

LETTERS TO THE EDITOR.

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Osmotic Pressure.

THE publication of a paper by Mr. Spens in vol. lxxvii. Proc. Roy. Soc., p. 234, in which he criticises a relation between the vapour and osmotic pressures of a solution which Mr. Hartley and I had deduced (see same volume), seems to be an opportune moment for directing the attention of physical chemists to the necessity for an agreement as to what is meant by the term osmotic pressure.

Mr. Spens, following Duhem, points out that the osmotic pressure, defined as the difference between the pressure on the solvent and the pressure applied to a solution to keep it in equilibrium with the solvent, when the two are separated by a semi-permeable membrane, varies according to the pressure on the solvent. He suggests using a definite pressure on the solvent, say its vapour pressure, as the standard.

I would point out that, by accepting this definition, one is necessarily bound to compare two solutions when they are under different conditions—not only on account of the different vapour pressures of different solvents, but also on account of the different pressures on the solutions themselves.

The following consideration will, I think, make this clear, and at the same time will suggest a more scientific standard.

There seem to be two methods of examining directly the osmotic phenomena of a solution.

(1) One, which I may call the osmotic "force" method, depends essentially on the determination of the rate at which the solvent will flow through a semi-permeable membrane into an infinite mass of solution when there is no pressure on the latter.

It is evident that if one knew the frictional resistance to the flow, the heat developed, &c., one could calculate the osmotic "force" in absolute units.

I would mention, in parenthesis, that Mr. Hartley and I have made some comparative experiments in this direction with results which were not entirely unsatisfactory.

(2) All other direct methods give what may be called equilibrium pressures; they depend on the measurement of the pressure necessary to bring about a balance between the solution and the solvent. These equilibrium pressures cannot, on account of the compression of the solution, be measured under the same conditions.

An example will show this plainly. The equilibrium pressure between a solution of 540 grams of cane-sugar in the litre of solution and the solvent (water) under atmospheric pressure is, in round numbers, 70 atmospheres. The equilibrium pressure for 750 grams in the litre is 134 atmospheres. In the actual measurements each solution had been compressed, in one case by 71 atmospheres and in the other by 135 atmospheres. The conditions were therefore not comparable.

If we could measure the osmotic "force" of these two solutions as in (1) then comparable results would be obtained, for in both cases the solution and the solvent would be under the same pressure (gravitational).

Up to the present, so far as I am aware, no serious attempts to measure the osmotic "force" have been made, but I would suggest that, pending these, the relation between the vapour and osmotic pressures of a solution as deduced by Mr. Hartley and myself may be useful for the purpose of comparing the osmotic pressures of different solutions.

This relation gives the osmotic pressure of a solution when it is under no pressure but its own vapour pressure. A knowledge of the vapour pressure, together with the density of the solvent, is all that is required for calculating

that pressure; while to apply the standard that Mr. Spens proposes, it is necessary to determine the increment in volume of the solution when unit mass of solvent enters it, and in some cases it may be necessary to obtain the coefficient of compression of the solution.

The experimental work saved by the adoption of the standard here proposed is apparent when it is remembered that, owing to the want of suitable semi-permeable membranes, the measurement of equilibrium pressures is confined to but a few substances dissolved in water.

Foxcombe, near Oxford.

BERKELEY.

The Eruption of Vesuvius.

YESTERDAY I ascended the cone of Vesuvius up to the crater, being, I suppose, one of the first climbers after the eruption. The ascent was made from Torre Annunziata without any difficulties, but care had to be taken to avoid the courses of the avalanches of stones and ashes rushing from the cone and spreading over the slopes more than half a mile from the foot of the cone.

I estimated the new crater to have a diameter of about 3000 feet; the bottom was not visible, but the walls could be seen to a depth of about 1000 feet. The inner walls are nearly perpendicular, partly overhanging, and I saw pieces of the very narrow crater edge breaking down, in this way still enlarging the crater. The very regular stratified construction of the crater walls was visible. The height of the crater edge is very different from what it was before the eruption, being greatest on the west side, and diminishing in irregular steps to the north and east. At the point to which I ascended the aneroid showed an elevation of 3760 feet. From this point, which was on the southern side, the Somma was clearly visible over the lower northern edge of the crater. This shape of the crater may account for the fact that the showers of lapilli and other fragmentary products which destroyed the villages of Ottajano and San Giuseppe were given a direction to the north and east over the Somma.

The crater now closely corresponds to the descriptions of the great crater formed in 1822, and described by Forbes and Scrope. From the throat of the crater I heard a constant roaring, and saw that white clouds of vapour filled the huge hollow, but I did not see any ejections of stones or dust.

On descending I visited the points where the lava streams started from the foot of the cone. The first lava reached the surface on the morning of April 4 a little west of the Casa Firenze, but it soon stopped. Another stream started from Casa Firenze, destroying the buildings, and flowed half the way toward Bosco-Trecase. The lava which damaged a part of Bosco-Trecase started on April 6 a little lower on the slope, and divided into two parallel branches. The quantity of lava during this eruption was on the whole comparatively small. No lava came from the crater. The general characteristics of the eruption are the immense amount of volcanic ash, lapilli, and other fragmentary material ejected, and this makes the eruption of April, 1906, very similar to that of the year 79 A.D.

Visiting the destroyed village Ottajano on April 19, I made the following curious observation. A great number of the window glasses are broken, but among the others there are many regularly penetrated or pierced by circular holes one or two inches in size. These holes are as common on the northern and eastern sides of the houses as on the other sides, and they can therefore not have been caused by the showers of lapilli, which only came from the south-west. Some people ascribed these holes to the very heavy lightning which accompanied the fall of the lapilli, but I am not aware that electrical discharges may produce such effects.

It may be of interest to note that when visiting the volcanic vents of the Phlegraean Plain to investigate if any kind of volcanic activity was shown in connection with the eruption of Vesuvius I heard that the emanation of steam from the Solfatara diminished greatly during the days of the strongest eruption of Vesuvius: normal conditions set in later.

Hj. SJÖGREN.

Naples, April 23.