Monsanto

FROM (NAME—LOCATION—PHONE) J. K. Sears - Galt Labs - 1730

DATE : June 29, 1978

SUBJECT : Dye Solvents
Moore Business Forms

REFERENCE :

TO : N. W. Touchette
1730

cc: M. W. Farrar 1730
Harry Teicher T3G
P. J. Allart/P. F. Stordeur 5045

The accompanying four tables rank the solvents I have evaluated in Moore's three dye systems by the rubber stamp test. Tables 1 and 2 are two series using their purplish-blue Michler's hydrol sulfinate (MHS). Table 3 shows data using their red dye, and Table 4 deals with the CVL/BLMB blue system. In several cases the solvent blends were not miscible. In a few of these I evaluated the lower layer anyway.

Michler's Hydrol Sulfinate Systems:

In their current system they use MHS dye in dibutyl phthalate (DBP). My data indicate we should be able to beat that technically. Many of our benzyl based solvents resulted in darker color to my eye in contrast to Moore's reports. This may signify a mechanical (viscosity?) problem in manufacture and/or wetting once the capsule is broken. The difference may result, however, from the difference in method of measurement. I believe Moore uses a reflectance meter to measure color after typing on actual paper. I used one-to-one visual comparison often enough to get a pretty good statistical view. The benzyls appear to my eye to give a brighter, purer blue hue while DBP gives a more purple hue. In the past I found purple measures darker but does not make as distinct a line (because it tends toward gray) as a blue does. To me the rich blue from the benzyls is an advantage.

Tables 1 and 2 show we seem to have several good possibilities. I will not try to evaluate them much further until we have more data from Moore on the seven samples submitted earlier.

Red Dye Systems:

Table 3 shows we have some good possibilities for solvents for this recalcitrant dye - much better than their DBP or Kureha KMC oil. With a little S-8 or with benzyl benzoate the color, to my eye, is an usually good red color - purer red, less blue hue. With S-8 present we may be approaching a problem of solvation or plasticization of their capsule wall.

CVL/BLMB Dye Systems:

Table 4 shows Santosol 100 is a good solvent for this system. I assume Functional Products' related solvents will also be good. However Table

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4 shows there is room for blends which may even improve these solvents in the Moore system on their clay CF paper. Certainly we should be able to give them a unique solvent if they so desire.

One test sheet in this series had been left open to my fluorescent light before I made my final color evaluations. I feel like a few of the stamp marks on that sheet may have faded noticably.

Norm, we have lots of room to maneuver from the technical point of view and ought to succeed. We might even find one unique solvent suitable for all three dye systems if that would be an advantage to them.

Kern Sears

Att.

Table 1 6/27/78

Ranking of Solvents for Moore's Blue Dye Precursor

1st Series No. 1 - 27

Sol. No.	Speed Faster (better) at the top Slower at the bottom
8	Benzyl Benzoate (BzBz)
18	S-160/Modaflow 95.5/0.5
1	DBP (Nominal dye conc. 3.4%)
2	DBP (Actual " " 1.7%)
3	S-160 (Actual " " 3.4%)
12	(S-160/A215/HRP) S-377 75/16.9/8.1
14	S-160/HOE 90/10
11	S-160/A-215/HRP 90/6.8/3.2
7	S-261
9	S-160/A-215 90/10
13	S-160/BzBz 90/10
19	S-261/A-215 90/10
20	S-261/HRP 90/10
21	S-261/A-215/HRP 90/6.8/3.2
22	S-261/A-215/HRP 75/16.9/8.1
23	S-261/Cereclor S-52 90/10
24	S-261/C_7-C_{11} Benzoate 90/10
15	S-160/Santowax OM 90/10
16	S-160/DPP 90/10
4	S-160 (Dye Conc. 1.7%)
10	S-160/HRP 90/10
26	S-160/DUP 90/10
27	S-160/Santoscreen 97/3
25	S-160/S-97 90/10
5	Diisobutyl phthalate
6	Methyl benzyl phthalate
17	S-160/Ze corez 90/10

DBP = dibutyl phthalate
A-215 = approx. dodecyl benzene
HRP = heavy recycle paraffin, approx. 12 carbons
HOE = heavy oxo-ends

Sol. No.	Final Color Intensity[a] Darker (Better) at the Top Lighter at the Bottom
6	Methyl benzyl Phthalate
23	S-261/Cereclor S-52 90/10
26	S-261/DUP 90/10
3	S-160 (3.4% dye)
7	S-261
10	S-160/HRP 90/10
11	S-160/A-215/HRP 90/6.8/3.2
14	S-160/HOE 90/10
18	S-160/Modaflow 99.5/0.5
24	S-261/C_7-C_{11} Benzoate 90/10
1	DBP Nominal 3.4% dye
2	DBP 1.7% dye
9	S-160/A-215 90/10
12	S-160/A-215/HRP (S-377) 75/16.9/8.1
13	S-160/BzBz 90/10
15	S-160/Santowax OM 90/10
16	S-160/DPP 90/10
17	S-160/Ze corez 90/10
19	S-261/A-215 90/10
20	S-261/HRP 90/10
21	S-261/A-215/HRP 90/6.8/3.2
25	S-160/S-97 90/10
27	S-160/Santoscreen 99 97/3
4	S-160 (1.7% dye)
8	Benzyl Benzoate
22	S-261/A-215/HRP 75/16.9/8.1
5	Diisobutyl phthalate

