of the other two products, but only a small amount (less than 0.08 g./l.) of Calgon was required to reduce the suspension viscosity of Titanox to that of Suntiox or Ti-Pure. About 0.3 to 1.5 g./l. of Calgon was needed to disperse Titanox suspension (in King City water) to such an extent that its viscosity was comparable to that of Titanox dispersed in distilled water.

Ti-Pure was slightly more flocculated than Suntiox in King City water.

INTRODUCTION

should be "hexameta"

The work reported here was initiated by the request of Mr. R. G. Woolery to determine the amount of Calgon (sodium hexamethyl phosphate) needed to disperse suspensions of Titanox-AT to such an extent that its viscosity is equivalent to viscosity of suspension of Suntiox SA-15. It has been known that Asbestos "T" made with Suntiox is superior to Asbestos "T" made with Titanox in their light scattering properties. However, according to the technical data provided by Titanium Pigment Corporation (manufacturer of Titanox), there was no significant difference in performance between Titanox-AT and Suntiox SA-15 (Japanese product). It has been suspected that the degree of dispersion in King City water is a major factor which distinguishes efficiency of the two TiO_2 products. Analysis data furnished by Titanium Pigment Corporation indicate that Suntiox SA-15 contains a little more dispersant (0.38% P_2O_5) than Titanox-AT (0.32% P_2O_5).

Because of the high content of cations such as Ca^{++} and Mg^{++} in King City water, a slurry of titanium oxide used in the process of making Asbestos "T" is naturally flocculated. The flocculation will give rise to large agglomerates of particles; consequently, TiO_2 will not be uniformly dispersed (distributed) when Asbestos "T" made from the flocculated TiO_2 suspension is incorporated into paper. In order to prepare

Research and Development Department
Chemicals & Plastics
Operations Division
Union Carbide Corporation
Niagara Falls, New York

asbestos coated uniformly with fine particles of TiO_2, it is necessary to have the starting suspension of TiO_2 sufficiently dispersed prior to addition of asbestos. The major objective of present work has been to determine the optimum amount of Calgon needed to disperse suspension of Titanox-AT. At present, Union Carbide uses mainly Titanox no! for the production of Asbestos T-135. In addition to flow data of suspension of Titanox-AT and Suntiox SA-15, flow data of suspensions of Ti-Pure LW have been obtained for comparison. Ti-Pure LW is known to be flocculation resistant TiO_2, manufactured by Du Pont.

Water of equivalent hardness to that of King City water was prepared in the laboratory by dissolving appropriate amounts of mono- and divalent salts in distilled water. Stability (dispersion or flocculation) of TiO_2 suspension was determined by measuring viscosities with a Fann-35 rotational viscometer.

DISCUSSION

Preparation of Water having Equivalent Hardness to that of King City Water

Appropriate amounts of various salts were dissolved in distilled water (specific resistivity $\simeq 3.5 \times 10^5\ \Omega$) so that its hardness, i.e., concentration of divalent cations, was equivalent to that of King City water. The pH of the water* was adjusted to 8 by adding 0.1N sodium hydroxide solution. Concentration of monovalent cation, i.e., sodium ion, was also closely adjusted. Considering the fact that stability of TiO_2 suspension depends mainly on concentration of cations, especially multivalent cations, accurate adjustment of concentration of anionic species was not attempted. Kinds and amounts of salt used in preparation of King City water are recorded in Table I.

Flow Data

Suspensions containing varying amounts of Calgon were prepared by mixing titanium oxide (Lightnin Mixer for 15 minutes) in water in which measured amounts of Calgon had been already dissolved. Flow data were obtained soon after preparation.

