and active seasons gave equally acceptable results.

In presenting this note it is the hope of the author that other workers will find it adaptable to their needs.

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SPECIAL ARTICLES

ON THE SIMULTANEOUS DIURNAL VARIATION OF THE ELECTRIC POTENTIAL OF THE EARTH AND THE AIR

IT has been known for more than a century that there is both an annual and a diurnal variation of the electric potential gradient of the air, but there is, as yet, no consensus of opinion among physicists as to the cause of these variations or even of the potential gradient itself.

The fundamental fact is that the earth is surrounded by an electrostatic field, so that if an elongated, insulated conductor be placed vertical anywhere over the surface of the earth it will regularly be found to have a negative charge at its upper end and a positive charge at its lower end. Such a condition can be maintained in a conductor only by the induction of a charge upon some other body. That this condition is maintained in the conductor mentioned above by a negative charge upon the earth or by a positive charge above the earth was plainly shown by Erman, in 1803, and by Peltier, in 1836. Peltier devised an apparatus for determining the potential gradient over the earth which was based upon the laws of electrostatic induction. This potential gradient has come to be called the potential gradient of the atmosphere, since it is measured in the atmosphere and was originally believed to be due to positive electric charges in the atmosphere.

Both Erman and Peltier believed the inducing charge to be upon the earth, and this opinion has been held by many physicists since that time; but others have believed it to be due to positive electric charges in the air or to a positively charged conducting layer in the upper air.

That the latter assumption can not be the true explanation follows from the fact that there is no potential gradient inside a charged hollow conductor due to a charge upon this conductor. Neither can a potential gradient be induced inside a hollow conductor by a charge outside the conductor. It accordingly follows that if the earth is surrounded by a good conducting layer in the upper atmosphere, the only possible potential gradient around the earth must result from its own charge or a charge upon its lower atmosphere.

In SCIENCE of May 25, 1923, the present writer undertook to show that the yearly variation in atmospheric potential gradient is such as would be expected to result upon a negatively electrified earth under the inductive influence of a similarly electrified sun. This paper is intended to show that the same may be said of the diurnal variation.

The writer has shown in various papers[1] that the day side of the earth is regularly electropositive to the night side. It is well known that the atmospheric potential gradient is regularly greater upon the night side of the earth than upon the day side, as it would be if it were due to the induction of the earth's negative charge.

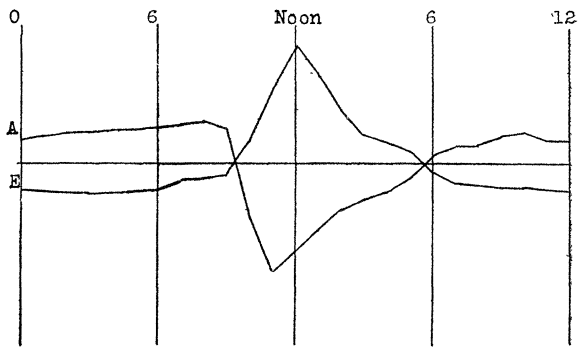

FIG. 1. Diurnal variation of earth potential and of air potential gradient for the months September, 1923–January, 1924. Curve A represents the variation of the air potential gradient and curve E the variation of earth potential.

Since last September, continuous photographic records have been kept of the diurnal changes in both the electrical potential of the earth and of the air. On February 1, the electrometer which was used for measuring the atmospheric potential gradient was moved and its sensitivity was changed, so the present report covers the time from September 1 to February 1. During that time there were occasions when the atmospheric potential gradient was greatly disturbed by storms, and otherwise, but measurable records were obtained for 87 days. All these were used in determining the mean diurnal variation for the period. During the same time 135 measurable records of the earth potential variation were obtained.

The mean values of the two diurnal variations in scale readings are shown in figure 1. Curve E represents the mean diurnal variation of the earth potential and Curve A the mean diurnal variation of the atmospheric potential gradient.

The agreement of these curves with theory is certainly very satisfactory. Since February the two electrometers used in the investigation have been

[1] See, especially, Bulletin of the Terrestrial Electric Observatory of Fernando Sanford, Palo Alto, California, Vol. 1.

placed in the same cage and their deflections are recorded upon the same sheet, and the agreement is, if possible, better than before.

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Studies of the vitamin potency of cod liver oils—X. Vitamin potency of medicinal cod liver oils: ARTHUR D. HOLMES. In order to obtain information concerning the vitamin potency of present-day medicinal cod liver oils, a number of bottles of oil were purchased on the open market. The chemical and physical characteristics of these oils were determined by the usual analytical methods. A study of their vitamin potency showed that the vitamin content of medicinal cod liver oils may vary as much as tenfold. Also, it appears that there is little, if any, relationship between the chemical and physical characteristics of cod liver oils and their vitamin potency. These results show the need of information concerning the amount of the fat-soluble vitamins present in cod liver oil to be used in vitamin therapy.

