The close correlation between reflectance readings and chlorophyll content indicates that changes in reflectance from day to day may be used to estimate changes in the chlorophyll content of a leaf from day to day. This is especially true for chlorotic leaves; for greener leaves, when the chlorophyll content approaches the maximum, further increases may not be proportionally indicated by decreases in reflectance. Because of this and other limitations, the method can be used to the greatest advantage in detecting changes or relative differences in the chlorophyll content of leaves responding to different treatments.

Reflectance readings for a given chlorophyll content have been found to change with the age of the vacuum tubes and batteries of the instrument as well as with the species and variety of the plants being studied. The instrument should therefore be calibrated regularly against standard chlorophyll determinations.

Other precautions must also be taken. The readings must be made in the shade and not in direct light, and care must be taken that a major vein does not intercept the light beam to be reflected. Light must be prevented from leaking into the instrument around the edges of the leaf. A small cushion of black foam rubber around the opening for the light source is helpful for this purpose. Readings must be made consistently from the same surface and the same portion of the leaf. When checkered or mosaic types of chlorosis develop, such as in manganese deficiency, it may be necessary to calculate the mean of many readings on the same leaf.

The results shown in Table 1 indicate how the method has proved useful in indicating the rate of chlorophyll development in leaves receiving iron in different forms. One hundred such readings can easily be made in 1 day (*4*).

Table 1. Percentage reflectance and estimated chlorophyll content of soybean leaves in different iron treatments.

Days from start of treatment	Treatment 1*	Treatment 2†
	Percentage reflectance	
0	56	58
5	41	50
8	35	45
	Estimated chlorophyll content, dry weight basis (mg/g)	
0	2.3	2.1
5	4.4	3.0
8	5.3	3.8

* Iron added to Hoagland solution as 0.5 part of iron nitrilotriacetate per million. † Iron added to Hoagland solution as 0.5 part of iron ethylene bis-hydroxyphenylglycine per million.

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Action of Gamma-Irradiation on Dimethyl Uracil in Aqueous Solution in Absence of Oxygen

Abstract. The action of ionizing radiations on dimethyl uracil in aqueous solution, in the absence of oxygen, was found to lead to the formation of the 4-dihydro, 5-hydroxy dimethyl uracil (I), shown to be identical with that formed by the action of ultraviolet radiation. In addition, the corresponding 4,5-glycol (II) has also been identified as one of the reaction products.

It has been shown by Sinsheimer and Hastings (*1*) that the action of ultraviolet light on uracil in aqueous systems leads to a well-defined photoproduct, which was suggested to be 4-dihydro, 5-hydroxy uracil. This supposition was later confirmed by the synthesis of such compounds by various authors; in particular the dihydro-hydroxy compound from dimethyl uracil could be obtained in a crystalline form (*2*).

We have recently studied the action of ionizing radiation (Co^{60} γ-rays and 200-kv x-rays on aqueous solutions of uracil and dimethyl uracil. In the presence of oxygen, the pyrimidine bases give the more or less stable hydroxy-hydroperoxides and also the corresponding glycols (*3*). The radiation-induced formation of a glycol from cytosine has recently been reported by Eckert and Monier (*4*).

In solutions irradiated in the *absence* of oxygen, we have now been able to identify among the products the corresponding pyrimidine 4,5 glycol and, in the case of dimethyl uracil, the 4-dihydro, 5-hydroxy compound (Fig. 1). The mechanism of the formation of the dihydro-hydroxy compound and of the glycol could go by way of the successive addition of a hydrogen atom and of a hydroxyl radical or of two hydroxyl radicals at the 4 and 5 double bond or by dismutation between two pyrimidine radicals. It is, however, also possible that in this system the formation of the dihydro-hydroxy compound proceeds in a way somewhat similar to the photochemical process—that is, by excitation of the pyrimidine molecule—since it has been pointed out previously that the relatively low energy electrons, formed in the absorption of ionizing radiations, should be able to bring about excitation processes similar to those produced by ultraviolet radiation (*5*).

Dimethyl uracil, in particular, was chosen as a model compound as it had been previously investigated in detail.

In the presence of oxygen a product is formed which on treatment with acid gives an ultraviolet-absorbing compound having a peak at 283 $\text{m}\mu$ at *p*H 2 and at 310 $\text{m}\mu$ at *p*H13. This latter product was identified by chromatography as dimethyl isobarbituric acid, suggesting that the original radiation product was dimethyl uracil glycol (II).

In the absence of oxygen, irradiation gave rise to a product, which on treatment with acid also gave an increase in the ultraviolet absorption with an absorption peak at 269 $\text{m}\mu$ at *p*H 2; on subsequent treatment with alkali (to *p*H 13) this spectrum was modified to give two peaks, a major absorption at

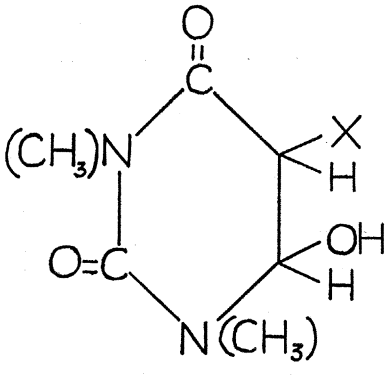

Fig. 1. Structure of the 4-dihydro, 5-hydroxy dimethyl uracil (I) and the corresponding 4,5 glycol (II). In I, *X* is H; in II, *X* is OH.