Figure 1 shows the flow curves obtained for Titanox-AT, Suntiox SA-15, and Ti-Pure LW, respectively. It is seen that Titanox in King City water (Curve 7) shows significantly heavier consistency than both Suntiox and Ti-Pure (Curves 5 and 6), indicating that the former is more highly flocculated than the latter two. In distilled water, they seemed to be dispersed to almost the same extent (Curves 1 and 2). On addition of about 0.08 g./l. of Calgon to Titanox suspension, its consistency became even smaller than the consistency of suspension of Suntiox (or Ti-Pure)(Curve 4). It appeared that Ti-Pure was slightly more flocculated than Suntiox in KCW (Curves 5 and 6). On addition of 0.33 g./l. of Calgon, Titanox suspended in KCW became almost the same as that of Titanox suspended in distilled water (Curves 3 and 7).

Table II summarizes values of apparent viscosities for the suspensions of three TiO_2 products.

*pH of plant water = 7.4 to 7.8

Figure 2 represents the effect of Calgon addition on apparent viscosity of 30% (by weight of water) suspension of Titanox-AT. One sees that the optimum range of Calgon addition for dispersing Titanox in KCW is about 0.3 to 1.5 g./l. It was observed that the suspension started to flocculate when the Calgon addition exceeded 3.3 g./l. It is shown in the figure that viscosity begins to increase at 1.5 g./l. of Calgon addition. Evidently at this level of Calgon addition, concentration of sodium ion is too high; thus, the particles of TiO_2 become agglomerated.

Kisoon Park

K. Park

KP:dmp

A17069

TABLE I

Preparation of Water having Equivalent Hardness to that of King City Water (Based on the Analysis Data by Water Conditioning Headquarters)

Salt Used	Amount Dissolved (g. per liter water)	Cationic Concentration as, e.g., Ca^{++} (ppm)
$CaCl_2$	0.1108	40
$MgSO_4 \cdot 7H_2O$	0.2375	23
Na_2CO_3	0.0895	40*

