KN-54-9 Newport Plant Assistance - CPC By: E. F. Klenke Jr. 1/1/52-1/31/52

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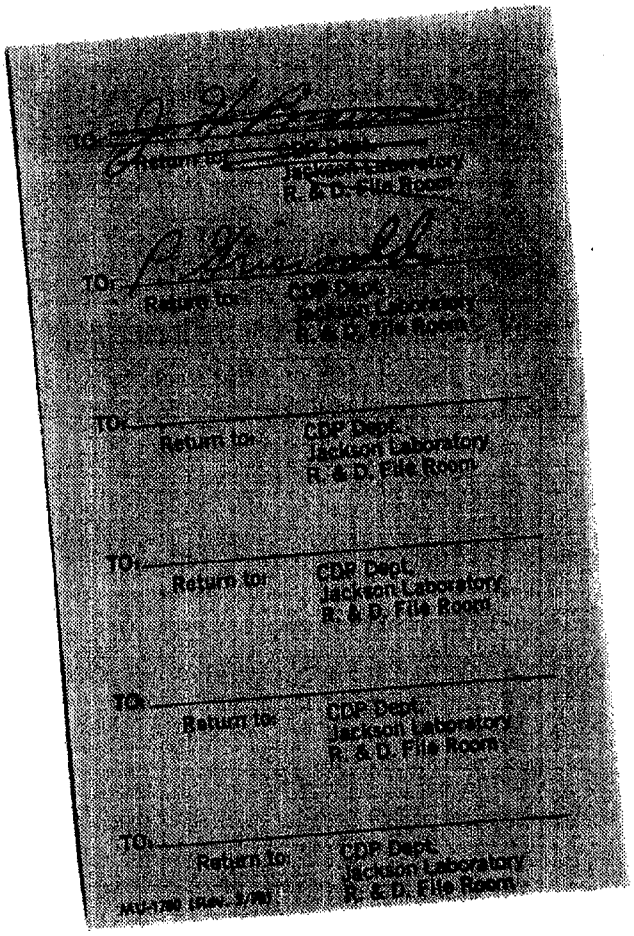
(Newport)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Serial No. KN-54-9

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NEWARK PLANT
PIGMENT COLOR RESEARCH REPORT

Final Report

NEWPORT PLANT ASSISTANCE - CPC

Period Covered JANUARY, 1 - DECEMBER 31, 1952

FILE: 223.4

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NEWARK PLANT

CHEMICAL DIVISION-COLORS

Final Report

TITLE: NEWPORT PLANT ASSISTANCE - CPC

PERIOD COVERED: JANUARY, 1 - DECEMBER 31, 1952

CHARGE: BCK-33

SUBMITTED BY: E. F. KLENKE, JR. E. F. Klenke, Jr. 5/19/54 DATE SUBMITTED: 4/14/54

APPROVED BY: J. H. COOPER J. H. Cooper 5/19/54 DATE ISSUED: 5/20/54

DUP050069720

INTRODUCTION

This report is a continuation of KN-52-9, and covers the Newport plant assistance work for the period January to December, 1952. During this period the expansion of the CPC plant (project 9199) was completed.

A new product "Monastral" Blue BNF was added, using a modification of the Blue LB process in the same equipment. This product was developed to meet the demand for a flocculation resistant CPC Blue, and was released as a "Ramapo" lake coded BP-366-D.

A number of process changes were introduced during this period, in the interest of better quality and/or lower operating costs. Paste milling (see Appendix II), which significantly increased the plant milling capacity, the use of "EF" type crude for chlorination and BG milling, and simplification of blue and green finishing processes (elimination of one extraction each) were the major contributions to the cost reduction program. Quality improvements were gained by better operating control and by the process changes indicated later in this report.

