

it could not be subjected to more than momentary bombardments. If, on the other hand, a salt of lithium was employed, it evolved gas rather copiously so that these experiments likewise had to be intermittent. At the time these experiments were made the writer did not have at his disposal either an alkaline earth oxide electrode nor a tungsten spiral to serve as source of electrons. As a consequence the pressure of gas in the bombardment tube had to be maintained within rather narrow limits. The procedure finally adopted as most satisfactory under the existing conditions consisted in introducing the requisite amount of oxygen gas into the thoroughly evacuated tube containing the lithium, which was present as oxide, and subsequently absorbing the oxygen in heated copper. Small quantities of other gases found to be present were absorbed by suitable reagents. The voltage then available, which was obtained from a very large spark coil, probably did not exceed 150,000 volts. With a bombardment chamber so designed that metallic lithium could be cooled by liquid air, or other refrigerant, while being subjected to a less concentrated beam of electrons from a tungsten filament electrode, it is probable that the bombardment could proceed indefinitely.

As a result of these bombardments a small unabsorbed residue showing strongly the spectrum of hydrogen always remained. Because of the excessive difficulty of removing last traces of water vapor from the surface of glass, there is no good reason for supposing that the hydrogen came from another source than water liberated and decomposed as a result of the bombardment. On the other hand it must be remarked that in view of the well known masking effect which hydrogen pos-

sesses over the development of the spectrum of helium, small quantities of helium that might have been present would not have been detected. Means were not at hand for entirely separating this hydrogen from any helium and searching for the latter by itself.

The purpose of this discussion is to suggest that with improved and more powerful apparatus there would be considerable hope of pursuing them to some sort of a definite conclusion.

For much advice in its design and for blowing many of the more difficult parts of the glassware of this apparatus, the writer was under great obligation to Dr. Harold S. Booth.

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#### THE EFFECT OF SODIUM HYDRATE UPON THE DIGESTIBILITY OF GRAIN HULLS

NUMEROUS experiments have been made during the last few years, particularly by German investigators, in attempts by various treatments to render more digestible the straws of the different cereals, legumes and cruciferae. Among the methods employed for this purpose may be mentioned (a) the heating of finely ground straws under atmospheric pressure, (b) the treating of the fine straw with 3½ and 7 per cent. of sodium hydrate under 5 atmospheres, (c) cooking the straw in open kettles or cement ovens with 8 per cent. sodium hydrate for 12 hours, and (d) the treating of ground straw with cold sodium hydrate of various strengths for different lengths of time. The action of sodium hydrate as well as of calcium hydrate has proved effective, and the

DIGESTION COEFFICIENTS  
AVERAGE TWO SHEEP

	DRY MATTER	ASH	CRUDE PROTEIN	FIBER	EXTRACT MATTER	FAT
Oat hulls untreated.....	36	00.00	0.00	53	34	0.00
Oat hulls treated.....	81	65	0.00	91	79	0.00
Rice hulls untreated*.....	5	10	0.00	12	5	0.00
Rice hulls treated.....	29	?	0.00	28	38	0.00

\*One sheep only.

digestibility of some of the materials treated has been increased fifty or more per cent.

At the Massachusetts Experiment Station studies of the effect of quite dilute sodium hydrate upon the digestibility of oat and rice hulls have been completed and gives a preliminary statement of the results.

It is evident that the action of the soda did improve the digestibility of the oat hulls to a marked degree and of the rice hulls to a limited extent. A thorough study is being made of the chemical composition of oat, barley, rice and cottonseed hulls, and of flax shives, and of the action of different strengths of sodium hydrate and of other chemicals in improving their digestibility.

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(Continued)

DIVISION OF FERTILIZER CHEMISTRY

F. B. Carpenter, *chairman*

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*The briquetting of mineral phosphates a promising method of conservation:* WILLIAM H. WAGGAMAN and H. W. EASTERWOOD. In connection with research work on the volatilization of phosphoric acid in a fuel fed furnace, preliminary work has shown that briquetting is a factor of prime importance. Samples from old phosphate deposits were found to be sufficiently high grade and contained enough natural binder (clay) to lend themselves to briquetting purposes. Also much phosphate rock from waste heaps could be used. It is only necessary to reduce the material for briquetting purposes to a point where it will pass a ten-mesh sieve and incorporate the necessary water into the mixture to give it the required plasticity. Where the composition of the material is such that sand must be added it was found that the necessary water could be added to the sand and coke and then this moistened mixture incorporated with the phosphate material. Coal presents a very promising possibility as a reducing agent in such briquettes since the volatile matter contained therein does not cause the briquettes to split open or disintegrate when heated.

*Cyanamid in some fertilizer mixtures:* W. S.

LANDIS. A study of the behavior of Cyanamid in some fertilizer mixtures and in several standard brands of mixed fertilizer. The rapid conversion of cyanamid into urea and other salts was noted, but no dicyandiamid was found in any of the mixtures studied. Reactions with ammoniated base of both cyanamid and dicyandiamid were studied and unidentified complexes found to occur in such mixtures. Cyanamid when added in the proportions recommended for formulating this material did not change to dicyandiamid, and dicyandiamid intentionally added as such disappeared on mixing in such goods.

*Comments on the formation of dicyandiamid in fertilizers:* J. E. BRECKENRIDGE.

*The value of the alkaline permanganate method:* CHAS. S. CATHCART.

*Remarks on the permanganate methods for the determining of availability of organic nitrogen:* J. E. BRECKENRIDGE.

*Ten years experience with the neutral permanganate method in South Carolina:* R. N. BRACKETT.

*The composition of cotton seed:* THOS. C. LAW.

*Cultivation and nitrogen fertilization:* H. A. NOYES, J. H. MARTSOLF and H. T. KING. A study of the comparative effects of different degrees of cultivation shows that with proper cultivation the average soil contains enough organic matter to stimulate bacterial activities and allow nitrates to accumulate during the growing season. Virgin soil rich in available organic matter gives nitrates in great excess of those needed by the growing plants. In early spring soils are depleted of nitrates and an early application of available nitrogen fertilizer is desirable and beneficial to stimulate plant growth until such a time as the soil has warmed up and responded to cultivation in increased bacterial activities. In no case studied have the authors been able to find the need for a second application of nitrogen fertilizer later in the season unless the soil did not receive proper cultivation. Nitrate production and accumulation resulting from and associated with thorough cultivation have a money value more than equal to the cost of the second application of nitrogen fertilizer.

*The effect of fertilizers of various compositions on the reaction of soils:* J. J. SKINNER. The hydrogen ion concentration and lime requirements of soil fertilized with mixtures of various compositions are reported. In a fertilizer experiment with grass on the Hagerstown loam soil, acid phosphate, sodium nitrate, and potassium chloride was used singly, in combinations of two and in