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# NEWARK PLANT
# PIGMENT COLOR RESEARCH REPORT

CENTRIFUGING STUDY: ORGANIC COLORS

**Period Covered:** March 4, 46



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NEWARK PLANT

PIGMENT COLOR RESEARCH REPORT

Progress Report

Title: CENTRIFUGING STUDY: ORGANIC COLORS

Period Covered: March 4, 1946

SUBMITTED BY: J. N. Baird

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## INTRODUCTION

With the initial object to make use of idle time in the projected Benzidine Yellow 40" basket centrifuge, and eventually to substitute centrifuges for wash presses wherever justified, development work has been initiated in the semi-works on the centrifugation of organic colors.

The plant has supplied a list of sixteen pigments to be tested, and experimental work, of a high spot nature, is being carried out on the Semi-Works Bird 12" perforated basket centrifuge.

## SUMMARY AND CONCLUSIONS

Of the 13 colors tested to date, based on the assumptions listed below, the following 9 appear to be likely candidates for centrifuging: RL-211-D, RE-85-D, RT-435-D, RT-499-D, RT-533-D, BT-181-D, RM-545-D, BF-173-D and SF-28. Those which may offer difficulty are RT-425-D, RT-438-D, RT-436-D and RT-347-D.

In preparing the following tabulation, the following assumptions have been made:

1. A scale-up factor of 25 from the 12" to the 40" machine.
2. Labor requirement: 14 kims per centrifuge charge and pressing room labor costs of $33.70/1000 kims.
3. OP Costs for centrifuge = direct labor plus electrical .
4. OP Costs for filter press = direct labor plus steam.
5. Bleed losses equal for both (centrifuge actually operated without bleed losses).
6. An arbitrary steam consumption of 0.75lbs. steam to pump a gallon of slurry through the press.
7. Production figures, at best, represent the average of not more than two runs.

| Code | Batch Size, lbs. | Centrifuge Production, lbs/hr. | Dewater, wash, Discharge Time, hrs. | Present Av. Filter, Wash Time, hrs. | Costs, $ per batch | |
|---|---|---|---|---|---|---|
| | | | | | Centrifuge | Filter |
| RL-211-D | 1143 | 115 | 10.0 | 20 hrs. vat wash + 8 hrs. | 13.15 | 13.37 |
| RE-85-D | 1001 | 298 | 3.4 | 6 | 4.13 | 7.12 |
| RT-435-D | 663 | 131 | 5.0 | 8 | 5.13 | 13.96 |
| RT-499-D | 319 | 51 | 6.2 | 13.5 | 7.20 | 9.00 |
| RT-533-D | 746 | 42 | 13.1 | 15 | 10.43 | 12.55 |
| BT-181-D | 230 | 51 | 4.7 | 6 | 3.75 | 11.04 |
| RM-545-D | 1960 | 248 | 7.9 | 9 | 7.70 | 13.80 |
| BF-173-D | 711 | 121 | 5.8 | 12 | 9.50 | 15.05 |
| SF-28 | 1110 | 222 | 5.0 | 8-10 | 5.66 | no data |
| RT-425-D | 460 | 34 | 14.0 | 11 | 11.71 | 17.96 |
| RT-438-D | 836 | 39 | 22.3 | 13 | 17.06 | 13.85 |
| RT-436-D | 778 | 39 | 19.1 | 9.5 | 24.43 | 17.05 |
| RT-347-D | 469 | 24 | 29.0 | 11 | 18.50 | 12.89 |

Similar data will be compiled for the remaining three codes, RT-386-D, RT-427-D, and GE-650-D, as they are scheduled for production in the plant.

DISCUSSION OF RESULTS

To make an accurate determination of the production to be expected on the 40" machine , scale-up factors should be calculated for each of the sixteen colors for which such information is desired. This would involve making at least three runs at a minimum of three centrifuge cake thicknesses for each pigment, measuring rates of filtration, calculating areas, driving force and viscosity, then solving the Lewis equation for optimum production rates. Such an undertaking is beyond the scope of the present problem.

For simplification, therefore, a scale-up factor of 25 has been selected for all of the pigments tested. This is felt to be a very conservative figure, easily attained in the light of the experimentally determined factor of 50 arrived at for Benzidine Yellow.

One observation should be noted at this point. In general it has been found that dilute slurries filter and wash less rapidly than concentrated slurries. This may probably be explained by the presence of a liquid layer building up behind the layer of solids and exerting a pressure forcing a decrease in size of the interstices between the solid particles and slowing down the rate of filtration. This effect becomes more serious the more compressible the cake.

Based on the information attained to date, no conclusions can be drawn as regards effect of slurry temperature on rate of centrifugation. It appears to vary from pigment to pigment.

It should be noted that all runs were made at a constant basket speed (3500 RPM), that the basket was loaded at full speed, and that the basket was run as full of slurry as possible at all times.

The costs reported are very superficial in nature and are not presented at this time to attempt to justify substitution of centrifuges for wash presses. At best, they reveal centrifuge costs in line with (and probably less than) filter press costs.

EXPERIMENTAL DETAILS

A sample calculation shows how figures in the table were obtained:

Example: RL-211-D

Batch size - 1143 lbs.

Present Cycle - 20 hr. vat wash plus 8 hrs. to filter and discharge.

1. Calculation of Centrifuge cycles:
Gallons filtered = 8; Solids in slurry = 0.24 lbs./gal.
# cake/ctrfge charge = 8 x 0.24 = 1.92
Time to filter = 6 minutes
" " wash = 12 (Cl free)
" " wring = 3
Start, stop, discharge = 4
Total 25

Scale up factor = 25 (assumed)
Production for 40" machine = $\frac{1.92 \times 60 \times 25}{25}$ = 115 lbs./hr.

Devater, Wash, Discharge Time = $\frac{1143}{115}$ = 10 hrs.

2. Calculation of costs for centrifuge:

Labor:

$\frac{1143 \text{ lbs./batch}}{(1.92 \times 25) \text{ lbs./charge}}$ x 14 $\frac{\text{hrs.}}{\text{charge}}$ x 33.70 $/1000 hrs = $11.15/batch

Electrical: (assume 20 HP, $0.0127/KW hr.)

10 hrs. x 20 HP x 0.745 KW/HP x 0.127 $/KWHr = $1.90/batch

Total $13.15/batch

3. Calculation of Costs for filter press

Labor: (Color Press Op = $8.32/batch; pumper = $4.00/batch)

8.32 + 4.00 = $12.32/batch

Steam: (0.75 # steam/ gal. slurry, 0.70 $/1000# steam) approx. 2000 gals. slurry (after waters drawn)

2000 gals. x 0.75 x $\frac{0.70}{1000}$ = 1.05/batch

Total $13.37/batch

Details may be found in DSN 46-18.