SUMMARY AND CONCLUSIONS

A. 4-CPA

During the period 2/7/52 to 4/15/52 the 4-CPA (4-chlorphthalic acid) batch size was changed several times in an effort to reduce the chlorine content of LB crude from a 4.6% average to the goal of 4.1%. By weighing and analyzing each batch of 4-CPA, and correlating these data with blue crude analysis, it was established that 40 lbs. of organic chlorine per batch of 4-CPA would produce LB crude of the desired chlorine content. On 4/15/52, this process (1-C) became standard and remained unchanged until the LB batch size was increased. More detailed information can be found in the plant standard job procedures 1A, 1B and 1C.

B. Synthesis

Starting 2/1/52, the use of dry instead of molten urea was adopted to eliminate the possibility of yield and/or quality loss due to decomposition of the urea during the melting process.

In April the amount of copper chloride used per synthesis was increased to 105% of theory as insurance against yield loss. At the same time, 10 lbs. of 50% NaOH was added to 12 consecutive batches on a trial basis in an effort to improve yield. The results of the NaOH trial were inconclusive.

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In June the quantity of phthalic anhydride used per synthesis was increased from 847 lbs. to 856 lbs., the urea increased from 1500 lbs. to 1600 lbs., the ammonium molybdate increased from 2.5 to 5 lbs., and the Ionol (anti oxidant) increased from 3 to 6 lbs. - all to improve synthesis yield. At the same time, the sequence of raw material additions to the synthesis kettle was changed (see SJP-20), so that urea was added after the water in the 4-CPA was boiled off, but before the other chemicals were introduced. This change was made because the occurrence of four "gunked" syntheses during April and May was attributed to oxidized kerosene, and it was postulated that the early addition of urea would lower the temperature of the kerosene, while the later addition of the $CuCl_2$ would reduce the possibilities of oxidation.

In November a series of syntheses was made using 3-1/2 hours instead of the standard 4 hours hold time at temperature (195° ± 5°C). Some yield loss occurred and was associated with the shorter holding time; therefore, the change was discontinued. It was agreed at this time to try adding 27 lbs. of flake caustic to each synthesis for one month to determine if the yield improvement reported by the Semi-works could be realized. There was a 3% yield increase attributed to the use of caustic; however, the simultaneous occurrence of some redness and dullness in N-623 led to the temporary discontinuance of the use of caustic. The addition of caustic in the synthesis was resumed in January, 1953, at which time no quality degradation was observed.

C. Sulfation and Hydrolysis

Starting in February, 1952, a campaign of 20 batches was made using 1) an increased quantity of ice (5000# vs 3000#) for hydrolysis and 2) adding the ice after the kerosene decantation instead of after the two subsequent water decantations. This "cold hydrolysis" procedure was tried as a means for improving LB quality. The occurrence of severe pelletization during or subsequent to hydrolysis was attributed to this process change; therefore, it was abandoned. There was no improvement in quality associated with the trials of "cold hydrolysis".

In the interest of obtaining LB crude of higher purity, the crude extraction time was increased from 2 to 4 hours (at 95°C), the filtration temperature increased from 70°-80°C to 95°C, and the press washing time increased from 3 to 4 hours. There was no significant improvement in purity; therefore, on 6/3/52 the filtration temperature was reduced to 75°-85°C. to increase the life of the press wood, and the extraction time decreased to 2 hours to relieve the extraction tank bottleneck.

With the hope of improving crude purity and/or quality, 20 lbs. of Triton X-100 was added to 6 batches prior to hydrolysis; there was no purity or quality improvement noticed.

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Two batches were acid hydrolyzed (no caustic added after sulfation and decantations) to collect plant operating and quality data. The final pH of the washed crudes was 3.0 - 3.3; therefore, 10 lbs. of tri-sodium phosphate was used per ball mill charge to inhibit possible corrosion. No processing difficulties were encountered, and the solvent milled products were equal to current products. This work was undertaken as part of a cost reduction program the goal being roughly $1.5/cwt. savings due to omission of NaOH. The equipment modifications needed to permit adoption of this process (acid slurry at high temperature) could not be justified by the savings involved; therefore, no further work was done.

