Properties: Iso-octane, made by the second method, is a colorless liquid boiling at 116° at 761 millimeters, and has a slight characteristic odor. Its specific gravity at 15° compared to water at 15° is 0.7035. Its index of refraction is $N_D(25°)$, 1.3944. It is, therefore, identical in properties with that obtained by the first method.

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THE PRESENCE OF A CHOLESTEROL SUBSTANCE IN SOILS; AGROSTEROL.[1]

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In the attempts which have been made to isolate definite organic compounds from soils it has been found that in most cases treatment of the soil with alcohol even at boiling temperature does not give a solution of soil organic matter from which definite results could be obtained.

However with some soils, characterized usually by a high content of organic matter, this treatment has led to the isolation and identification of definite organic compounds.

The details of the method and the properties of one of the compounds obtained are the subject of this paper.

The soil from which this compound was obtained was the Marshall clay from North Dakota, a black soil containing 10.6 per cent. organic matter and 0.51 per cent. nitrogen.

When this soil was treated with boiling 95 per cent. alcohol there was obtained a greenish-brown colored extract from which on cooling a yellowish microcrystalline precipitate separated. On treating the soil with successive portions of boiling alcohol, the extracts combined and concentrated to smaller volume and allowed to cool yielded this precipitate in considerable quantity, 250–300 parts per million of soil. This precipitate contained both mineral and organic matter and is at present the subject of further investigation. The mineral matter is alumina for the most part, and the organic portion is a mixture, some of the so-called waxy acids being present.

The filtrate from this precipitate was a dark greenish-brown solution which on evaporation of the alcohol became a thick resinous mass. On treating this residue with cold ether nearly all of the coloring matter went into solution leaving a small quantity of a yellowish wax-like substance, the nature of which is yet unknown.

[1] Presented at the New Haven meeting, June, 1908, of the American Chemical Society by permission of the Secretary of Agriculture.

The colored ether solution on evaporation of the ether left again a thick viscous residue. Treatment of this with successive small quantities of cold absolute alcohol removed the coloring matter, leaving a nearly white residue. This residue was readily soluble in ether and crystallized from such solution in needles, usually arranged in radiating clusters. If, however, this body was dissolved in hot 80 per cent. alcohol in which it is quite easily soluble, it crystallized in flat plates very similar in appearance to those of phytosterol.

The compound so obtained melts at 237° (uncorrected) and the melting point remains unchanged after recrystallization. It is readily soluble in ether or chloroform, little soluble in cold alcohol, but readily so in hot, and almost insoluble in hot water. It is unchanged by treatment with alcoholic potash. When crystallized from 80 per cent. alcohol it contains water of crystallization which is lost at 100°.

The appearance and properties of this substance suggested a member of the cholesterol group, and it was found to respond readily to Liebermann's "cholesterol reaction," but gave no reaction with other color tests for members of this group. Liebermann's reaction is characterized by the violet color produced when a drop of strong sulphuric acid is added to a solution of the substance in acetic anhydride. This test is best performed by dissolving a very small quantity of the substance in a few drops of chloroform, adding about 1 cc. of acetic anhydride and then one drop of concentrated sulphuric acid. With the compound from the soil the color produced by this treatment is intense, appears immediately and a good reaction is obtained with a very minute quantity. Cholesterol and a number of isomeric substances which have been described are usually represented by the formula $C_{26}H_{44}O + H_2O$. Very little, however, is known of their constitution beyond their alcoholic nature and even the elementary composition is doubtful, the formula $C_{27}H_{44}O + H_2O$ being given by some investigators.

The composition of the compound obtained from the soil was found to agree very closely with the formula $C_{26}H_{44}O$. The analysis was made with 0.15 gram dried at 100°. Calculated for $C_{26}H_{44}O$: C, 83.8; H, 11.8. Found: C, 83.6; H, 11.5.

The melting points of most of the described cholesterol substances are much lower than that of the body obtained from soil. Cholesterol found in animal fats melts at 145–6°, phytosterol found in vegetable fats and waxes melts at 132–3°, isocholesterol found in some animal fats melts at 137–8°, paracholesterol found in etiolated yellow lupines melts at 134–134.5°, sitosterol found in plant fats melts at 137.5°, paraphytosterol found in the seed coat of *Phaseolus vulgaris* melts at 148–50°, parasitosterol found in the embryo of wheat melts at 127.5°, homocholesterol found in Dalmatian insect powder (*Chrysanthemum cinerariaefolium*)

melts at 183°, and ergosterol found in ergot melts at 154°. However, anthesterol, a closely related alcohol found in *Anthemis nobilis*, melts at 221–3° and arnesterol found in *Arnica montana* melts at 249–50°.

The cholesterol substance obtained from the soil does not correspond in melting point with any substance of this group so far described. For this compound, isolated from a soil, having the chemical properties and general appearance of substances of the cholesterol group, but differing in melting point from any of the members of this group so far described, the generic name *agrosterol* is suggested in harmony with the nomenclature of this group.

With regard to the origin of this compound in the soil at least two possibilities present themselves: It will be seen that several members of the cholesterol group are so far as known found only in single species of plants. It may be that agrosterol is characteristic of some plant grown on this soil and that on the decay of plants of this species it has survived the action of enzymes, fungi and bacteria and remained in the soil as an unchanged plant residue. Since, however, the presence of a substance of this group is shown by Liebermann's reaction above-mentioned in several soils from widely separated localities with different native vegetation and cropping, it would seem that this suggestion has not much weight. To make this conclusive it would be necessary to show that the substances from different soils giving Liebermann's reaction are really identical, since the reaction is only a class reaction and not specific for agrosterol or any other member of the cholesterol group.

On the other hand it is within the range of possibility that agrosterol may be formed from some other substance through the agency of micro-organisms or chemical oxidation. The fact that Lifschütz[1] has shown that a cholesterol substance can be formed by the oxidation of oleic acid emphasizes this possibility. The fact that paracholesterol mentioned above is found in slime molds further supports the suggestion that agrosterol may be formed by micro-organisms. Agrosterol is very little soluble in water and saturated solutions of it had no effect on wheat seedlings.

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NEW BOOKS.

Synthetic Inorganic Chemistry. A Laboratory Course for First-year College Students. By ARTHUR A. BLANCHARD, PH.D. New York: Wiley and Sons. 1908. Pages viii + 89. Price, $1.00.

The object of this book is clearly stated in the preface: "During the first term's study of chemistry there can be little doubt that a course of

[1] *Z. physiol. Chem.*, **55**, 1 (1908).