[a]None of the colors of Table 1 or Table 2 was poor. Dividing lines between any two adjacent groups is vague at best, but there is a definite difference between those at the top and those farther down. Within any one group (between horizontal lines) there is no noticeable difference in speed (or in color by my tests)

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TABLE 2 6/28/78

Ranking of Solvents for Moore's Blue Dye Precursors
2nd Series

Sol. No.	Speed Faster (better) at the top Slower at the bottom	
39	S-160/A-215	70/30
44	S-160/Modaflow	99.8/0.2
31	S-160/HRP	90/10
35	S-160/HRP/HOE	80/15/5
37	S-160/HOE	97/3
40	S-160/A-215/HRP	80/10/10
56	S-160/BzBz	80/20
59	o-Cresyl benzyl ether	
28	DBP	
34	S-160/HRP/HOE	90/7/3
38	S-160/A-215	80/20
43	S-160/Cereclor S-52/HRP	70/20/10
45	S-160/HRP/Modaflow	89.5/10/0.5
46	S-160/S-97	90/10
47	S-160/S-97	70/30
48	S-160/S-97/HRP	70/20/10
50	S-160/S-711/HRP	80/10/10
57	S-160/BzBz/HRP	80/5/15
58	S-160/S-8/HRP (lower layer)	60/10/30
69	S-261/Cereclor S-52/HRP	70/20/10
73	S-261/S-711/HRP	70/20/10
30	S-160	
41	S-160/A-215/HRP	70/20/10
51	S-160/S-711/HRP	70/20/10
60	S-261	
61	S-261/HRP	90/10
62	S-261/HRP	80/20
63	S-261/HRP	70/30
65	S-261/HOE	97/3
70	S-261/Modaflow	99.8/0.2
71	S-261/S-711	90/10
74	S-261/S-711/HRP	50/40/10
29	Diisobutyl Phthalate	
36	S-160/HRP/HOE	70/15/15
49	S-160/711	90/10
66	S-261/A-215	80/20
72	S-261/S-711/HRP	80/10/10
64	S-261/HRP/HOE	80/15/5
67	S-261/A-215	70/30
68	S-261/A-215/HRP	80/10/10
53	S-711	
54	S-711/HRP	90/10
55	S-711/BzBz	90/10
52	S-160/S-711/HRP	50/40/10

Sol. No.	Final Color Intensity Darker (Better) at the Top Lighter at the Bottom	
69	S-261/Cereclor S-52/HRP	70/20/10
43	S-160/Cereclor S-52/HRP	70/20/10
44	S-160/Modaflow	99.8/0.2
61	S-261/HRP	90/10
65	S-261/HOE	97/3
70	S-261/Modaflow	99.8/0.2
71	S-261/S-711	90/10
72	S-261/S-711/HRP	80/10/10
56	S-160/BzBz	90/10
60	S-261	
30	S-160	
37	S-160/HOE	90/10
46	S-160/S-97	90/10
49	S-160/S-711	90/10
50	S-160/S-711/HRP	80/10/10
51	S-160/S 711/HRP	70/20/10
52	S-160/S-711/HPR	50/40/10
73	S-261/S-711/HRP	70/20/10
31	S-160/HRP	90/10
34	S-160/HRP/HOE	90/7/3
35	S-160/HRP/HOE	80/15/5
38	S-160/A-215	80/20
39	S-160/A-215	70/30
40	S-160/A-215/HRP	80/10/10
45	S-160/HRP/Modaflow	89.5/10/0.5
47	S-160/S-97	70/30
48	S-160/S-97/HRP	70/20/10
53	S-711	
74	S-261/S-711/HRP	50/40/10
58	S-160/S-8/HRP (lower layer)	60/10/30
28	DBP	
36	S-160/HRP/HOE	70/15/15
55	S-711/BzBz	90/10
57	S-160/BzBz/HRP	80/5/15
62	S-261/HRP	80/20
64	S-261/HRP/HOE	80/15/5
66	S-261/A-215	80/20
67	S-261/A-215	70/30
68	S-261/A-215/HRP	80/10/10
29	Diisobutyl phthalate	
41	S-160/A-215/HRP	70/20/10
54	S-711/HRP	90/10
59	o-Cresyl benzyl ether	
63	S-261/HRP	70/30