The practice of drying unwashed crude (after hydrolysis) was discontinued in June, 1952, after several fires in the crude driers were attributed to this procedure.

D. Solvent Milling

By January, 1952, K, L, and M mills were put into service. These were the last of the new mills installed as part of the 9199 project. The initial performance of J, K, L, and M was unsatisfactory; weak (106:100) dull material was produced repeatedly, even at reduced milling rates (314#/21 hours vs. 362#/21 hours). The use of improperly cleaned shot and/or mills was suspected, and a cleaning program was started. Several millings of blanc fixe/acetone and salt/acetone were tried without success. In addition to being ineffective as a shot and/or mill cleaner, the blanc fixe residue in the mill was difficult to remove. Washing the shot with "Duclene" (inhibited HCl) was also unsuccessful. The final approach was to mill a tri-sodium phosphate/water solution and discharge the balls on to an inclined screen which in turn discharged into drums of TSP/water solution. As the shot traveled down the inclined screen, they were washed with a water spray. One such operation was found to be adequate, and after a few charges of blue crude were milled, the mills were considered acceptable.

In January, the problem of LB weakness (105:100) at the standard milling conditions (362 lbs. crude and 21 hr. milling cycle) was referred to the Chemical Division. The first approach was to return to the old standard milling conditions of 314 lbs. loading and 21 hr. cycle. However, at these conditions the quality averaged 106:100; therefore, the milling cycle was increased to 30 hrs. at the 314 lbs./30 hr. conditions, the ball mill quality averaged 97:100; packed lot quality averaged 100:100.

Quality fluctuations persisted, however; therefore, in an effort to achieve better uniformity of mill quality, the steel shot loadings were adjusted to 24,000# (± 4%) per mill. This was subsequently reduced to 21,000# per mill on 4/18/52. One extra 100 gallon acetone flush was added at the end of each mill discharge, since tests showed roughly 50# of pigment remained in the mill after the standard flushing (1 dilution plus 1-100 gallon flush).

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In May, the milling conditions were changed from 314#/30 hours to 362#/30 hours for increased productivity. A very slight strength loss was associated with this change. The conditions were again changed in June and July for increased production, and 362#/26 hours was used most of the time. Average quality dropped from 97 to 99:100 from May to July.

In July, two trials were made of increased mill loading; seven packed lots were made at 410#/36 hours, and three packed lots at 430#/26 hours. The quality at 410#/36 hours averaged 101:100, and at 430#/26 hours the average was 102:100. Three more packed lots in August at 430#/26 hours also averaged 102:100.

A statistical study was made of LB milling for the period 4/15-10/1/52 and the results summarized in a memorandum report issued 11/12/52 (Appendix I). This study indicated the four major milling variables to be milling time, pigment loading, mill speed, and pigment purity, and a formula was developed for the relationship of these variables to pigment strength. (See report for details.)

Due to a drop in packed lot quality at 362#/26 hours (11 lot average = 102:100, September - October), the mill loading was changed to 362#/30 hours (24 lot average = 99:100), but returned to 362#/26 hours for extra production.

For a two week period at a mill loading of 362#/24 hours, the mill dilution at 1 and 6 hours was omitted; all the acetone was put into the mill at the start. A strength loss of 1/2-1% was attributed to this change, and it was therefore discontinued.

In December, 1952, paste milling was started and is reported in detail in a report issued 2/17/53 by J. W. Minnich. (Appendix II)

E. LB Finishing

In March, alkaline extraction of milled LB was resumed in an effort to improve quality. Approximately 1-2% strength was gained; however, the extraction was discontinued in April to reduce costs. Substituted for the alkaline extraction was a press wash with dilute ammonia, and this procedure is still in use.

