molecule or are only physically associated as envisaged in the cellulosan of Hawley and Norman[10] is not known.

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Action of Thionyl Chloride on Carboxylic Acids in Presence of Pyridine

IN order to use thionyl chloride most effectively for the preparation of acyl chloride, *R*CO.Cl, a knowledge of the sequence of reactions occurring is desirable. Trichloroacetic acid reacts extremely slowly with thionyl chloride even at higher temperatures; but Carré and Libermann[1] have shown that pyridine (1 mol.) helps the reaction. Mills and Human[2] adopted the use of the base in the preparation of anilides and esters of the half-esters of phthalic acid. We have now shown that during the addition of the first half of the thionyl chloride (1 mol.) to an ethereal solution of *cyclo*hexyl hydrogen phthalate (1 mol.) and pyridine (1 mol.), the following reactions occur:

$$R.CO_2H,NC_5H_5 + SOCl_2 \rightarrow R.COCl + C_5H_5NHOSOCl$$
$$R.CO_2H,NC_5H_5 + R.COCl \rightarrow (R.CO)_2O + C_5H_5NHCl$$

The second half of the thionyl chloride then converts the anhydride into the acyl chloride, and it was from the latter that Mills and Human obtained the anilide by adding the amine together with pyridine. Now the significant point is that although the formation of anhydride is very rapid[3], the formation of acyl chloride from the anhydride is comparatively slow and requires a time which depends on the nature of *R* in the acyl group. It just happens that the anhydride of *cyclo*hexyl hydrogen phthalate (the example quoted by Mills and Human) will give acyl chloride in yields approaching 80 per cent in the one hour of reaction time allowed by these workers; but the rate of formation of acyl chloride from the anhydride of 2-octyl hydrogen phthalate is definitely slower, and we were at a loss to account for the high yield of anilide reported by Mills and Human.

It appeared possible that the anhydride itself was giving the anilide; but in this case this reaction would have to compete with a very quick interaction of the amine with thionyl chloride remaining.

Trichloroacetic acid is a special case[3]. The acyl chloride is formed directly from the acid by the addition of thionyl chloride (1 mol.) to the acid (1 mol.) and pyridine (1 mol.), and the acyl chloride does not react with the acid to give the anhydride.

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Use of the Warburg Apparatus in Soil Metabolism Studies

METHODS so far used for studying the evolution of carbon dioxide resulting from the decomposition of soil organic matter[1], although satisfactory for periods of 24 hr. or more, do not permit measurements for shorter periods, which may be important in studying the immediate effects of soil treatments.

It seemed that the Warburg respirometer had possibilities in this regard. Other workers[2] have, in fact, used it to study the respiration of suspensions of non-soil organisms added with excess substrate to soils at various moisture-levels, in order to assess aeration conditions in the soil. In these studies, however, the respiration of the soil population itself was not closely followed, and no attempt was made to relate respiration to the decomposition of soil organic matter.

The application of the Warburg apparatus to the study of soil metabolism has the particular advantages that respiration can be accurately measured over short periods, respiratory quotients obtained and the immediate effects of substrate or inhibitor studied by addition from the side arm of flask.

Although the purpose of the present communication is chiefly to direct attention to its possibilities, it is of interest to note some points that have become apparent.

Table 1. RESPONSE OF THE SOIL POPULATION TO AMELIORATION

Soil	Gas	Microlitres of gas per gm. of soil after 1 hr.	2 hr.	3 hr.	4 hr.	5 hr.	6 hr.	7 hr.
(*a*) Untreated soil *p*H 4·8	O_2	9	21	34	46	58	72	86
	CO_2	8	20	33	47	60	75	89
(*b*) Soil with $Ca(OH)_2$ to *p*H 6·7	O_2	15	26	40	52	72	88	105
	CO_2	17	30	45	57	73	88	102

The soil from which the results in Table 1 were obtained had been stored in an air-dry condition for ten weeks before use, and respiration studies commenced within an hour of wetting. It is interesting to note the short duration of any lag period in the development of respiration. Note, too, the immediate increase in respiration-rate on raising the *p*H with calcium hydroxide. Both results suggest the existence of a soil population in a relatively resting or inhibited state, able to respond without significant multiplication or adaptation to improved moisture or *p*H relationships.

Subsequent decline in the respiration-rate after several days with moisture-level constant suggests that some part of the soil organic matter is in a more readily decomposable form after the soil has been air-dry for a period.

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