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NEWARK PLANT

PIGMENT COLOR RESEARCH REPORT

Final Report

X-544-D, Plant and Semi-Works Development

Period Covered: May, 1943 - September, 1943.

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NEWARK PLANT

PIGMENT COLOR RESEARCH REPORT

Final Report

Title: Y-544-D, Plant and Semi-Works Development

Period Covered: May, 1943 - September, 1943.

SUBMITTED BY: J. R. Borst DATE SUBMITTED: 5/5/44

J. R. Borst

APPROVED BY: V. Chalupski DATE ISSUED: 5/26/44

V. Chalupski May 26, 1944

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INTRODUCTION

The zinc yellow Y-544-D was created in response to a demand for a low cost product in which the presence of an appreciable quantity of sulfate is not objectionable; the composition of the new yellow is similar to Y-232-D. This product like Y-539-D is made from zinc oxide and the process differs mainly from the Y-539-D formula in the acid used for neutralization of the freshly struck slurry (sulfuric instead of hydrochloric). This report covers semi-works and plant development of the Y-544-D process. A limited amount of laboratory work which was performed concurrently with this study is reported in KN-43-160.

THEORY

The Y-544-D type of zinc yellow is very similar in preparation to its prototype Y-539-D. Both of these products are made by striking a slurry of zinc oxide and potassium chloride with sodium bichromate liquor. The strike is immediately followed by acidification but Y-544-D uses sulfuric acid whereas Y-539-D is neutralized by hydrochloric acid. The effect of the sulfuric acid on the composition is shown by the table below, where the approximate compositions of Y-539-D and Y-544-D are shown with the theoretical zinc yellow composition based on the formula $K_2O.4ZnO.4CrO_3.3H_2O$.

	Theoretical Composition	Y-539-D	Y-544-D
% ZnO	37.2	38.0	38.0
% CrO_3	45.8	44.3	42.0
% K_2O	10.8	10.5	10.5
% H_2O (combined)	6.2	7.0	7.0
% SO_3	None	0.15 max.	2.5
% Cl	None	0.05 max.	0.1-0.2 approx.

It is probable that the sulfate is a definite part of the zinc yellow crystal lattice, replacing an equivalent amount of chromate with which it is isomorphous. The sulfate in Y-544-D is extremely important since its presence is responsible for the higher yield per pound of chromate used and lower cost than would otherwise be attainable.

SUMMARY AND CONCLUSIONS

At about the same time as the work on Y-544-D was being started a Bird centrifuge was installed in the plant for the dewatering of zinc yellows. Considerable effort was expended to determine factors which influenced the centrifuging capacity (pounds of pigment per hour). The settling rate of the zinc yellow was assumed to be a measure of the centrifuging rate. Consequently,

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references made here to the settling characteristics should be construed to indicate the ability of the color to centrifuge.

The first batch of Y-544-D was made in the semi-works on a formula later designated as K-1921. This was based on a combination of laboratory recommendations and previous experience with Y-539-D. This batch settled poorly and the yield was lower than anticipated. It contained approximately 1.3 per cent SO_3.

Plant production was started on this formula and nearly sixty batches were struck on it under development supervision. A great proportion of this work was in collaboration with the Industrial Engineering Division in order to make material which would centrifuge at a high rate. Of the several variables studied, only the elimination of the caustic soda improved the rate of settling. Caustic was added as a dispersing agent for the zinc oxide (as in Y-539-D) and was varied from 0 to 1/2 per cent (based on the estimated yield). The settling results were not sharply defined but it was evident that the batches made without caustic settled most rapidly. The rate of strike, volume of water for dispersing the zinc oxide and time of stirring after acidification failed to improve the settling rate.

As a result of the work on settling, a new formula, K-1926, was set up for centrifuging. This formula omitted the caustic for dispersing the zinc oxide. Seven plant batches were made on this formula under development supervision. The average capacity of these in the centrifuge was 1330 pounds per hour on the first pass and 950 pounds per hour on the second pass (after reslurrying). While these rates of through-put were not as great as desired, they were, nevertheless, a considerable improvement over earlier batches.

Subsequent to the work on settling, the laboratory recommended the use of a greater amount of sulfuric acid for increased yield. Semi-works and plant trials were run with higher acid to verify this lead and these batches actually showed a slight improvement in yield. This material contained about 2.5 per cent SO_3 whereas batches made on previous formulas analysed 1.5 per cent SO_3 or less. The change in acid combined with some simplifications in making procedure resulted in the formulation of the present standard, K-1934.

The Y-544-D process was turned over to the plant after K-1934 was set up and has performed satisfactorily since. Two batches made on the present standard were vat washed to 0.11 and 0.19 per cent Cl. Previous attempts to vat wash Y-544-D were unsuccessful because of its failure to settle.

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EXPERIMENTAL DETAILS

The procedure employed for predicting the ability of the zinc yellow to centrifuge from its settling rate may be of interest because of its potential usefulness on other colors. It should be emphasized that no empirical relationship has been found which would permit forecasting of rates through the centrifuge knowing the settling characteristics. The relationship is merely qualitative but has been useful in a general manner. The samples of zinc yellow slurry from the strike vat were always made to the same concentration in a graduate. Then the graduate was inverted several times (while covered by the hand to prevent spilling) in order to uniformily suspend the slurry. Readings of the volume of clear backwater were taken at five minute intervals until constant results were obtained. Then a graph was plotted correlating time of settling versus decantable volume. The greater the slope of this curve the greater the settling rate and the higher should be the centrifuging rate.

See DSN-43-61.

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