"Monastral" Blue BG

Material produced in January was roughly 5% weak, red and dull primarily due to the use of new mills J, K, L, M and/or rusty shot (see LB milling). During the same period A, B, and C mills were producing satisfactory material; therefore, their production was segregated. The other material was remilled in the plant (after extraction and drying), and acceptable quality was attained.

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In the April-May campaign (13,000#) the first 8 packed lots averaged 104:100 dull; therefore, the milling conditions were changed from 345#/30 hours to 314#/40 hours. The balance of the campaign (15 lots) averaged 103:100 vvs green, vs intense. The use of dry urea in the synthesis was started with this campaign, and has been continued ever since.

The 15,000 lb. June campaign was milled 314#/40 hrs. with an average packed lot quality of 105:100, intense. Also, one packed lot (247) was made from "EF" type crude, milled 314#/40 hrs.; the quality was v green, and dull versus BT-297-D (lot 373). During this campaign dilute ammonia press washing was instituted and is still in use.

During the July-August campaign the use of a 20/80 blend of "EF"/"KF" crude was tried as a means of increasing the BG milling rate. It had been demonstrated by lab. milling that "EF" crude developed strength more rapidly than "KF" crude, and that a 20/80 blend of "EF"/"KF" crude gave the improved rate of strength development without adversely affecting any color properties. The results of this plant trial were as follows:

at 314#/40 hrs. (20% "EF"/80% "KF" crude = 99 s green, vs intense
(100% "KF" crude = 102 equal

at 362#/40 hrs. (20% "EF"/80% "KF" crude = 100 vvs red, vs dull
(100% "KF" crude = 103 vs red, s dull

These plant data confirmed the laboratory data; the use of the 20/80 blend of crude gave a significant increase in milling rate which, together with the use of the lower cost "EF" crude, reduced the cost of solvent milled Blue BG.

Based upon this information, the November campaign was made using a 20/80 blend of crude and milling 362#/40 hrs.; average quality was 99:100, equal. Two packed lots made exclusively from "EF" crude, milled 345#/45 hrs., were rated 94:100, green and dull.

See Appendix III for tabulation of Blue BG quality data.

Blue BNF

The first synthesis of Blue BNF (lot 431) was made in May, 1952, and no unusual operating problems were encountered.

The crude was milled 30 hours with a 362# pigment loading and shipped to Newark as packed lot N-623 (S), lot 568. By rubout, versus N-623 standard, this lot was 101:100 green, intense.

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The second Blue BNF campaign was made in July. Five syntheses were made and finished in 12 mill charges as 5 packed lots. A fresh shipment (lot 3) of Monsanto 4-sulfophthalic anhydride was used; two of the syntheses were 5% 4-sulfo, and the other three were 7%. The plant had trouble pumping each finished synthesis slurry from the kettle to the sulfation tank due to the sandy nature and rapid settling tendency of the pigment. After consultation with E.S.D. a special pumping procedure was set up and is still in use. The operation cannot be considered completely satisfactory, however, since it requires excessive operator attention. The final packed lot quality was satisfactory, as judged by flush-out at Newark.

In November, the plant decided to make a second trial campaign of Blue BNF to determine if any operating problems other than pumping difficulties exist. They felt that the pumping problem could be overcome. This campaign was ultimately made in January, 1953, and the results reported in the plant Quality Control report issued 2/19/53.

"Monastral" Green

A. Chlorination

During the month of March attention was directed toward elimination of the excessive blueness of tint (blue to v blue). Antimony oxide ("Timonox") and antimony trichloride were both evaluated in the plant as replacements for the aluminum chloride catalyst, and in April antimony oxide was used almost exclusively. Both lab and plant quality indicated a significant reduction in blueness, presumably as a result of this change. The initial reaction violence associated with the use of Sb_2O_3 catalyst was overcome by "reverse" addition of ingredients; i.e., adding the CPC and the catalyst to the sulfur chloride (in the autoclave).

