Table 1. R_F VALUES OF INDOLES ON POLYAMIDE LAYERS

Compound	Solvent (1)	(2)	(3)	(4)
(1) 5-Hydroxy indolyl-3-acetic acid	0·07	0·02	0·33	0·35
(2) Tryptophan	0·11	0·09	0·87	0·16
(3) Serotonin	0·13	0·08	0·93	0·26
(4) Abrine (*N*-methyl tryptophan)	0·27	0·27	0·89	0·28
(5) Tryptamine	0·55	0·67	0·91	0·58
(6) Indolyl-3-acetic acid	0·45	0·43	0·26	0·77
(7) *N*-methyl tryptamine	0·73	0·84	0·92	0·72
(8) Melatonin (*N*-acetyl-5-methoxy tryptamine)	0·75	0·80	0·38	0·81
(9) 5-Hydroxy tryptophan	0·71	0·41	0·00	front
(10) Indole	0·83	0·85	0·21	0·93

Solvents as in text.

These experiments provide evidence of polyamide sorption of the indole skeleton. It is probable that acidic hydrogen of pyrrole nitrogen is the centre of adsorption. Investigations of other indole derivatives and the application of this technique to indole metabolites in human urine are in progress.

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SOIL SCIENCE

New Method for measuring Heat Flux Density at the Surface of Soils or of Other Bodies

Two methods for determining thermal conductivity λ, and heat capacity per unit volume C, at a soil surface have recently been developed[1]. One method also measures the heat flux density.

A block of an appropriate material, at a uniform temperature, is placed on the soil surface and the temperature of the contact plane recorded. The product λC and the heat flux density can be calculated. In experiments by myself and by Derksen, Schneider and Belghith, 'Perspex' blocks of $10 \times 10 \times 4$ cm dimensions were used[2]. The temperature near the centre of the contact plane (10×10) was recorded for about 6 to 12 min.

The method might also be useful outside the field of soil science since it possesses the following favourable features: no correction need be made for the presence of the block; no sensing elements need be placed in the soil; a good thermal contact between block and soil surface is not essential.

The temperature near the centre of the contact plane is calculated from the theory of two semi-infinite bodies, each filling a half space, which are suddenly brought into contact along the plane $z = 0$ at the instant $t = 0$ (ref. 3). This happened during a certain interval of time in which the contact with the other body affects only a layer of a depth which is much smaller than the dimensions of the body. In the experiments referred to, this depth was about 1 to 2 cm.

If at $t = 0$ the initial temperature in the block is uniform at ϑ_1 and in the upper soil layer is at $\vartheta_2 + Ez$, where z is the depth, the temperature in the plane of contact becomes

$$\vartheta(t) = \frac{\vartheta_1\sqrt{\lambda_1 C_1} + \vartheta_2\sqrt{\lambda_2 C_2}}{\sqrt{\lambda_1 C_1} + \sqrt{\lambda_2 C_2}} + \frac{2}{\sqrt{\pi}}\,\frac{E\lambda_2}{\sqrt{\lambda_1 C_1} + \sqrt{\lambda_2 C_2}}\sqrt{t} \quad (1)$$

The indices 1 and 2 refer to the block and the soil, respectively. $-E\lambda_2$ is the initial heat flux density, since E is the gradient of the temperature in the soil near its surface. It can be calculated from the slope of the $\vartheta(t)$ versus $\sqrt{t}$ curve if ϑ_1, ϑ_2 and $\lambda_1 C_1$ are known and $\lambda_2 C_2$ is found from the temperature immediately after contact.

If two blocks are used at different initial temperatures, the initial surface temperature of the soil ϑ_2 need not be known, but can be calculated.

Equation (1) holds only for perfect thermal contact, that is, $\vartheta(t) = \vartheta_1(0,t) = \vartheta_2(0,t)$, where $\vartheta_i(0,t)$ denotes the limit of the temperature in body i for z approaching zero.

The records show that a more realistic assumption is $\vartheta_1(0,t) = \vartheta_2(0,t) + \mu H(t)$, in which $H(t)$ is the heat flux density pointing from the block into the soil and μ a positive constant which indicates the quality of the contact. With this assumption one obtains for the temperature at the contact face of the block

$$\vartheta_1(0,t) = \frac{\vartheta_1\sqrt{\lambda_1 C_1} + \vartheta_2\sqrt{\lambda_2 C_2}}{M} - \frac{NE\lambda_2}{M^2} + \left[\frac{(\vartheta_1 - \vartheta_2)\sqrt{\lambda_2 C_2}}{M} + \frac{NE\lambda_2}{M^2}\right] e^{\frac{M^2}{N^2}t} \cdot erfc\left(\frac{M}{N}\sqrt{t}\right) + \frac{2}{\sqrt{\pi}}\,\frac{E\lambda_2}{M}\sqrt{t} \quad (2)$$

$M = \sqrt{\lambda_1 C_1} + \sqrt{\lambda_2 C_2}$, $N = \mu\sqrt{\lambda_1 C_1\,\lambda_2 C_2}$, and *erfc* is the complement of the error function, $erfc(x) = 1 - erf(x)$. $\lambda_2 C_2$, $E\,\lambda_2$ and μ can be calculated if ϑ_1, ϑ_2 and $\lambda_1 C_1$ are known and the use of two blocks renders a separate determination of ϑ_2 superfluous. In our experiments the term with $erfc\left(\frac{M}{N}\sqrt{t}\right)$ became negligible after an interval ranging from 10 sec to 2·5 min in the individual experiments.

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AGRICULTURE

Relation between Mineral Deficiency and Amine Synthesis in Barley

IT has been shown that when potassium is deficient, barley—like other species—accumulates the amines putrescine and agmatine[1,2], which are derived from arginine. The product of decarboxylation, agmatine, is converted to putrescine with the intermediate formation of *N*-carbamylputrescine. Furthermore, when phosphorus is deficient, barley has an increased agmatine content, but there is no corresponding increase in putrescine[3]. In the plants deficient in potassium the production of