*Includes Na^+ added as NaOH to adjust pH of the water to 8

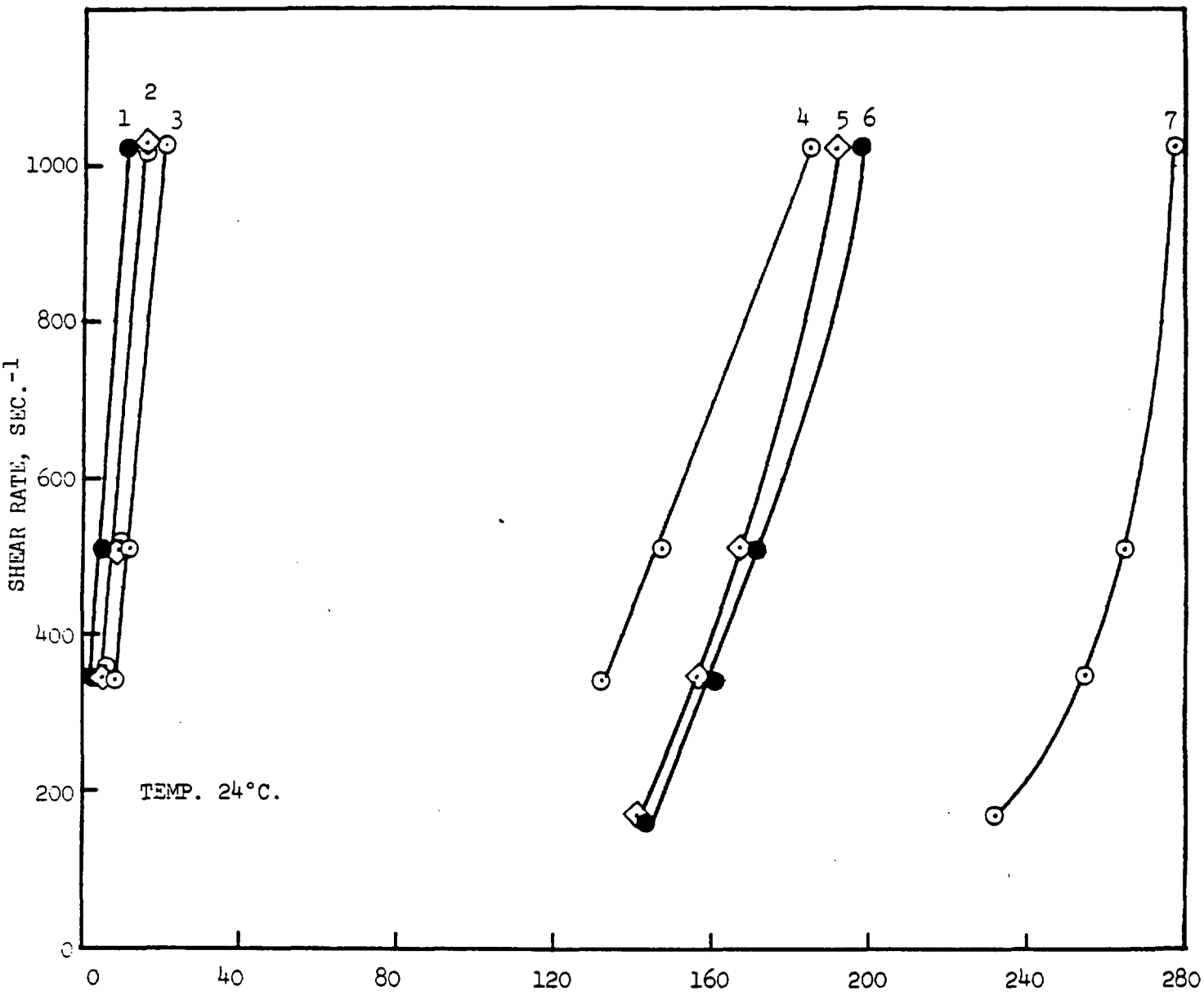
TABLE II

Apparent Viscosities (cps) of Suspensions of Three TiO_2 Products, Titanox-AT, Suntiox SA-15, and Ti-Pure LW

Shear Rate ($sec.^{-1}$)	Distilled Water			King City Water		
	Titanox	Suntiox	Ti-Pure	Titanox	Suntiox	Ti-Pure
511	1.9	1.9	1.5	52	33	34
1022	1.6	1.6	1.3	28	19	20

A1707C

FIGURE 1 - FLOW CURVES OF SUSPENSIONS (30% BY WEIGHT OF WATER) OF THREE TiO_2 PRODUCTS, TITANOX A-AT, SUNTIOX SA-15, AND Ti-PURE LW.



CURVES: 1, Ti-PURE IN DISTILLED WATER; 2, TITANOX AND SUNTIOX, RESPECTIVELY, IN DISTILLED WATER; 3, TITANOX IN KING CITY WATER WITH 0.33 g./l. OF CALGON; 4, TITANOX IN KCW WITH 0.076 g./l. OF CALGON; 5, SUNTIOX IN KCW; 6, Ti-PURE IN KCW; 7, TITANOX IN KCW