A series of 18 chlorinations was made in May using a 3 hour hold time at temperature (4 hours standard), 10 with sulfur chloride of 68.7% maximum chlorine content, and 8 in the range 68.7-69.6% chlorine. The 10 at 68.7% chlorine were blue in tint; whereas the 8 at average 69.1% chlorine were equal to standard. This work was discontinued to concentrate on the rotary dryer problems.

In May the use of "EF" type (unsulfated) chlorine-free crude for chlorination was adopted as standard procedure, and standard quality and performance were maintained at a lower ingredient cost; see EN-52-9 for details.

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As part of the program to alleviate the plugging of the rotary dryer vapor line, lengthened dryer cycles and pelletization of the crude in the rotary dryer, the following were tried:

1. The quantity of Sb_2O_3 catalyst was reduced from 13-1/2# to 10# and then to 7# per chlorination. No improvement in dryer performance was noted, nor any quality shift associated with these changes.

2. The chlorination size was reduced 15%; no improvement noted.

3. 200# salt (NaCl) in the rotary dryer, prior to dropping the charge from the autoclave, failed to reduce pelletization or improve drying characteristics.

4. The use of extra bars in the dryer was also ineffective.

5. A longer steam drying cycle was also tried without success.

6. Finally, six chlorinations were made using $AlCl_3$ catalyst, and a significant improvement in dryer performance was noted (less vapor line pluggage and less pellets).

Additional work on this problem was deferred until repairs to the absorption towers and rotary dryer exhaust system were completed (7/26-8/9; vacation shutdown). Because of the more violent reaction, when using $AlCl_3$ instead of Sb_2O_3 catalyst, additional trials using $AlCl_3$ were delayed until the wind was consistently blowing away from Newport to avoid any possible fume complaints. Resumed use of $AlCl_3$ in October, significantly improved dryer performance; however, some blueness and dullness occurred (later attributed to the use of aged $AlCl_3$) and the switch back to Sb_2O_3 was made. Meanwhile, modifications of the rotary dryer vapor and exhaust system sufficiently improved the rotary dryer performance so that the use of Sb_2O_3 was permanently adopted, because of its better storage properties and more easily controlled rate of reaction. The problem of pellet formation in the rotary dryer was never overcome. Each charge was screened (± 1/8" holes), and the pellets sent to Newark for pulverization and then back to Newport for extraction and milling,etc.

B. Milling and Finishing

In March, a new lump standard (N-624, S.W. 1480) was set up to replace AGT-729-D, S.W. 2609 as the Newport shipping standard. By rubout, S.W. 1480 was rated 100:100, s intense, versus S.W. 2609.

As part of a cost reduction program, 8 plant packed lots (914 to 921 inclusive) were processed without a final acid extraction (following solvent milling and distillation). Newport and Newark quality evaluations indicated no quality loss due to this change; therefore, following a similar campaign in May, the process change was permanently adopted on 6/9/52.

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Starting in July, the plant milling operations were studied. The pigment loading per mill charge was increased from 400# to 420# and then to 450# (24 hour milling cycle) to utilize the finishing facilities at capacity. There was a very slight (± 1%) strength loss associated with this change; however, the increased loading was continued to gain production.

A study of plant finishing indicated the alkaline extraction following acetone distillation might be unnecessary. Two short campaigns in the plant, pressing and washing the slurry from the still after acetone distillation, confirmed this; Newport and Newark quality were found to be satisfactory in all applications. Therefore, in the interest of cost reduction, this processing change was adopted in November.

During December the first trials of paste milling were made in the green mills. This work is reported in detail in a report issued by J. W. Minnich, 2/17/53.

