and pestle were washed and dried. A few days later some crushed pumice stone was required in the laboratory and the same mortar and pestle were used. A loud explosion resulted. The mortar and pestle were broken into many pieces and thrown violently about the room. One piece passed through a window scarcely shattering the glass. The room was filled with sulfur dioxide and fine particles of sulfur were scattered over the floor and table. An examination of the pieces of the mortar showed no traces of sulfur but quite large quantities of sulfur were found adhering to the fragments of the pestle. The wooden handle of this pestle had been sealed into the ball part with sulfur. Evidently a small amount of the potassium chlorate worked into the crevice with the sulfur and caused it to explode when given a sudden jar.

FRAGMENTS OF BROKEN MORTAR AND PESTLE

An examination of other pestles of the same type showed them to contain as much as 10 to 20 g. of sulfur.

This explosion might have been more disastrous had not the mortar been used at this time for grinding the pumice stone, as, in a few days it would have been used again to pulverize more potassium chlorate, and with the excess chlorate the explosion would have been more violent.

It certainly is not generally known that the handles of these pestles are sealed in with sulfur, for if it were they would never be permitted in the laboratory.

The pestle was of German make and whether or not they still employ sulfur for this purpose is difficult to say. If any companies in this country are using sulfur for this purpose they should substitute in its place some inert cement. Laboratories should bar the use of this type of pestle until the sulfur has been replaced by some safe material.

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A RAPID METHOD FOR COMPARING THE DECOLORIZING EFFICIENCY OF CHARCOALS

By LEONARD WICKENDEN AND JOHN W. HASSLER

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The various methods in general use at the present time for comparing the decolorizing values of charcoals, possess features which render them, for one reason or another, unsatisfactory. In most oil laboratories, direct tests are made with the oil which is to be treated. Such tests are satisfactory as far

as they go, but filtration is slow and small differences in the decolorizing powers of charcoals are difficult to detect, even with the aid of a colorimeter. When the operation is repeated on a manufacturing scale, these small differences become magnified and may mean a considerable difference in the final product. The same argument applies, though perhaps to a lesser degree, to the testing of charcoal on argols solution and on various pharmaceutical products.

The use of an alcoholic solution of caramel, as suggested by Laube, is open to the objection that the solvent is volatile and the solution cannot, therefore, be used at high temperatures. If an aqueous, instead of an alcoholic, solution of caramel be used, trouble is experienced in obtaining clear filtrates, and, moreover, the solution will not keep.

An aqueous solution of an aniline dye gives unreliable results owing to the fact that many charcoals on the market contain appreciable amounts of soluble ash, and the alkalinity of this ash produces color changes which vitiate the results obtained.

A method has been devised in these laboratories, which is very rapid and which enables charcoals to be classified with great ease and accuracy according to their decolorizing efficiency. A solution of Aniline Red, Soudan III (oil soluble), in kerosene is used. The strength of the solution is largely a matter of choice, but we have obtained the most satisfactory results with a 0.025 per cent solution (0.25 g. per liter). One hundred cubic centimeters of this solution are measured into a 150 cc. beaker, 5 g. of the charcoal are added and the beaker placed on a boiling water bath in such a manner that the beaker is entirely enveloped in steam but does not dip into the water. The charcoal is kept in suspension by frequent stirring and at the end of ten minutes the beaker is removed from the water bath and the mixture filtered. The kerosene solution filters very rapidly and comes through clear and bright. Its color is compared with a scale prepared in the following manner:

One hundred cubic centimeters of the kerosene solution of Soudan III are treated with 1 g. of a charcoal of average quality. The solution thus obtained is given the value 10. A second solution, obtained by treatment with 2 g. charcoal, is given the value 20, a third, obtained with 3 g. charcoal is numbered 30, and so on up to 100.

The scale thus obtained is, of course, of a purely arbitrary nature, but it has, none the less, a real meaning. Thus, if, by treating the standard solution with 5 g. of charcoal according to the method above described, a solution is obtained of the same depth of color as that which has been given the value 70, it means that 5 g. of the charcoal under examination will do the same work as 7 g. of the average charcoal, and thus possesses a 40 per cent greater efficiency.

By using a solution of the strength indicated, the difference in color between the solutions forming the scale is sufficiently marked for comparisons to be made without the aid of a colorimeter. In order, however, to make our comparisons easier and more exact, we

have devised a simple form of colorimeter whose effect is to increase the contrast between one color on the scale and that next above or below it.

The colorimeter consists of a wooden box, 18 in. long, as shown in the sketch, painted black on the inside. Set back 1 in. from the front is a partition in the center of which is a hole, $\frac{1}{2}$ in. in diameter. Immediately behind this is placed a color screen, whose effect is to increase the contrast between the colors of the solutions being compared. This may consist of a glass cell filled with a very dilute aqueous solution of aniline blue (we use Indigo-disulfonic acid, No. 692) or of a piece of blue glass. If the latter is used, care must be taken to choose the right tint, as some deep purple-blue glasses are useless for the purpose.

