Color-in-oils study results are in

The results of the automated vs. manual color-in-oils study, conducted by Michael Erickson during 1988, are shown in Tables 1 and 2. Table 1 shows the results for color values determined using an automatic spectrophotometer (Tintometer Model AF 960, unless otherwise noted). Table 2 shows the results for color values determined using the manual Lovibond Tintometer Model 710. Table 3 lists the type of sample and coding key. Laboratories are listed by number only.

For each pair of letter codes in the tables, the first letter always refers to Series 1 and the second letter always refers to Series 2. For example, for "A & I" in Table 1, A refers to the sample in Series 1 and I refers to the sample in Series 2. This order is the same for B & H, C & G, etc.

Two values are reported for each sample. The first value is yellow color, the second value is red color.

TABLE 1

Automatic Determination

		Sample																	
Lab		A & I		B & H		C & G		D & F		E & E		F & D		G & C		H & B		I & A	
1		24	3.1	4	0.4	8	1.3	21	3.0	10	1.2	34	3.9	3	1.4	21	2.3	4	0.4
		24	3.2	4	0.3	7	1.1	19	2.6	10	1.2	35	3.9	7	1.1	20	2.1	4	0.3
2		26	3.3	4	0.4	7	1.1	17	2.5	10	1.3	37	4.1	7	1.3	22	2.2	4	0.4
		26	3.4	4	0.7	7	0.9	16	2.4	10	1.3	38	4.4	7	1.2	21	2.1	4	0.4
3		23	3.4	4	0.6	8	1.4	18	2.5	10	1.5	30	1.8	7	1.5	19	2.6	4	1.6
		24	3.4	4	0.5	6	1.2	14	2.5	11	1.5	30	4.0	6	1.3	21	2.6	4	0.5
4	A	27	3.4	4	0.3	7	1.2	17	2.4	12	1.3	40	4.4	6	0.9	21	2.3	4	0.3
		31[a]	3.7	6	0.5	8	1.2	20	2.8	13	1.4	—	4.7	8	1.1	25	2.5	5	0.3
	I	27	3.4	4	0.5	3	0.5	10	1.5	12	1.3	—	4.6	3	0.5	23	2.4	4	0.5
		31[a]	3.5	4	0.4	3	0.6	12	1.8	14	1.7	—	5.1	3	0.6	26	2.7	4	0.4
5		27	3.1	4	0.6	8	1.3	20	2.8	11	1.4	38	4.0	8	1.3	21	2.2	4	0.5
		28	2.6	4	0.4	15	1.8	6	1.1	11	0.8	40	3.7	8	0.9	23	1.8	4	0.4
6		24	3.2	5	0.7	8	1.3	17	2.3	10	1.3	32	3.2	7	1.4	20	2.4	4	0.4
		37	5.3	3	0.2	6	1.7	20	2.6	10	0.8	42	3.8	8	1.4	22	1.9	4	0.4
7		28	3.4	3	0.5	6	1.1	16	2.2	11	1.7	40	4.7	6	1.0	23	2.6	3	0.6
		50	3.5	6	0.6	11	1.3	50	2.2	17	1.0	70	11.0	11	1.2	40	1.9	6	0.6
8	A	20	3.6	3	0.7	5	1.1	14	2.2	11	1.5	41	4.7	6	1.1	27	2.9	4	0.6
		—[a]	3.3	—	0.6	—	1.0	—	2.0	—	1.4	—	4.0	—	1.0	—	2.5	—	0.6
	I	28	3.5	5	0.7	8	1.5	22	3.3	11	1.7	39	4.4	8	1.6	23	2.5	4	0.7
		—[a]	3.2	—	0.5	—	1.4	—	3.0	—	1.3	—	3.9	—	1.6	—	2.2	—	0.5
9		29	3.5	6	0.9	8	1.2	21	2.7	12	1.5	38	3.8	9	1.3	24	2.3	5	1.0
		28	3.6	4	0.4	8	1.3	22	3.1	12	1.7	41	4.7	9	1.8	23	2.6	4	0.5
10		29	3.2	4	0.3	8	1.2	21	2.6	12	1.4	41	4.3	8	1.2	23	2.2	5	0.5
		29	3.6	6	1.0	9	1.4	24	2.9	12	1.5	41	4.6	9	1.4	24	2.5	4	0.3
11	A	27	3.5	5	0.7	8	1.3	19	2.8	13	1.5	34	4.9	8	1.3	25	2.6	4	0.7
		—[a]	3.4	—	0.9	—	1.4	—	3.0	—	1.6	—	4.3	—	1.6	—	1.6	—	0.9
	I	20	2.1	3	0.2	5	0.9	10	1.1	6	0.7	22	2.1	5	0.5	10	1.0	2	0.2
		—[a]	3.4	—	0.7	—	1.2	—	2.9	—	1.5	—	4.0	—	1.2	—	2.3	—	0.7
12		25	3.2	4	0.4	7	1.2	18	2.5	10	1.3	38	4.3	7	1.1	21	2.2	4	0.4
		26	3.2	4	0.4	6	1.0	19	2.5	11	1.3	37	4.1	7	1.1	20	2.1	4	0.4
13		27	3.5	4	0.6	7	1.4	18	2.8	11	1.5	38	4.5	7	1.4	21	2.3	4	0.7
		28	3.7	4	0.7	8	1.4	17	2.9	11	1.6	39	4.6	7	1.6	21	2.7	4	0.8
14		27	3.4	6	1.0	7	1.1	17	2.4	11	1.3	39	4.5	8	1.2	22	2.3	4	0.4
		34	4.6	4	0.5	8	1.4	19	3.0	10	1.2	36	4.0	7	1.1	19	2.0	4	0.4
15		3	0.6	1	0.1	1	0.3	2	0.6	2	0.3	5	0.9	1	0.3	2	0.4	1	0.1
		3	0.6	1	0.2	1	0.3	2	0.6	1	0.2	5	0.8	1	0.2	2	0.4	1	0.1