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APPENDIX I

E. I. DU PONT DE NEMOURS & CO.

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PIGMENTS DEPARTMENT

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J. W. Minnich - "
File 12.4, 3.1

Newport, Delaware
November 12, 1952
(typed 11/13/52)

MEMORANDUM REPORT

STATISTICAL ANALYSES OF BLUE LB MILLING VARIABLES

Introduction

As part of a program to improve blue ball milling (strength and/or productivity), a statistical study of milling variables was undertaken. The quality data of approximately 200 plant mill samples were tabulated, together with such available operating and analytical information as might be expected to be related to tinting strength, and these collective data were subjected to a statistical analysis. By simple and multiple correlation methods four variables were found to be significant, and a formula was developed to show their respective (and collective) relationship to ball mill strength.

Summary and Conclusions

Of the eight variables studied only four were found to be significant; these were (in order of decreasing effectiveness) 1) milling time, 2) pigment loading, 3) mill speed, and 4) % extracted solids. These four variables collectively accounted for 88% of the total variation of ball mill strength; their respective effects may be summarized as follows:

1. Increased milling time from 21 to 30 hours increased strength by 3.62 units. Provided everything else remained constant, this would mean a strength increase of 0.4 units for every extra hour of milling over 21 hours.

2. Increased pigment loading from 314# to 362# caused a strength loss of 1.34 units, or a loss of 1% for every additional 36# of pigment over 314#.

3. Increased mill speed from 20.7 to 22.3 RPM caused a 1.1% increase in strength, or roughly a 1% increase for every 1.5 RPM over 20.7.

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4. Increased purity (% extracted solids) from 87-93% caused a strength loss of 0.4 units, or 0.5% strength loss for every 7.5% increase in % extracted solids over 87.0%.

The formula derived for predicting ball mill strength, using the above four variables, was:

$$S = 115.6 + 1.34\,(L) - 3.62\,(T) - 0.67\,(R) + 0.06\,(E)$$

where S = ball mill strength
L = pigment load (1 = 314#, 2 = 362#, etc.)
T = milling time (1 = 21 hours, 2 = 30 hours, etc.)
R = RPM (use actual figures)
E = % extracted solids, minus 80.0

(See discussion for applied example.)

Using this formula final ball mill strength can be predicted within ± 1.2% of the actual value, provided the values for the four variables are within reasonable limits (See discussion.)

The above formula was used to prepare the following table showing predicted ball mill strength for variations in milling time and pigment loading, assuming an average RPM (21.5), 10:1 acetone to pigment ratio in the mills, and average crude quality and purity.

Ball Mill Strength

Milling Time Hrs.	Pigment Loading - Lbs. 314	362	410	460*	510*
21	99.5	100.9	102.2	103.6	104.9
24	98.4	99.8	101.1	102.5	103.8
26	(97.5)	98.9	100.2	101.6	102.9
30	95.9	(97.3)	98.6	100.1	101.3
34	94.3	95.7	(97.0)	(98.4)	99.7
39	92.3	93.7	94.9	(96.3)	(97.6)
44	90.7	92.1	93.4	94.8	96.0

*Calculated from data far beyond the limits used during derivation of the formula and therefore not within the accuracy of the formula (± 1.2% strength deviation from actual value). ( ) goal figure to produce pack lots in the range 99-100:100, assuming roughly 2% strength loss due to finishing operations.

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Discussion

The variables correlated during the period of this study (4/15/52 to 10/1/52) and their respective ranges were:

1. Milling time (21 and 30 hours)
2. Mill loading - balls - (20,500# to 24,000#)
3. Mill loading - pigment - (314# and 362#)
4. Mill speed (RPM) - (20.7 to 22.3 RPM)
5. Crude purity (% extracted solids) - (87 - 93%)
6. % chlorine in crude - (3.7 - 4.5%)
7. % kerosene in crude - (0.7 - 1.1%)
8. Quantity of H_2SO_4 used in sulfation - (39" and 41")

Within the above ranges, variables 2, 6, 7 and 8 were found to be insignificant, whereas 1, 3, 4 and 5 had significance factors well above the minimum required for 95% correlation. In using the derived formula (see summary) it would be reasonably safe to use figures outside the ranges shown; however, care should be taken not to do this with all the factors simultaneously.