At the further end of the colorimeter is a platform on which are placed the solutions under examination. As containers, we use square glass jars with screw tops¹ of 2 oz. capacity, and the platform is made sufficiently wide to accommodate three of these jars. The solution under examination is placed in the middle and a standard solution is placed on either side—the one of a slightly darker shade, the other of a slightly lighter. With a little practice, it is easy to give a value

to the tested solution with considerable accuracy. Thus, if a solution is found to be between 50 and 60, it is easy to determine whether the value should be 52, 54, 56 or 58.

As far as oils are concerned, the test with the kerosene solution of Soudan III appears to be absolute. We have compared a very large number of charcoals from various sources, both of vegetable and animal origin, and in every case we have found that charcoals which give equally high results with the kerosene solution show equally high efficiencies as decolorizers for cottonseed, coconut and palm kernel oils. As regards sugar solutions, since the sugar chemist has other things to consider besides the removal of color, he will probably not be able to substitute the kerosene test for his present tests with molasses. The method should, however, be of great service to him in enabling him to eliminate charcoals which are not worth a more elaborate examination.

We find that animal charcoals, when used for decolorizing some aqueous solutions, show a higher efficiency than would be expected from the results obtained with the kerosene solution of Soudan III (see Table I—Argols Solution). Also, there are many charcoals on the market which give eminently satisfactory results with oils and other liquids, but are worthless for glycerine. In testing charcoals, therefore, which are to be used for either of these purposes, these facts must be taken into consideration.

We have kept a solution of Aniline Red, Soudan III, standing in our laboratory for several weeks, and no perceptible fading has occurred. It is well, however, to reserve a portion of the charcoal used for mak-

TABLE I—DYE TEST VALUES OF CHARCOAL COMPARED WITH COLOR REMOVAL TESTS BY LOVIBOND COLORIMETER

LIQUIDS TESTED	No.	CHARCOAL Origin	USED %	TEST VALUE	Per cent color
				Soudan III Solution	Removed from Oil (Lovibond)
Cottonseed Oil...	1	Animal	2.0	8	3.0
	2	Animal	2.0	10	5.7
	3	Vegetable	2.0	28	12.3
	4	Vegetable	2.0	38	19.4
	5	Vegetable	2.0	48	27.2
	6	Vegetable	2.0	50	27.3
	7	Vegetable	2.0	75	33.9
	8	Vegetable	2.0	75	34.0
	9	Animal	2.0	80	34.4
	10	Vegetable	2.0	85	35.0
Coconut Oil...	1	Animal	0.5	10	47.0
	2	Vegetable	0.5	48	65.6
	3	Vegetable	0.5	50	65.6
	4	Vegetable	0.5	55	66.8
	5	Vegetable	0.5	72	71.2
	6	Animal	0.5	80	76.1
	7	Vegetable	0.5	85	78.5
Palm Kernel Oil.	1	Animal	0.5	10	26.2
	2	Vegetable	0.5	30	36.3
	3	Vegetable	0.5	50	41.3
	4	Vegetable	0.5	72	46.3
	5	Animal	0.5	80	46.3
Argols Solution... (saturated)	1	Animal	0.8(a)	8	46.0
	2	Vegetable	0.8	15	25.0
	3	Vegetable	0.8	30	46.0
	4	Vegetable	0.8	50	87.0
	5	Vegetable	0.8	75	90.0
	6	Animal	0.8	80	93.0

(a) 0.8 g. charcoal per 100 cc.

ing the scale of colors and to make a test every few weeks in order to ascertain if any color change has taken place.

NOTE—Since the above article was written we have ascertained that it is no longer possible to obtain Aniline Red, Soudan III. We have substituted for it Oil Red R N, manufactured by the Schoellkopf, Hartford & Hanna Co., Buffalo, N. Y. We use a solution of 1 gram of the Oil Red R N per liter and find it to give satisfactory results.

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A NEW COLORIMETER

By C. FRANK SAMMET

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The fact that it is rarely possible exactly to match the color of one liquid with another colored liquid or with colored glass often leads to considerable error in determinations where colorimetric methods are used. These difficulties of color matching may be due to a number of causes, the most important of which are the differences in luminosity, refractive index, turbidity and color composition of the materials to be matched.

The colorimetric determination of ammonia by the Nessler procedure or of phosphoric acid in soil solution by comparison with a standard solution of phosphomolybdate, or of either by comparison with standard colored glasses, are examples which well illustrate the differences existing in the usual methods of colorimetric matching.

Similar differences which are often very striking are also observed in the determination of the color of oils. With pure oil of turpentine, which is sold on the primary markets exclusively on the basis of its color, the color match is a matter of much commercial importance. The arbitrarily fixed grades have given

¹ Eimer and Amend, Catalogue 4142.