TABLE VII

Daily Transmissions of $NiSO_4$ Solution (Using Storage Battery)

	New Soll. Made 9/16 pH 0.27			$NiSO_4$+5 ml. HCl+H_2O			Made 7/48 pH 1.02		
	$NiSO_4$+5 ml. H_2SO_4+H_2O						$NiSO_4$+5 ml. H_2SO_4+H_2O		
	470	510	550	470	510	550	470	510	550
Sept. 16	40.5	75.7	55.4	40.7	76.7	56.5	40.3	76.2	55.7
				41.8	77.5	56.9	41.3	77.3	56.3
Sept. 17	41.0	75.4	56.0	42.1	77.7	56.9	41.6	77.2	56.1
	42.2	78.4	57.3	43.7	80.3	58.7	43.2	79.8	58.0
Sept. 20	39.2	74.4	55.4	39.7	75.8	56.5	39.4	75.4	55.8
	38.2	73.6	54.3	39.8	76.3	56.4	39.3	75.7	55.7
Sept. 21	39.0	74.2	55.2	39.9	76.0	56.5	39.5	75.4	55.9
	38.7	74.4	54.9	39.8	76.4	56.3	39.5	75.8	55.7
Sept. 22	39.0	74.6	55.0	40.2	76.4	56.4	39.7	75.8	55.7
	39.5	74.6	55.2	40.4	76.3	56.5	40.0	75.8	55.7
Sept. 23	39.4	74.8	55.1	40.3	76.4	56.3	39.8	75.8	55.6
	39.4	74.6	55.3	40.3	75.9	56.6	39.7	75.6	55.9
Sept. 24	38.8	74.8	55.5	39.7	76.2	56.6	39.2	75.6	55.8
	39.0	75.2	55.4	39.8	76.3	56.7	39.4	75.7	55.9
Sept. 27	39.3	75.6	55.4	40.0	76.7	56.4	39.5	76.1	55.7
	40.0	75.7	55.6	40.8	77.2	56.6	40.3	76.6	55.8
Sept. 28	39.8	76.1	56.1	40.8	77.3	57.2	40.3	76.8	56.4
	40.6	76.3	56.0	41.4	77.5	57.2	40.8	76.8	56.5
Sept. 29	40.1	76.2	55.8	40.8	77.4	57.0	40.3	76.9	56.3
	40.2	76.4	55.7	41.4	77.6	56.9	40.6	77.0	56.2
Sept. 30	40.2	76.0	56.3						
Average	39.7	75.4	55.6	40.7	76.9	56.8	40.2	76.4	56.0
Std. Deviation	.562	1.05	.607	.984	.983	.526	.948	.996	.524

concluded from these data as to the relative merits of using a battery or a transformer.

In order to check the reproducibility of a single operator on a single instrument three nickel sulfate solutions were prepared, put into stoppered cuvettes, and measured morning and afternoon until 20 readings were taken.

These solutions were all acidified, two of them with sulfuric acid and one with HCl, to prevent any precipitation from occurring during the period of the observation. The measurements made are shown in Table VII. It will be noted that the average results obtained are higher when HCl is used than when sulfuric acid is used and all the acidified samples give higher peak values than those obtained by the Committee where no acid at all was used. Standard deviations at 470, 510, and 550 mμ. vary from 0.5 to 1.05. This is about one-half of the deviation found between the various laboratories on both nickel sulfate and oil samples.

Conclusions

The data completed on oils and on nickel sulfate solutions indicate that there is a standard deviation of up to 2% transmittance between measurements made by different laboratories on different instruments. This standard deviation is decreased by one-half when measurements are made by a single laboratory on a single instrument. The data indicate that nickel sulfate may be a satisfactory solution to use in standardizing the instruments in use in the various laboratories.

The results obtained on the 12 oils submitted for readings indicate that about the same degree of reliability is obtained spectrophotometrically as with the Lovibond system at low color levels. At high color levels the spectrophotometer shows considerably more reproducibility.

It is impossible to tell from the data obtained whether a single number system, such as a density measurement of 550 mμ., or a color index value, consisting of some function of measurements at two or more wavelengths, would be the most suitable for general measurement.

PROCTER THOMSON, R. C. STILLMAN.

Letter to the Editor

On the Use of Sodium Carboxymethyl Cellulose as a Detergent, Especially as Combined with Fatty Acid Soap

DEAR SIR:

In the paper by Thomas H. Vaughn and Clifton E. Smith (Journal of A.O.C.S., Vol. 25, No. 2, Feb. 1948, p. 44) it is stated that, judging from published information, the applicability of sodium carboxymethylcellulose to the field of detergency appears relatively unknown in the U.S.A. Therefore it might be of interest to your readers to know something about the use of Na-C.M.C. in the Netherlands (Holland).

Owing to the scarcity and high prices of animal and vegetable oils and fats, the percentage composition of washing preparations and their allotment had been prescribed by the Government Office for Chemical Products (Rijksbureau voor Chemische Producten). Since May 1, 1948, the washing powder for laundries should contain: 12% of fatty acid (such as sodium soap), 1.25% of Na-C.M.C., and 40% of soda ash. Before this date the composition was: 21% of fatty acid (as sodium soap) and 35% of soda ash. In both cases the remainder (difference from 100%) is water.

The change in composition of the washing powder for laundries has been proposed by Mr. Smit, Director of the Experimental Station for Laundering (Proefstation voor de Wasindustrie) at Delft. The proposal was based on the results of theoretical and experimental research, carried out at the Laboratory of the Experimental Station for Laundering.