A17071

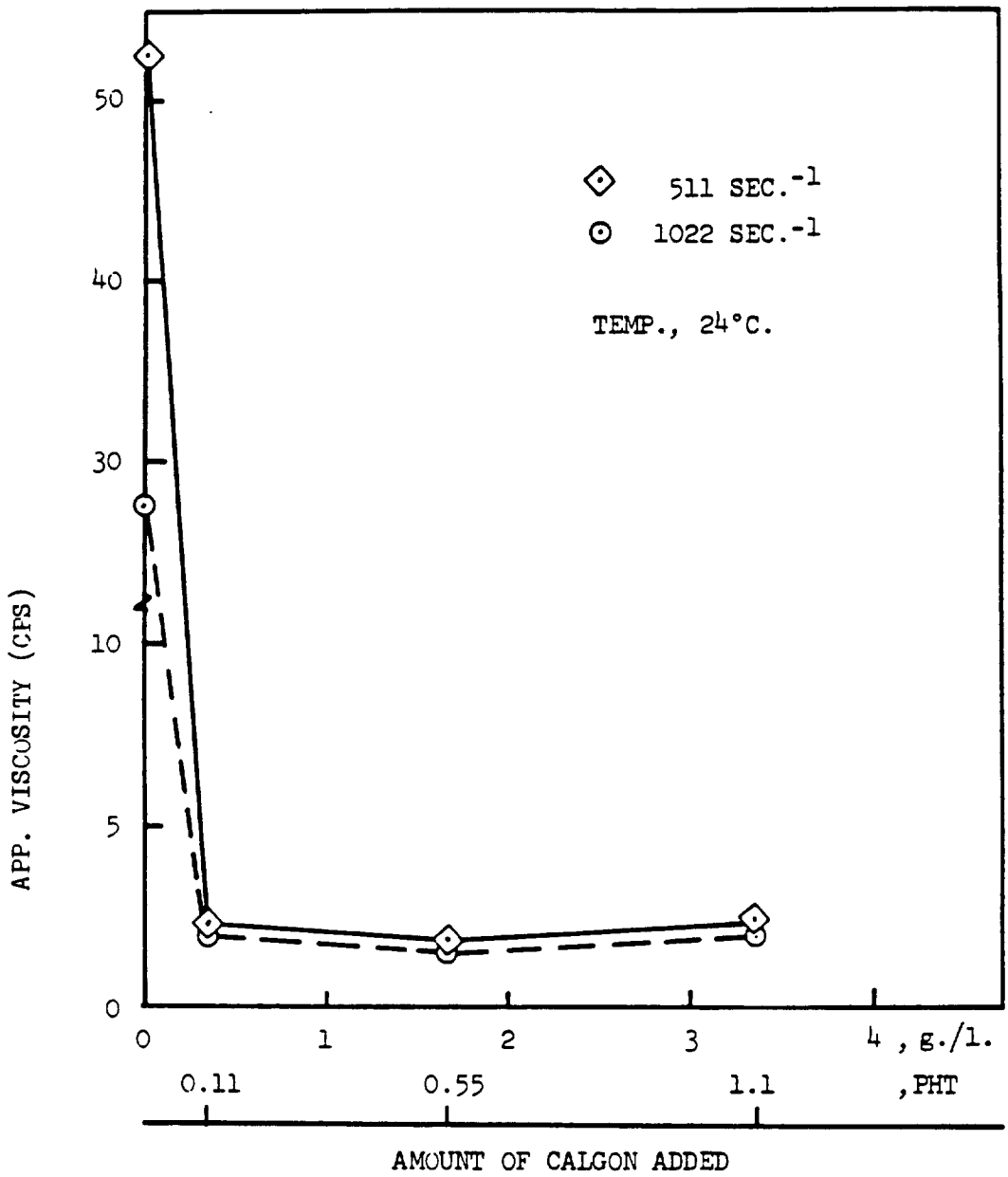


FIGURE 2 - EFFECT OF CALGON ON APPARENT VISCOSITY

(CALCULATED AT TWO DIFFERENT SHEAR RATES) OF TITANOX A-AT SUSPENDED IN KING CITY WATER
g./l.: GRAM PER LITER OF WATER, PHT: PART PER HUNDRED OF TiO_2

A17072

DISTRIBUTION

BOUND BROOK

I. Allen
W. T. Higgins
W. Miller
P. E. Pratt
R. W. Quarles
P. A. Thomas
N. L. Zutty

NEW YORK

F. D. Dexter
L. P. Jehle
A. E. Pufahl
N. J. Setter
L. Shechter
J. Sidlovsky
J. F. Voit
J. R. Wilkinson

SOUTH CHARLESTON

J. W. Biddle
F. B. Brown
N. R. Eldred
R. I. Hoaglin
F. Johnson
C. S. Maxwell
C. W. McGary
J. J. Smith
F. J. Welch

TARRYTOWN

T. H. Welch

GENEVA, SWITZERLAND

T. J. Hall

KING CITY

J. A. Riddle
J. L. Myers ✓

TONAWANDA

S. Sterman

NIAGARA FALLS

R. E. Byrne
H. B. Rhodes
S. Chwastiak
G. L. Dickson
R. A. Hard
B. L. Ingalls
M. S. Kisiel
E. J. Markiewicz
K. Park
J. E. Skvarla
F. H. Thompson
R. G. Woolery

A17073