To simplify the calculations the numbers 1 and 2 were assigned to some of the variables (loading and time); therefore, these same numbers, or fractions thereof, must be used in the formula and not the actual # loading or hours.

Example

Assuming 97:100 ball mill strength is required, what maximum pigment loading could be tolerated, assuming 1) use of crude with 93.5% extracted solids, 2) RPM mill speed, and 3) 24 hour milling cycle.

Solution

$S = 115.6 + 1.34\ (L) - 3.62\ (T)^* - 0.67\ (R) + 0.06\ (\#)$

$97 = 115.6 + 1.34\ (L) - 3.62\ (1.45) - 0.67\ (24) + 0.06\ (11.5)$

$L = 1.52$ or 339# load would be maximum**

*T = 1.45 = 1 + 4/9, since 1 = 21 hours; 2 = 30 hours; $\Delta T = 9$.

**L = 1.52 = 339# = 314 + [(0.52) (48)] since 1 = 314#; 2 = 362#; D = 48#

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Since the derivation of this formula its predictions have been checked several times against actual plant data and found to be well within the prediction accuracy of ± 1.2 strength units; therefore, its use, as previously specified, can be recommended.

E. F. KLEMKE, JR.
CHEMICAL DIVISION

EFKJr:ad

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APPENDIX II

E. I. DU PONT DE NEMOURS & CO.

INCORPORATED

PIGMENTS DEPARTMENT

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C. J. Higgins - Files
J. W. Minnich - " (2)
J. N. Tully-J. H. Cooper - Res. File - Newark
E. F. Klenke, Jr.

Newport, Delaware
February 17, 1953

PASTE ("DRY") MILLING OF CPC PIGMENTS
PROGRESS REPORT NO. 1

Introduction

The paste milling technique was first established in the plant in late November 1952. Because of our oversold condition, the first goal in utilizing this technique was to establish that combination of mill load-mill hours most compatible with other steps in the finishing area for maximum output.

Blue LB

Because the blue still capacity permitted capitalization on only small reductions in milling time, efforts were directed towards establishing a larger mill loading. As a result of this work a 550 pound mill charge (150% of standard), with a 30 hour milling cycle (125% of standard) was adopted. This combination produced satisfactory quality at a rate that could have consumed more crude than available in December and January.

Various other combinations of loads and milling times were evaluated to establish tentative quality levels. This information is listed in Table I.

Green

The size of the green finishing press forbade immediate utilization of increased milling rates by increasing mill loads beyond 450 pounds; therefore, the efforts to improve green milling rates were directed to reducing milling hours. Recently the green press has been enlarged and investigation of increased mill loads is proceeding. Green milling data is listed in Table II.

Future Work

1. Establish optimum combination of paste and wet grinding times. (Newark Semi-works)
2. Establish optimum degree of wetness in paste grinding. (Newark Semi-works)

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3. Determine effect of 2% kerosene crude on millability.
4. Investigate 2-step acetone addition during wet grinding.
5. Determine production rates possible by paste grinding along--no wet grinding.
6. Improved mill discharge and drainage.
7. Replacement of acetone with safer, less expensive liquids.

J. W. MINNICH
QUALITY CONTROL SUPERVISOR

JWM:ad

DUP050069734

TABLE I - LB MILLING

A. Conditions which produce project strength.

	Pigment Load Lbs.	Paste Milling Hrs.	Total Milling Hrs.	Average Mill Strength	No. of Mins. Averaged	Blue Milling Production Rate (3) Lbs./Month	% o
Std. Wet Grind	362	0	30	97.5	(1)	50,000	
	550	6	30(2)	97.5	14	71,500	
	362	6	24	98.0	25	59,000	

B. Conditions which produce acceptable strength in Newark extended product.

	Pigment Load Lbs.	Paste Milling Hrs.	Total Milling Hrs.	Average Mill Strength	No. of Mins. Averaged	Blue Milling Production Rate (3) Lbs./Month	% of
Std. Wet Grind	362	0	24	99.0	(1)	59,000	
	362	6	16	100.0	26	80,800	
	550	6	24(2)	99.5	17	86,000	
	550	6	30(2)	99.5	45	71,500	

(1) Taken from E. F. Klenke's report on "LB Milling Variables."

