The results obtained established the following high proportion (per cent.) of digestion and assimilation of the total furfuroids of the mixed diet

96.4	98.4	97.3	96.4	94.5

which are certainly minimum numbers for the special group of furfuroids under investigation. No pentoses or other furfural-yielding products were present in the urine, which was examined from time to time.

It may be concluded from these results that the typical furfuroids of cereal tissues when fully hydrolyzed are digested and assimilated by the herbivera as completely as starch and its products of hydrolysis. In this respect they differ from the pentoses and their anhydrides.

In view of these results and the exceptional physiological history of this group of constituents of plant tissues, which is by no means fully elucidated, we consider the term "furfural gebende substance," or more shortly "furfuroid" is to be preferred as a general designation, reserving the term pentosan for its strict use; *i. e.*, as applied to a pentose-anhydride ($H.C_5H_{10}O_5—MH_2O$).

4 NEW COURT, LONDON, AND LANCASTER,
ENGLAND, May 10, 1900.

ESTIMATION OF PYRRHOTITE IN PYRITES ORE.

BY F. B. CARPENTER.

Received August 15, 1900.

SINCE the introduction of pyrites into the manufacture of sulphuric acid, industrial laboratories have been frequently called upon to make analyses of pyrites ores to determine their quality for manufacturing purposes. In order to determine the relative value of these ores it is not only necessary to determine their sulphur content, but it is also essential that an estimation be made of those sulphides, which are difficult to decompose in the furnace. Fairly satisfactory methods have been described for the determination of zinc, arsenic, copper, etc., but I have heretofore seen published no satisfactory methods for the estimation of pyrrhotite. It is well known by acid makers that it is difficult to get the sulphur from this material, especially in lump burners, and as it is contained in nearly all our domestic ores to a greater or less extent, the importance of its presence should not be overlooked.

The usual method for the determination of pyrrhotite in pyrites is based on its magnetic properties, and briefly stated, is carried out as follows: About 25 grams of the material, ground to pass a 60-mesh sieve, is spread out on a piece of glazed paper, and a magnet of the horseshoe type is passed backward and forward through small portions at a time. As soon as the poles of the magnet are loaded with attracted material the bridge between them is broken down with the armature, so that as much of the mechanically retained pyrites as possible may be dislodged; then after striking the magnet several times sharply with the bare hand to further free the magnetic portion from the pyrites, the adhering substance is transferred to a clean sheet of paper; then another portion of the ore is treated like the first, cleansing and transferring the attracted part in the same way, and this continued until the whole amount has yielded all magnetic matter. The portion removed to the second paper is still far from pure, and the cleansing operation is repeated for a second and third time in the same manner as the first, except that the magnet is held at a sufficient distance to lift the material and not rub among the particles. The magnetic material thus obtained is weighed and sulphur determined in one-half to one gram. The percentage of sulphur existing as pyrrhotite is then calculated from the results by multiplying the percentage of magnetic material found in the ore by the amount of sulphur found in 1 gram of the same. The difficulties in working this method are no doubt apparent to all who have used it. Pyrrhotite is only slightly magnetic and is very difficult to separate from the non-magnetic ore. After following out the method just described with the greatest care it is impossible to remove all the pyrrhotite or to have the magnetic material free from pyrites. We have slightly improved the method in this laboratory by substituting the electromagnet for the ordinary style, but the results are still far from satisfactory.

The method which I am about to describe was worked out in this laboratory, and is based on the solubility of the two sulphides (FeS_2 and Fe_7S_8) in hydrochloric acid, FeS_2 having been found to be practically insoluble while Fe_7S_8 seems to be wholly decomposed.

Details of the Process.—Determine total sulphur and silica by the usual methods; also copper, zinc, etc., if they are present in appreciable amounts. Test for pyrrhotite with magnet, and if present proceed as follows:

Treat 2 grams of the sample (ground to pass a 100-mesh sieve) in an 8-oz. beaker, covered with a watch-glass, with 30 cc. concentrated hydrochloric acid, boil ten minutes, filter on a weighed Gooch crucible, wash successively with warm dilute hydrochloric acid, hot water, alcohol, and finally several times with small portions of carbon disulphide. Dry at 100° and weigh. Weight of residue $= FeS_2 + SiO_2$. $(FeS_2 + SiO_2) - SiO_2 = FeS_2$. The sulphur required to satisfy the iron in the resulting FeS_2 is subtracted from the total sulphur, and the remaining sulphur calculated to Fe_7S_8 (pyrrhotite). The details of the calculations are as follows: $FeS_2 \times 0.534 =$ sulphur in FeS_2; subtract this from the total sulphur and multiply the result by factor 2.529; this gives the percentage Fe_7S_8 present in the ore. These calculations apply to ores containing only traces of other metals besides iron. If other metals are present in appreciable amounts due allowance will have to be made. Zinc sulphide will be practically all decomposed by the hydrochloric acid; the percentage of zinc found, will therefore have to be satisfied with the required amount of sulphur, and the sulphur thus used deducted from the total sulphur before other calculations are made. Chalcopyrite, on the other hand, is only partly decomposed by the treatment with hydrochloric acid. Thus for the accurate estimation of pyrrhotite it will be necessary to make copper determinations both in the residue and filtrate, and calculate the results to chalcopyrite, subtract the amount of chalcopyrite found in the residue from the total residue, and the amount of sulphur required to satisfy the percentage of copper in the filtrate from the total sulphur before making the calculations. If only a small percentage of copper is present with no other metals, approximate results may be obtained by using dilute acid (1 to 1) for treating the ore. The amount of copper dissolved out by this treatment will be so small that it may be overlooked in the determination. The whole percentage of copper in the ore is in this case calculated to $CuFeS_2$, and deducted from the total residue. Copper may be determined very quickly and accurately by the cyanide process as described by Ricketts and Miller. If other disturbing factors are present the method will have to be modified accordingly, but the method as described gives results sufficiently accurate for all practical purposes on the great majority of commercial pyrites ores. This process is simple, reasonably quick, and gives much more satisfactory results than the other methods we have tried.

Mr. S. H. Sheib who is connected with this laboratory has rendered valuable assistance in perfecting this method of pyrrhotite determination, and its success is largely due to his careful work.

LABORATORY VIRGINIA-CAROLINA CHEMICAL CO.,
August 1, 1900.

THE ESTIMATION OF FAT IN SWEETENED CONDENSED MILK.[1]

BY JOSEPH F. GEISLER.

Received August 8, 1900.

CONDENSED milk, as its name indicates, is a more or less concentrated milk, prepared by evaporating or distilling off a large percentage of the water of the milk. The concentration is usually carried to a degree to meet popular taste and trade requirements, unless the law establishes a specified degree of condensation. Broadly, this class of milk may be divided into the sweetened and unsweetened condensed milk, the former containing a large per cent. of cane-sugar as sweetener and preservative. Aside from its general good qualities, the extreme precaution of cleanliness in the preparation of most of the condensed milks has added much to their popularity, so that the sale and consumption of these milks is assuming vast and rapidly increasing proportions. As an article of food it is therefore more frequently being made the subject of analytical inquiry to determine its quality and freedom from adulteration.

While certain manufacturers pride themselves in turning out a product of uniform color, consistency, and superior keeping qualities and purity, others have deliberately put adulterated goods on the market and were prosecuted and fined for the same.

The analysis of ordinary milk presents no particular difficulties

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[1] Read at the Twenty-first General Meeting of the American Chemical Society, June, 1900.