

unit length; a is a constant of proportionality; ϵ is the dielectric constant (or S.I.C.) of the liquid in which the wood is swollen.

The extent of the agreement is shown in the accompanying graph.

The above equation is in accord with W. Sementchenko's theory of absorption² if we assume that the mechanical strain energy per unit volume of swollen wood is proportional to the energy produced on absorption of molecules from the liquid by all the cellulose micelles in a unit volume of wood.

The strain energy per unit volume is $\frac{1}{2}Es^2$, where E is a mean value of Young's modulus of the birch; the absorption energy is proportional to $(\epsilon-1)$. Assuming proportionality between these two quantities, we see that the above equation at once results.

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¹ Hasselblatt, M., *Z. anorg. allg. Chem.*, **154**, 375 (1926).

² Sementchenko, W., *Z. physik. Chem.*, **129**, 176 (1927).

A Concentration and Measurement of Atmospheric Ozone

Prof. F. A. Paneth and Mr. J. L. Edgar are to be congratulated on having devised a new and ingenious chemical method of measuring both the ozone and nitrogen peroxide in the London atmosphere¹.

It is interesting to note that their measurements agree with those which I obtained as a result of five years' continuous measurements at both Plaistow and Upminster by means of an entirely different chemical method². My mean figure for the ozone in spring air was given as 1.2×10^{-6} vol. per cent, whilst that of Prof. Paneth and Mr. Edgar is given as 1.1×10^{-6} .

Prof. Paneth and Mr. Edgar's criticism that the older methods of analysis were not specific and did not distinguish between ozone and nitrogen peroxide does not apply to my own method, which was specific. I passed half the air through a tower filled with fine crystals of copper sulphate (which completely destroys the ozone but does not affect the nitrogen peroxide) and compared it with the other half containing both the ozone and the nitrogen peroxide. The ozone is obtained by difference.

There is an interesting point regarding the nitrogen peroxide in the atmosphere which my measurements of both town and country air brought out. Nitrogen peroxide is not a normal constituent of country air. Like the sulphur dioxide and ammonium chloride in town air (which I also measured), all three are the products of the combustion of coal. The percentage of all three increases in the winter. In country air near London the percentage of all three is trifling unless the direction of the wind brings them from London. The percentage of ozone is independent of the direction of the wind.

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IN the note on atmospheric ozone¹ we confined ourselves to a brief outline of our method, leaving the discussion of the great number of other chemical attempts at ozone measurements to an intended fuller publication; there, of course, due credit will be given to the very interesting paragraphs dealing with atmospheric ozone determinations in Dr. W. C. Reynolds's paper on London air².

It has frequently been assumed that the presence of ozone in air is sufficiently proved by the observation that part of its oxidizing property is quickly destroyed by contact with various reagents. Dr. Reynolds made use of this effect for a quantitative ozone evaluation by determining the oxidizing power of air before and after this treatment. Whether such a method of measurement should be called "specific" for ozone is a question of terminology, but we are sure that Dr. Reynolds will agree that it is safer to collect the ozone in a pure state, to prove its identity by its absorption spectrum, and then to titrate it in a range of concentration in which the potassium iodide method has been found to be satisfactory. For highly diluted ozone this method of titration is liable to various errors, and the simultaneous titration both of ozone and nitrogen peroxide in such dilutions would have to be investigated very thoroughly before full confidence could be placed in it.

It is not obvious from Dr. Reynolds's paper whether such preliminary work has been done, but apparently he himself does not consider the nitrogen peroxide titration with potassium iodide as very satisfactory since he employs quite a different method when this gas is to be measured. Further, if anyone intends to apply such a differential method for the ozone determination, we should not recommend copper sulphate for the destruction of the ozone content of air; according to our experiments, even in a slow current of gas this substance is likely to leave part of the ozone unaffected while manganese dioxide, which has been used for the same purpose by Usher and Rao³, or charcoal, destroys it completely.

Nevertheless, it may well be that the figures obtained by Dr. Reynolds, as well as many of the other figures published by chemists on the ozone content of air, were essentially correct; it can scarcely have been a mere coincidence that, by crude chemical methods, at least the right order was found long before any spectroscopic measurement was available. The trouble was not that these methods necessarily gave wrong results, but rather that their reliability could not be checked, and that there were not infrequently big discrepancies between results which seemed equally trustworthy. It is, in fact, our hope that a much simpler chemical method than the one described by us may be found to be sufficiently exact for meteorological purposes; but there is scarcely a better way for deciding this than by comparison with a method which, by isolating and identifying the atmospheric ozone, is free from the obvious shortcomings of the older ones.

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¹ NATURE, **142**, 112 (July 16, 1938).

² *J. Soc. Chem. Ind.*, 168T (March 28, 1930).

¹ NATURE, **142**, 112 (1938).

² Reynolds, W. C., *J. Soc. Chem. Ind.*, **49**, 168T (1930).

³ Usher, F. L., and Rao, B. S., *J. Chem. Soc.*, **111**, 799 (1917).