266 mμ and a smaller peak at about 310 mμ. This spectral behavior can be accounted for if the formation of both the glycol and the 4-dihydro, 5-hydroxy compound (I) are assumed to occur in the ratio of about 1:3. The glycol gives, on acid treatment, dimethyl isobarbituric acid and the dihydro-hydroxy compound, after the acid-catalyzed dehydration, gives dimethyl uracil with an absorption maximum at 266 mμ in both acid and alkali solutions.

The dihydro-hydroxy product and the glycol have also been characterized in other ways.

1) Chromatography of the product treated with acid showed the presence of both dimethyl isobarbituric acid and dimethyl uracil.

2) The rate of formation of the ultraviolet-absorbing product on treatment with acid was compared with the rate of formation of the ultraviolet-absorbing product formed photochemically from dimethyl uracil.

The second order rate constant (at 25°C) of the acid-catalyzed restoration of the ultraviolet absorption at pH 1.30 was found to be 1.13×10^{-2} lit. mole^{-1} sec^{-1} for the photochemical product and 1.10×10^{-2} lit. mole^{-1} sec^{-1} for the product obtained on irradiation with x-rays; this latter value was confirmed by measurements of the rate of double-bond restoration from the uptake of molecular bromine, which gave a rate constant of 1.12×10^{-2} lit. mole^{-1} sec^{-1}.

These figures support the conclusion that one of the products formed by x-irradiation of aqueous solution of dimethyl uracil, in the absence of oxygen, is the 4-dihydro, 5-hydroxy compound, identical with that produced photochemically (*6*).

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Five New Minerals from Moctezuma, Sonora, Mexico

Abstract. Five new minerals have been found in a tellurium deposit near the town of Moctezuma, Sonora, Mexico. Preliminary study shows that they are a lead-oxy-fluoride, a zinc tellurite or tellurate, a manganese-zinc tellurite or tellurate, a manganese tellurite or tellurate, and an iron tellurite or tellurate.

Mineralogical interest in the deposit at Moctezuma was first aroused by the identification of several rare minerals, including mackayite, emmonsite, tellurite, native tellurium, and paratellurite. Paratellurite was recently described by Switzer and Swanson (*1*). Moctezuma is the second occurrence of mackayite and paratellurite.

Five new species of minerals have been found in this deposit. Since complete chemical data are not available, the naming of these minerals is being delayed. Preliminary descriptions of the five minerals follow.

Lead-oxy-fluoride, which was found in extremely small amounts, occurs as minute, yellow plates with a high adamantine luster. The x-ray powder data agree with those for synthetic Pb_2OF_2 published by Byström (*2*). The x-ray data and appearance of material synthesized during the present study are the same as those of the natural mineral. At present, there is not enough of the mineral for a chemical analysis.

Zinc tellurite or tellurate occurs as small, brown, hexagonal prismatic crystals terminated by a bipyramid. It is optically uniaxial positive with $\omega = 1.85 \pm 0.01$ and $\epsilon = 1.93 \pm 0.01$. A spectographic analysis gave only zinc and tellurium as major constituents. The x-ray powder data do not match those of any known tellurium minerals. The strongest spacings (in angstroms) are 8.1 (very strong), 4.04 (strong), and 2.75 (strong).

Manganese-zinc tellurite or tellurate is a red to purple mineral which occurs in platy masses. Partial optical data are: biaxial positive, $2V = 60°$ (estimated, $\beta = 1.89$, and $\gamma > 2.10$. The specific gravity, determined with the Berman balance on 20 mg of material, is 5.01 ± 0.02. Since only manganese, zinc, and tellurium were reported as major constituents by spectrographic analysis, the mineral is probably a manganese-zinc tellurite or tellurate. X-ray powder data are different from those of known tellurium minerals. The strongest spacings (in angstroms) are 2.98 (very strong), 3.30 (strong), 1.62 (strong), 4.00 (strong −), 4.93 (medium strong), and 2.21 (medium strong).

Manganese tellurite or tellurate occurs as pale green to colorless platy masses and occasionally as small euhedral crystals. The crystals are plates and have an octagonal shape. The material examined has variable physical properties, and an isomorphous series is indicated. The following data are averages of values obtained from several samples. The mineral is optically biaxial positive, $2V = 15°$ (estimated), α and β are approximately 1.89, and γ is about 2.0. The specific gravity is 5.05. Spectographic analysis yielded manganese and tellurium as major constituents and zinc in lesser amount. Strongest spacings (in angstroms) are 2.03 (strong), 3.36 (strong −), and 2.61 (strong −).

Iron tellurite or tellurate (a mineral or mineraloid) is amorphous to x-rays and occurs as red-brown botryoidal coatings. Optically the material is very weakly anisotropic and has a mean index of 1.885 ± 0.005. The specific gravity is about 3.7. Only iron and tellurium were detected as major constituents by spectographic analysis.

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Evaluation of the Origins of Strontium-90 Contained in Wheat Plant

Abstract. Twenty percent of the strontium-90 in wheat flour in 1959 was due to root absorption, 30 percent was due to floral absorption from soil particles attached to the ear, and 50 percent was due to current fallout. In 1960, 35 percent was due to root absorption, 50 percent to floral absorption from soil, and 15 percent to current fallout.

For evaluation of the Sr^{90} hazard level in the future, the argument concerning radioactive contamination of wheat and other cereals by fallout has been narrowed down to the problem of how much Sr^{90} in grain depends on the