so that the chances of them occurring in the liquid condition are small. No account is taken herein of gases that are closely associated under heavy pressure with oil in the sands. Under such condition there is a solution of gases in the oil to a great extent. The natural gas used in Pittsburgh is not associated with oil in the earth's strata.

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THE ANALYSIS OF CHROME YELLOWS AND GREENS

By A. GIVEN

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From inquiries received at this laboratory, it appears that the determination of the composition of chrome yellows and chrome greens is not well understood in many color and paint works; and the excellent publications of the Bureau of Standards on the analysis of inks help only in a degree. The method here given is the result of a great deal of work and experience with these colors, and has given excellent satisfaction.

METHOD

MOISTURE AND LEAD CARBONATE—Weigh out accurately about 1 gram of the yellow or green into a small beaker, and dry for 4 hours at 105–110°C. Calculate the loss in weight as water. Add 50 cc. of 50 per cent acetic acid to the dry substance in the beaker, mix thoroughly, and let stand over night. Filter through a tared Gooch, wash with hot water, dry, cool and weigh. Calculate the loss from dry weight as lead carbonate.

LEAD SULFATE AND CHROMATE—Weigh out accurately about 1 g., wash into a 250 cc. beaker, add 50 cc. water and 50 cc. of 25 per cent caustic soda and boil for 5 or 10 minutes. Filter through a tared Gooch, wash thoroughly with hot water, cool the filtrate and make up to 250 cc. Save the residue. To 50 cc. of the solution add an excess of hydrochloric acid and 5 cc. alcohol and boil until the chromate is reduced to chromic chloride. Add an excess of barium chloride, boil, let settle, filter on an ashless paper, wash, burn and weigh as barium sulfate. Calculate to per cent lead sulfate.

To 50 cc. of the above solution add an excess of nitric acid, heat to boiling and add 25 cc. boiling saturated solution of potassium bichromate. Boil 1 minute, let settle, filter through a tared Gooch, wash, dry and weigh. Calculate as per cent lead chromate. From this amount subtract the lead sulfate and lead carbonate, both calculated to lead chromate, and call the difference actual lead chromate present.

RESIDUE—Fill the Gooch containing the residue from the solution for lead sulfate and chromate with hot 1 : 1 hydrochloric acid, let stand 10 minutes, filter and wash with hot water. Repeat twice, wash thoroughly, dry and weigh. Calculate remaining residue as per cent barytes or china clay according to base.

PURE BLUE—The sum of all the previous determinations is subtracted from 100, and the difference called pure blue.

LABORATORIES OF MORRIS HERRMANN AND COMPANY
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THE UTILITY OF SULFUROUS ACID AND PURE YEAST IN CIDER VINEGAR MANUFACTURE

By W. V. CRUESS, J. R. ZION AND A. V. SIFREDI

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A study of methods of alcoholic fermentation of apple juice destined to be made into vinegar in various California factories showed that in almost every case no attempt was made to control the microorganisms of fermentation. A brief description of the various ways of handling the cider stock will no doubt be of interest.

In one of the largest factories the cull apples and peels and cores from apple driers are ground or "grated" in an Ohio apple grater as soon as received. The juice is pressed out with heavy screw presses driven by a motor and cog gearing with a capacity of 60 tons per day. The juice goes to 20,000 gallon tanks. The first tank of the season is started with a large starter of compressed yeast. When this tank is in fermentation, about one-third of its contents is used to start the next tank. The third tank is started from the second, and so on through the whole series of tanks. Over 500,000 gallons are made in this way during a season. Examination of the fermented juice showed it to be "dry;" that is, practically free from unfermented sugar, but it was shown by microscopical examination to contain large numbers of lactic acid bacteria and the large tanks soon developed a heavy growth of *mycoderma* (wine flowers) after alcoholic fermentation. The lactic bacteria develop a "mousey" flavor and the *mycoderma* rapidly oxidizes alcohol to CO₂ and H₂O without forming any corresponding amount of acetic acid.¹ Laboratory tests demonstrated that *mycoderma* isolated from cider was capable of destroying all of the alcohol of a fermented orange juice containing 4.5 per cent alcohol in three weeks. The gravity of heavy *mycoderma* growth may be seen from these figures.

Another large factory stores its cull apples, peels and cores in a large wooden bin. Often this material undergoes a fermentation, resembling silage fermentation, before it can be crushed. The juice after crushing and pressing is allowed to undergo spontaneous fermentation in 30,000-gallon tanks. Wild yeasts, lactic bacteria and *mycoderma* develop profusely, giving a very cloudy cider. Occasionally a tank "sticks" with some unfermented sugar, but in general the fermentations are complete.

A third factory (until 1914) crushed its apples and allowed the crushed apples to undergo spontaneous fermentation 3 or 4 days before pressing. This method gave a high yield of juice, due to the softening effect of the fermentation. Beginning with this season, this factory used pure "Burgundy" wine yeast on the crushed apples with good results. The yeast was propagated according to *Bulletin 230* of the University of California Experiment Station. No sulfurous acid is used on the crushed apples, consequently the fermented cider shows a strong tendency to develop *mycoderma*.

The above factories all use the generator process

¹ A. V. Sifredi, Thesis for M. S., Univ. Calif., Dec., 1914.