Studies of the vitamin potency of cod liver oils—XI. The vitamin potency of butter oils produced on summer feeds. ARTHUR D. HOLMES. To obtain information concerning the vitamin potency of dairy butter, a supply of milk was obtained from several cows. These cows represented a number of well-known dairy breeds, but they were of different ages, and their pasture diet had been supplemented by different commercial grain rations. For the purpose of this study, the milk fat was separated in the form of butter oil. The vitamin potency of the different butter oils was determined under uniform laboratory conditions. The results of these tests indicate that summer butter produced under favorable conditions may have a vitamin potency equal to one hundredth that of first quality cod liver oils.

Detoxication of aromatic cyanides: C. P. SHERWIN and L. R. CERECEDO. Giacosa fed benzyl cyanide to dogs and found an increase in the ethereal sulfate excretion and also a positive reaction with Millon's reagent. He claims to have isolated phenaceturic acid from the urine. We fed benzyl cyanide to dogs and found neither phenaceturic nor hippuric, but free benzoic acid in the urine. After feeding p-chlorbenzyl cyanide to dogs, we noticed no symptoms indicating marked toxicity. We found only p-chlor-benzoic but neither p-chlor-phenaceturic or hippuric acid. We are studying the effects of this compound in the metabolism of the dog.

A method for the estimation of hydrogen sulfide in food products: L. H. ALMY. Hydrogen sulfide is driven out by a current of carbon dioxide bubbling through the aqueous acidified mixture of the food product. It is absorbed in dilute zinc acetate solution, the latter solution then being treated with p-amino-dimethylaniline hydrochloride, hydrochloric acid and ferric chloride solution for the production of the methylene blue color. The amount of sulfide sulfur present is determined by comparison of the color with that of standards prepared by treatment of solutions containing known amounts of sulfide sulfur with the aforementioned test reagents. Analyses of beef, pork and fish showed that hydrogen sulfide was formed progressively during the putrefaction of these products. The method is also applicable to the examination of mineral waters, sewage, bacterial cultures, etc.

The isolation of a crystalline substance (M. P. 223° C.) from autolysed yeast with the properties of a bios: WALTER H. EDDY, RALPH W. KERR and R. R. WILLIAMS. A crystalline substance with a melting point of 223° C. will be exhibited, which by crystallographic methods has been shown to be a single substance and which when added to Fulmer's Medium F. in quantity not exceeding .005 mgs per cc of culture medium increases the volume of yeast cells in a 24-hour incubation at 31° C. by approximately 15 to 20 times that of a control on the medium alone. The method of obtaining this crystalline bios through use of differential adsorbents and pH control will be outlined.

A colorimetric method for the determination of furfural: GUY E. YOUNGBURG and GEORGE W. PUCHER.

The vitamin A content of fresh eggs: JOSEPH C. MURPHY and D. BREESE JONES. Experiments indicate that rats which have been permitted to develop xerophthalmia on a Vitamin A free basal diet can be cured of xerophthalmia, and restored to normal weight by feeding 0.75 gm of fresh whole egg daily. Smaller amounts are sufficient for curing xerophthalmia than for restoring of growth. 0.25 gm fed daily, after onset of xerophthalmia, sufficed to cure the eye condition, without, however, permitting restoration to normal weight and growth. Based on analyses previously reported, 0.75 gm and 0.25 gm of whole egg are equivalent, respectively, to about 0.25 gm and .088 gm of yolk. On the basis of dried yolk, these figures would be 0.13 and 0.41 gm. Expressed in terms of the oil content of egg yolk, about 75 mgm of egg oil would be required for growth restoration, and 25 mgm for curing xerophthalmia.

Determination of the protopectin in Irish potatoes: C. M. CONRAD. In attempting to work out a reliable method for the determination of protopectin in potatoes, the concentration of acid, the pressure and the period of heating have been systematically varied and the resulting pectin determined by the calcium pectate method of Carre and Haynes. The results show that each of these factors has a very important effect. The highest yield of calcium pectate was obtained by boiling the material at atmospheric pressure for one hour in one thirtieth to one fiftieth normal hydrochloric acid. When the other conditions were optimum, a higher pressure did not increase the amount of pectin liberated.

The equilibrium between creatine and creatinine in aqueous solution and the effects of hydrogen ion: GRAHAM EDGAR and H. E. SHIVER. The equilibrium con-