(2) The establishment of equivalent strength levels at the two significantly d rates and the establishment of two different strength levels for the same has not yet been fully explained. Relaxation of the kerosene specificatio from 1% to 2% and/or inadequate discharge and drainage of the mills may be to be further investigated.

(3) Calculated for a 30-day month with 10% downtime, 8 mills in service. BG p average of 8,000 pounds per month is built into these figures.

Table I omitted from copies 9 and 10 of this report

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TABLE II - GREEN MILLING

	Pigment Load Lbs.	Paste Milling Hrs.	Total Milling Hrs.	Average Mill Quality	No. of Mills Averaged	Production* Rate Lbs./Month	Production Rate % of Standard Wet Grind
Std. Wet Grind	400	—	24	99, s int.	30	35,000	—
Std. Wet Grind	450	—	24	102, equal	27	39,500	—
	450	6	24	98.5, int.	34	39,500	113%
	450	6	22	99, int.	—	42,500	121.5%
	450	6	20	100, s int.	15	46,000	131.5%
	550	6	27	99, s int.	6	43,000	123%
	550	6	30	98, int.	4	39,500	113%

*Calculated for 30-day month with 10% downtime, 4 mills in service.

Table II omitted from copies 9 and 10 of this report

DUP050069736

APPENDIX III

BLUE BG QUALITY REVIEW

Date	Conditions		Ball Mill Average	Packed Lot Average	
APRIL 1952	KF - 345#/30 hrs.	No. Alk. Extr.	100 vvs green, vvs dull	104 vvs red, dull	
	KF - 314#/40 hrs.		98 vs green, s int.	102.4 =, vs int.	
	(KF - 314#/30 hrs.)		(100, =, =)	—	
JUNE 1952	KF - 314#/40 hrs.	NH_4OH-Press Wash	101, vs green, int.	105 = vs-s int.	
	KF/[illegible] - 314#/40 hrs.		97, vvs green, =	102, =, s dull	
	KF - 314/48		92, v green, vs dull)	Lot 247	
	(" - 314/42		(95 v green, dull))	97, v green, s dull-dull	
	(" - 314/36		(96 v green, dull))		
AUGUST 1952	KF - 314#/40 hrs.	NH_4OH - Press Wash	100, vs green, vs int.	102, =, vvs dull	
	EF/KF - 314#/40		96, vs-s green, s int.	99, s green, vs int.	
	" - 362#/40		97, vs green, vs-s int.	100, =, vs dull	
	KF - 362#/40		101, vvs green, vs-s int.	103, vs red, s dull	
	EF - 314/55		91, green, s dull)	Lot 265*	
	" - 400/55		92, green, dull)	95, green, s dull-dull	
	" - 362/48		91, green, dull)		
	KF - 314#/40 hrs.	NH_4OH - Press Wash	101, =, s int.	104, s red, s dull	
	EF/KF - 362#/40 hrs.		96, vs-s green, s int.	99, =, vs dull	
	EF - 314#/36 hrs.		96, green, dull)	Lot 281, 282)	
	" - 314#/40		95, green, dull)	94, green, dull)	
	" - 362#/40			93, (=?) dull)	
	" - 362#/48				

* Lot 265 was designated as the Newport reference standard for BT-297-DMJ (Blue BGN) See letter J. H. Cooper to V. H. Chalupski, 2/3/53

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