[a]McCloskey Colorimeter.

TABLE 2

Manual Determination

Lab	A & I	B & H	C & G	D & F	E & E	F & D	G & C	H & B	I & A
	Sample								
1	NOT CONDUCTED								
	NOT CONDUCTED								
2	27 3.1	4 0.4	6 1.3	16 2.3	11 1.3	36 3.9	7 1.3	17 2.3	4 0.4
	24 3.0	4 0.5	6 1.2	12 2.2	10 1.4	29 3.8	5 1.2	18 2.3	4 0.4
3	NOT CONDUCTED								
	20 1.2	3 0.3	3 0.2	6 0.7	10 1.0	20 3.4	4 0.4	18 0.6	5 0.5
4	33 3.1	4 0.4	9 1.2	24 2.5	11 1.1	38 3.7	9 1.3	22 2.0	4 0.5
	33 3.0	4 0.4	7 0.9	16 1.7	10 1.1	39 3.8	5 0.7	20 2.0	4 0.4
5	NOT CONDUCTED								
	NOT CONDUCTED								
6	18 2.8	5 0.7	9 1.4	14 1.8	10 1.4	13 3.8	5 1.1	14 1.8	4 0.6
	30 4.7	4 0.3	6 1.4	19 2.1	10 1.0	35 3.4	6 1.5	19 1.6	4 0.2
7	20 2.5	3 0.5	4 0.6	12 1.6	9 1.0	35 3.7	4 0.8	20 2.0	3 0.6
	41 6.3	4 0.8	9 1.5	24 3.4	11 1.7	70 4.1	9 1.5	21 2.5	4 0.7
8	23 2.8	3 0.7	4 0.9	9 1.6	10 1.2	31 3.2	4 0.9	19 2.2	3 0.6
	20 2.6	4 0.4	5 1.0	11 2.1	9 1.1	27 3.2	6 0.9	14 1.8	4 0.5
9	22 3.0	5 0.5	7 1.2	19 2.5	9 1.1	35 3.5	7 1.4	20 2.1	5 0.5
	21 2.9	5 0.6	7 1.2	14 2.5	10 1.2	35 3.4	8 1.2	18 2.1	4 0.6
10	34 3.0	4 0.7	7 1.0	18 2.4	11 1.0	39 3.6	6 1.1	24 2.0	4 0.4
	28 3.0	6 0.8	8 1.0	15 1.7	9 1.1	56 4.1	8 1.0	21 1.9	3 0.4
11	13 2.2	3 0.2	4 0.3	11 1.1	8 0.4	14 2.4	5 0.5	12 1.0	3 0.2
	20 2.1	3 0.2	5 0.9	10 1.1	6 0.7	22 2.1	5 0.5	10 1.0	2 0.2
12	23 3.0	3 0.2	6 1.1	15 2.2	10 1.2	33 3.9	5 1.1	17 2.2	3 0.3
	26 3.1	3 0.3	5 0.9	15 2.3	10 1.2	35 3.8	5 0.9	17 2.2	3 0.3
13	23 2.6	4 0.4	8 1.0	20 2.0	12 1.2	40 3.4	8 1.1	35 1.8	4 0.5
	35 3.2	4 0.4	7 1.0	18 1.9	11 1.1	40 3.8	7 1.0	20 2.1	5 0.4
14	23 3.5	6 1.2	8 1.2	17 2.7	11 1.2	35 4.2	7 1.4	23 2.6	4 0.5
	35 3.8	4 0.5	8 1.5	21 3.0	11 1.1	39 4.0	7 2.0	16 2.0	4 0.4
15	2 0.1	<1 <0.1	1 0.1	2 0.4	3 0.1	5 0.3	1 0.1	3 0.1	<1 <0.1
	4 0.5	1 <0.1	1 0.4	2 0.6	2 0.4	5 0.8	1 0.1	2 0.2	<1 <0.1

