considering them as part of the ring and adjusting the zero balance of the instrument with the droplets adhering to the ring.

Experiments to test this explanation have shown a difference of 3.3 dynes per centimeter for water when the former technique and the new technique, respectively, were employed. This brings the results by the ring method into agreement within .1 dyne with the average of the values obtained by the other methods. The modified technique therefore bridges the gap between the ring method and the group of other methods cited in the literature, and it finally removes whatever doubt there might have been about the trustworthiness of the ring method.

A more detailed description of the new technique, together with experimental data, will be published elsewhere.

PAUL E. KLOPSTEG

DEVELOPMENT LABORATORY,
CENTRAL SCIENTIFIC COMPANY,
FEBRUARY 15, 1924

HEAT OF WETTING AS A NEW MEANS OF ESTIMATING THE COLLOIDAL MATERIAL IN SOILS

ONE of the greatest needs in soil studies is a method for determining the amount of colloidal material in soils, for it now appears that most of the chemical and physical reactivities and properties of soils are due mainly to their colloids. Such phenomena as adsorption and absorption of chemical reagents, moisture adsorption and retentiveness, heat of wetting, unfree water, rate of evaporation of water, plasticity, cohesiveness, etc., are all closely associated with or mainly controlled by the colloids in the soil. To intelligently understand and compare the different soils with one another it is important and essential, therefore, to know their colloidal content.

At present there is really no method for determining quantitatively and accurately the colloidal material of soils. There have been several methods proposed, but it appears that all of them involve serious errors. Probably the most important methods proposed are those based upon the adsorption of dyes and those upon the adsorption of liquid vapors. The methods in the first category involve the serious error that the different soils contain different kinds of colloids which adsorb the same dye differently and consequently the results are reliable neither quantitatively nor relatively. The methods in the second category contain several disadvantages which may be accompanied with serious errors. Some of these disadvantages are as follows: (1) Besides the real surface adsorption there may also be a capillary absorption, *i.e.*, a condensation of vapor in the capillaries; (2) there may be a condensation of vapor by a slight change of temperature; (3) the procedure is long and uncertain as to when equilibrium is attained.

The present writer has been interested in trying to work out a method for determining the colloidal material in soils for some little time. After trying out several methods, including those mentioned above, he has come to the conclusion that the heat of wettings presents probably the best means for estimating the colloidal content of soils, as well as their state of activation. It has been found that the heat of wetting of soils is due mainly, if not entirely, to their colloids, as non-colloidal material even in very fine state of division does not produce heat of wetting. For instance, rocks and minerals ground to very fine condition fail to give any measurable amount of heat of wetting. Even colloidal soils which give a tremendous amount of heat of wetting in their natural state fail to give any heat of wetting after being ignited, even though they may be ground extremely fine.

It has been found according to this method that the colloidal content of soils may range from 0 to as high as 80 per cent. of their weight and that the average soils contain a far larger amount of colloids than is commonly believed.

One of the interesting things that this method has revealed is the fact that the reactivity of material may not depend entirely upon the size of its particles but also upon the state of its activation. The latter may be due to several factors such as degree of decomposition, nature, etc. It would seem that the reactivity of the material may be more important than the size of its particles.

The procedure of the method consists of determining the heat of wetting of the soil, then extracting a certain amount of colloids from the soil and determining their heat of wetting. Knowing the heat of wetting of both the soil and the extracted colloids, the colloidal content can be readily calculated. It may be possible to ascertain the colloidal content of a soil by multiplying its heat of wetting with a factor, without having to extract the colloids.

The method of determining the heat of wetting is very simple, rapid and accurate and appears to be far superior to the vapor adsorption and dye adsorption methods.

Several other liquids besides water have been employed to determine the heat of wetting, but it was found that these other liquids did not react with all the different kinds of colloids in the soil, but water reacted with all of them.

A detailed report of the investigation is now in preparation.

GEORGE JOHN BOUYOUCOS

MICHIGAN AGRICULTURAL
EXPERIMENT STATION,
EAST LANSING, MICHIGAN