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TABLE 3

Ranking of Solvents for Moore's Red Dye System

Sol. No.	Speed Faster (better) at the Top Slower at the bottom	
3	Benzyl Benzoate (BzBz)	
6	o-Cresyl Benzyl Ether	
14	S-160/S-8/HRP (lower layer)	70/10/20
15	S-160/BzBz	90/10
11	S-8/HRP (lower layer)	90/10
13	S-160/S-8/HRP	80/10/10
1	Me Bz Phthalate	
2	S-160 (1st Series)	
9	S-160/HRP	90/10
18	S-160/HOE	90/10
19	S-160/HOE/HRP	80/5/15
8	S-160 (2nd Series)	
10	S-160/HRP	80/20
7	DBP	
16	S-160/BzBz (good)	80/20
17	S-160/BzBz/HRP	80/10/10
20	S-261	
21	S-261/HRP	90/10
22	S-711/BzBz	90/10
23	S-711/BzBz	80/20
24	S-711/S-8/HRP	80/10/10
25	S-711/S-8/HRP	70/10/20
5	Santosol 100	
4	Moore's Solvent (Kureha KMC)	

Sol. No.	Final Color Intensity* (Darker at Top; Lighter at Bottom)	
3	BzBz	
14	S-160/S-8/HRP (lower layer)	70/10/20
11	S-8/HRP (lower layer)	90/10
13	S-160/S-8/HRP	80/10/10
15	S-160/BzBz	90/10
16	S-160/BzBz (good)	80/20
17	S-160/BzBz/HRP	80/10/10
18	S-160/HOE	90/10
19	S-160/HOE/HRP	80/5/15
1	Methyl Benzyl Phthalate	
2	S-160 (1st Series)	
8	S-160 (2nd Series)	
9	S-160/HRP	90/10
20	S-261	
6	o-Cresyl benzyl ether	
10	S-160/HRP	80/20
7	DBP	
21	S-160/HRP	90/10
23	S-711/BzBz	80/20
22	S-711/BzBz	90/10
24	S-711/S-8/HRP	80/10/10
5	Santosol 100	
25	S-711/S-8/HRP	70/10/20
4	Moore's Solvent Kureha KMC	

* All those above the horizontal (23) were good to excellent in color. Those below the line were rapidly poorer.

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TABLE 4

Ranking of Solvents for CVL/BLMB System

Sol. No.	Speed (Fast at Top; Slow at Bottom) (No difference within groups)
3	Santisol 100/DPP 95/5
2	Santisol 100
4	Santosol 100/BzBz 90/10
1	Moore's Sol.
30	Benzyl Benzoate (BzBz)
31	Benzyl Benzoate/HRP 80/20
8	HB-40/BzBz 90/10
29	S-711/BzBz 70/30
35	S-160/Santosol 100 50/50
5	HB-40
7	HB-40/DPP/HRP 85/5/10
10	DBP/HRP 90/10
23	S-261
24	S-261/HRP 90/10
25	S-261/S-374 90/10
32	C_7-C_{11} Benzoate
36	S-160/HB-40/HRP 45/45/10
6	HB-40/HRP 90/10
34	nonylphenyl Benzoate/HRP 90/10
22	S-377
9	DBP
13	S-160/HRP (lower layer) 80/20
20	S-160/S-711/HRP 70/20/10
12	S-160/HRP 90/10
14	S-160/DPP/HRP (lower) 80/5/15
15	S-160/S-99/HRP (lower) 80/5/15
16	S-160/HOE 90/10
17	S-160/HOE/HRP (lower) 80/5/15
11	S-160
18	S-160/BzBz 90/10
19	S-160/S-711/HRP 80/10/10
21	S-160/C_7-C_{11} Benzoate 90/10
26	S-711
27	S-711/HRP 90/10
28	S-711/BzBz 90/10
33	nonylphenyl Benzoa te

Sol. No.	Final Color Intensity* (Darker at Top; Lighter at Bottom)
4	Santosol 100/BzBz 90/10
30	Benzyl Benzoate
33	nonyl phenyl Benzoate
2	Santosol 100
8	HB-40/Benzyl Benzoate 90/10
31	Benzyl Benzoate/HRP 80/20
34	nonylphenyl Benzoate/HRP 90/10
35	S-160/Santosol 100 50/50
36	S-160/HB-40/HRP 45/45/10
5	HB-40
22	S-377
23	S-261
1	Moore's Solvent (Bleached?)
3	Santosol 100/DPP (Bleached?) 95/5
7	HB-40/DPP/HRP 85/5/10
10	DBP/HRP 90/10
16	S-160/HOE 90/10
20	S-160/S0711/HRP 70/20/10
24	S-261/HRP 90/10
25	S-261/S-374 90/10
29	S-711/BzBz 70/30
11	S-160
13	S-160/HRP (lower layer) 80/20
14	S-160/DPP/HRP (lower) 80/5/15
17	S-160/HOE/HRP (lower 80/5/15
6	HB-40/HRP 90/10
9	DBP
12	S-160/HRP 90/10
15	S-160/S-99/HRP (lower) 80/5/15
18	S-160/BzBz 90/10
19	S-160/S-711/HRP 80/10/10
21	S-160/C_7-C_{11} Benzoate 90/10
27	S-711/BzBz 90/10
26	S-711
28	S-711/HRP 90/10
32	C_7-C_{11} Benzoate

*Repeated tests at times raised or lowered solvents, somewhat because of line thickness etc. Results are fairly good, unless for bleaching.

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