Nitric acid is a more immediately active solvent than carbonic acid, and will dissolve soil material rapidly while its action lasts. The duration and measure of its action, however, are fixed by the quantity, and can extend only to the point of neutralization with the bases it acts upon, which is the case with the carbonic acid. Moreover, nitric acid is a monatomic acid, whilst carbonic acid is a diatomic acid ; which thus doubles the solvent power of the forty-five parts of carbon, and lowers the possible action of the one part of nitric acid to only $\frac{1}{90}$ part of that of carbonic acid, providing both acids exercise their action on the soil bases to neutralization.

These considerations have appeared to the writer to constitute the nature of any method, and the character of any solvent whose action can approximately compare with the processes operating in the field. Their reasonable nature has been amply endorsed in a course of work in which methods were adopted, from which mineral acids were excluded, and simple carbon acids and amido acids were exclusively used as solvents. The results, which form only a part of a broad investigation which is being carried on of Hawaiian soils, and which have been obtained with the aid of the associated labors of our first assistant chemist, J. T. Crawley, and C. F. Eckart, second assistant chemist, will be published in later issues of this Journal.

LABORATORY OF THE HAWAIIAN SUGAR PLANTERS' ASSOCIATION.

A DELICATE TEST FOR THE DETECTION OF A YELLOW AZO DYE USED FOR THE ARTIFICIAL COLORING OF FATS, ETC.[1]

BY JOSEPH F. GEISLER.

Received January 5, 1898.

THE food laws of several of the states prohibit the use of coloring-matter in oleomargarine, and inasmuch as the presence of artificial coloring-matter in many cases constitutes the only infraction of these particular laws, simple tests for its detection are desirable. Those engaged in clarifying and decolorizing oils and fats are no doubt familiar with the use of Fuller's earth as a precipitant of coloring-matter, the latter usually being precipitated without any pronounced color reaction. Since text-books and the chemical literature, to my knowledge, do not mention the red to pink color which Ful-

[1] Read at the Washington Meeting.

ler's earth produces with some of the yellow azo dyes, I desire to call attention to the practicability of using this earth as a most convenient and delicate test for the detection of at least one, if not more, of the yellow azo dyes. The latter are now largely used as constituents of butter-colors, and replace annatto to a considerable extent.

While analyzing a sample of a reddish-colored butter intended for export, my attention was drawn to the large amount of coloring-matter present and the intense violet-red color developed when I attempted to remove the coloring-matter from the clarified fat by means of Fuller's earth. The color developed depended much upon the relative amount of Fuller's earth added, ranging from a deep violet-red to pink. All the coloring-matter giving this particular reaction was readily precipitated. The precipitate, after having been thoroughly washed with naphtha to remove the fat, presented, upon drying, a violet-red powder. Contact with alcohol immediately decolorized it, the color reappearing upon the evaporation of the alcohol. Boiling alcohol readily extracted all the coloring-matter from the precipitate, producing a yellow solution. As obtained from the latter, the coloring-matter was found to be quite insoluble in water, sparingly soluble in hot water, reprecipitating from the latter on cooling. It dissolved with a yellow color in concentrated sulphuric acid which, upon dilution with water, developed a bright pink to red color. Strong mineral acids also produced a violet to pink color. The latter reaction is familiar through the use of methyl orange as an indicator in acidimetry. True methyl orange as supplied in the market for use as an indicator, however, does not give the Fuller's earth reaction nor is it as soluble in fats as this particular coloring-matter. These reactions with others would indicate one of the yellow azo dyes. The reactions throughout corresponded closely with a commercial yellow azo dye soluble in fats and used as a constituent of butter-colors.

Applying the Fuller's earth test to various samples of butter and oleomargarine, I found a large number of the samples to give the Fuller's earth reaction even where the samples were but lightly colored.

In view of the fact that in certain localities oleomargarine was

readily sold on the strength of the statement that only "two ounces of coloring-matter had been used per ton" and that the amount was "too small to admit of detection" it became a matter of interest to determine the limit of the Fuller's earth test and the probable amount of coloring-matter present in commercial samples of average color. With this end in view mixtures were made with varying amounts of the yellow azo dye and pure white lard and the test applied to the same. The mixtures were as follows:

		Ratio.	Equivalent per ton. Ounces.
A....	100 mgms. coloring-matter per kilo of lard	1 : 10,000	3.2
B....	50 " " " " " " " "	1 : 20,000	1.6
C....	10 " " " " " " " "	1 : 100,000	0.32
D....	1 " " " " " " " "	1 : 1,000,000	0.032

The latter ratio indicates fourteen grains per ton. Treated with Fuller's earth

A developed a deep violet-red color,
B developed a deep violet-red color,
C developed a deep pink color, and
D developed a pink tint.

In the latter case a half gram of the sample spread upon a white porcelain slab developed a strong unmistakable pink upon the addition of Fuller's earth. When D was dissolved in naphtha and the Fuller's earth added to the solution, the pink appeared as a distinct ring or zone at the edge of the deposited layer of the reagent. The reaction is therefore a very delicate one.

Of the mixture A the average of several experiments showed that so minute a quantity as the $\frac{1}{200}$ of a milligram still gave a pink reaction perceptible to the naked eye. Under the microscope the $\frac{1}{100}$ part of this was still perceptible. Since the amount of coloring-matter actually present under the latter conditions was only $\frac{1}{200.000.000}$ of a milligram (equivalent to $\frac{1}{18.000.000.000}$ of a grain) the applicability of the test as a definite color reaction under ordinary conditions is apparent. The use of as little as two ounces of the coloring-matter per ton produces a highly-colored oleomargarine, while fourteen grains (the $\frac{10}{625}$ part of two ounces) per ton would be barely perceptible as a

faint yellow tint, but readily detected by the pink tint developed by the test.

Commercially, the yellow azo dye is generally used in conjunction with an orange variety. The latter does not give the Fuller's earth test.

For practical purposes the test is readily applied by spreading some of the clarified fat to be tested upon a white porcelain surface and stirring into the fat a pinch of Fuller's earth and observing the change in color. A pink to violet-red color will appear within a few moments if any considerable proportion of this coloring-matter is present. If the experiment is performed in a glass tube it is readily preserved for court exhibits where such are desirable. The test may therefore be used as a valuable adjunct in testing for this coloring-matter in fats as well as differentiating between certain of the azo dyes.

DISCUSSION: *C. A. Crampton.*—I wish to call attention to the very valuable and *apropos* nature of this test. It seems to be a very good one and is especially valuable because this form of coloring-matter seems to have driven out of use the old-fashioned butter-color which was made of annatto. The manufacturers say the dyes "hold up" better than annatto, by which is meant, I suppose, that they will stand time and exposure to light much better. In the paper to be presented to-morrow, I hope to show some samples of this butter-color dye, which will illustrate the extent to which it is used in a certain class of butters.

J. F. Geisler.—It is generally claimed that these azo dyes are not detrimental to health. They are certainly used in very minute quantities.

E. A. de Schweinitz.—A number of physiological experiments have recently been made to determine the effect of these dyes, and, as a result, it is stated that they are not poisonous even when used in considerable quantities.

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THE LECITHINS OF SUGAR-CANE.

BY EDMUND C. SHOREY.

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IN a former paper on the principal amid of sugar-cane, mention was made of an attempt to estimate the amount of different nitrogenous bodies in molasses, according to a scheme by