For the two sets of values shown from each laboratory, the first value corresponds to the first letter in the letter pair in the "Sample" row and the second value corresponds to the second letter in the letter pair. For example, under "A & I" for Laboratory 1 in Table 1, the result for Sample A is 24Y 3.1R, and the result for Sample I is 24Y 3.2R. This order is repeated throughout Tables 1 and 2.

Participants in the study were asked to measure the color of all samples in a 5.25 inch-cell at a temperature of 60°C ± 1°C.

At this time, the results of the study have not been subjected to statistical analysis. It has been recommended to the Commercial Fats and Oils Analysis Committee that the most appropriate action at this time would be to develop an AOCS recommended practice instructing laboratories how to perform their own manual vs. automated studies and how to develop comparison charts. At this time, no further manual color vs. automated color studies are planned.

TABLE 3

Key to Samples

Sample	Series 1	Series 2
RBD cottonseed oil	A	I
R & B tallow[a]	B	H
Mineral oil & annato[b]	C	G
Mineral oil & annato	D	F
R & B tallow	E	E
RBD cottonseed oil	F	D
Mineral oil & annato[b]	G	C
RBDH corn oil	H	B
R & B tallow[a]	I	A

[a] Same sample.
[b] Same sample.

Overlooked method?

It is interesting to note that the AOCS Color Committee reached the conclusion that the Lovibond color system was "in many repects obsolete and must be replaced." Perhaps most interesting is the fact that this conclusion was published in *JAOCS,* Vol. 25, page 271, in 1948.

The committee followed up with studies to find an objective alternative to the Lovibond method. The results, published in *JAOCS,* Vol. 27, page 233, in 1950, became the basis of AOCS method Cc 13c-50, the spectrophotometric color method.

In 1950, the AOCS Color Committee reported that the spectophotometric color method showed a correlation coefficient of 0.993 with the manual Lovibond method. Because of the complexity of the committee study, the full details of the statistical analysis, resulting in the equation used in AOCS method Cc 13c-50, were never reported in *JAOCS.*

Based on the 1950 report of the AOCS Color Committee, it would appear that the spectrophotometric method for determining color is a potential alternative to the manual Lovibond method. It is not immediately obvious why method Cc 13c-50 has been overlooked as an alternative. In the current version of the method, there is no reference to the study of 1950 or to the fact that this method was intended to be a supplement (or replacement) of the manual Lovibond method and there is no reference in the current method to the correlation coefficient of 0.993 with manual Lovibond.

Recently, interest has been shown in AOCS method Cc 13c-50 for the spectrophotometric determination of color. Two basic concerns with the method have been that cells with 21.8 mm light path seem to be no longer available and transmittance specifications noted in the method cannot be met. The reason for the latter is under investigation. The "cells" required by the method can be made from standard glass tubing stock with outside diameter of 25 mm if they are not available commercially. Possible suppliers are Kontes and Kimball.

Comments and/or concerns about method Cc 13c-50 should be directed to the AOCS Technical Director at AOCS headquarters.

Dave Berner
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