In the Netherlands laundries most of the white work (cotton, linen, rayon) is washed together. This classification therefore includes sheets, pillow slips, body linen, towels, table cloths, tea-cloths, and rubbing cloths, etc.; but neither white shirts nor white coveralls are included in it.

Before the war it was regarded as normal if 1.5 lb. of soap (80% fatty acid) and either 2.4-3.6 lb. of soda ash or 1.6-2.4 lb. of metasilicate were used per 100 lb. of average soiled white work. Our research has shown (1) that it is possible to replace at least 0.75 lb. of the soap by 1.2 oz. of a good quality Na-C.M.C. (calculated as pure, dry substance). The results with three-fourths lb. of soap (80% fatty acid) plus 1,2 oz. of Na-C.M.C. are even better than with 1½ lb. of the same soap, the hardness of the water used varying from 0 to 120 p.p.m. (as $CaCO_3$). Formerly a decrease in reflectivity for white light of 10% for originally clean test pieces, laundered 25 times together with this white work classification, was considered to be satisfactory. Nowadays, with only half the amount of fatty acid soap, which was used

formerly, and a very small amount of Na-C.M.C., a decrease in reflectivity for white light of only 2% after washing 25 times in commercial launderies is not uncommon. Thus the whiteness retention of the laundered goods is improved very much, whereas the degree of soil removal is at least as high. Perhaps it is useful to point out that normally in the Netherlands the washing process for white work comprises two suds. The first is given at 60° C. (140° F.) and two-thirds of the amount of washing agents mentioned are added to it. The temperature of the second suds is about 180° F., and the rest of the washing agents are added to it so that the concentration of the washing agents is about the same during the two suds. Bleaching is carried out during one of the rinses at a low temperature.

It will be seen that on the basis of our research the fatty acid content of the washing powder for laundries might have been reduced to 10.5%. This was not done because some of the smaller laundries are using rather hard water up to 200 p.p.m. (as $CaCO_3$), and it was thought that part of the fatty acid soap might be taken away by this high hardness. It is true that Na-C.M.C. possesses slight water softening properties; however, it is cheaper and more effective to have the hardness of the water taken away by soda ash or fatty acid soap than by Na-C.M.C. Of course, the very best way to deal with hard water is to remove the hardness before it enters the washing machine.

For the same reason the washing powder for domestic purposes has always contained more fatty acid (such as sodium soap) than the washing powder for laundries. Tap water from the diverse mains in the Netherlands on the average shows a hardness of about 250 p.p.m. (as $CaCO_3$). The prescribed composition of the domestic powder is: 27% of fatty acid (as Na-soap) and 35% of soda ash. It is anticipated that this composition will be changed within some months into: 20% of fatty acid (as Na-soap), 0.85% of Na-C.M.C. (calculated as pure, dry substance) and 35% of soda ash.[1] However, it is thought that the fatty acid content might be decreased further if the Na-C.M.C. percentage is increased at the same time, in spite of the rather high hardness of the tap water to be used in the households.

So far no synthetic detergents have been used in the Netherlands for the washing of white work because of the high prices of synthetics. The cheapest synthetic detergent "Teepol," a product of the Royal Dutch-Shell group, and an invention of the Laboratory of the Bataafse Petroleum Maatschappij at Amsterdam, costs about florin 5.20 (about $2.00) per kg. of dry, active substance (sodium salts of sulphated secondary fatty alcohols).[2] On the other hand, one kg. of fatty acid as such, or in the form of sodium soap, costs about f. 1.75 to f. 1.84 ($0.70 to 0.74). In the washing of white work (cellulose fibers) the presence of alkaline builders cannot be avoided for reasons of efficiency and economy so that the use of a synthetic detergent does not prevent the deposition of insoluble lime salts on the goods.

On the other hand, the use of Na-C.M.C. in combination with common soap entails a substantial economy as compared with the use of soap alone. The new washing powder for laundries (with Na-C.M.C.) costs f. 47 per 100 kg., whereas formerly the price of the washing powder (without Na-C.M.C.) was f. 56 per 100 kg. Since December 1947 many laundries have been buying the ingredients, sodium soap, Na-C.M.C., and soda ash as such; this, of course, is still less expensive as 12 kg. of fatty acid in the form of sodium soap costs f. 22.10; 1.25 kg. Na-C.M.C. costs f. 6.75 and 40 kg. of soda ash costs f. 8.80. It will be seen that 1.25 kg. of Na-C.M.C. (calculated as pure, dry substance) is much less expensive than 10.5 kg. of fatty acid in the form of sodium soap. Hitherto the Na-C.M.C. necessary has been imported from Sweden. At the moment two large factories, one at Deventer and one at Nijmegen, are coming into production.

In 1947 the Netherlands were only able to import 60% of the amount of fats intended for soap making which were imported before the war. Therefore, it can easily be seen how important the development, described above, is for this robbed and devastated country. The total sales of washing powder to the laundries are about 6,000 tons a year; the total sales of washing powder to the households are about 22,000 tons a year.

Research about the value of cellulose ethers as washing agents is being continued. It may result in Na-C.M.C. types of improved detergency characteristics and in new types of cellulose ethers as well as in new combinations of cellulose ethers, fatty acid soaps, and synthetic detergents.

August 1948.

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[1] Again, in both cases the remainder (difference from 100%) is water.

[2] The current exchange rate of the florin is: 1 florin = $0.377 or $1 = f. 2.653.

REFERENCE

1. K. J. Nieuwenhuis, Chem. Weekblad *43* (1947) 510.
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