

# **THE DECOMPOSITION OF THE FIXED ALKALIES AND ALKALINE EARTHS**

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The Decomposition of the Fixed Alkalies and Alkaline Earths by Humphry Davy

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**HUMPHRY DAVY**

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OF THE FIXED ALKALIES  
AND ALKALINE EARTHS**



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THE DECOMPOSITION OF THE FIXED  
ALKALIES AND ALKALINE  
EARTHS

BY  
HUMPHRY DAVY  
(1807-1869)

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## PREFACE.



THE present reprint contains the Bakerian Lecture delivered by Davy before the Royal Society in 1807, and also part of a paper communicated by him to the same Society in the following year.

The former is the first published record of the experiments by which Davy proved the compound nature of the alkalies, and prepared the metals potassium and sodium. Fuller details as to the properties and reactions of the metals were given in subsequent papers.

The second paper above mentioned is, for the most part, a description of similar experiments carried out upon the earths and alkaline earths. At first Davy had some difficulty in getting satisfactory results with these, but ultimately he succeeded in preparing moderate quantities of amalgams of the alkaline-earth metals and of magnesium. Only that section of the paper which describes these successful experiments is now reprinted.

H. M.

THE BAKERIAN LECTURE, ON SOME  
NEW PHENOMENA OF CHEMICAL  
CHANGES PRODUCED BY ELECTRI-  
CITY, PARTICULARLY THE DECOM-  
POSITION OF THE FIXED ALKALIES,  
AND THE EXHIBITION OF THE  
NEW SUBSTANCES WHICH CONSTI-  
TUTE THEIR BASES; AND ON THE  
GENERAL NATURE OF ALKALINE  
BODIES.\*

*Read Nov. 19, 1807.*



*I. Introduction.*

I N the Bakerian Lecture which I had the honour of presenting to the Royal Society last year, I described a number of decompositions and chemical changes produced in substances of known composition by electricity, and I ventured to conclude from the general principles on which the phenomena were capable of being explained, that the new methods of investigation promised to lead to a more intimate knowledge than had hitherto been obtained, concerning the true elements of bodies.

This conjecture, then sanctioned only by strong analogies, I am now happy to be able to support by some conclusive facts. In the course of a laborious experimental application of the powers of electro-chemical analysis, to bodies which have appeared simple when

\* [From "Philosophical Transactions" for 1808, vol. 98, pp. 1-44.]

examined by common chemical agents, or which at least have never been decomposed, it has been my good fortune to obtain new and singular results.

Such of the series of experiments as are in a tolerably mature state, and capable of being arranged in a connected order, I shall detail in the following sections, particularly those which demonstrate the decomposition and composition of the fixed alkalis, and the production of the new and extraordinary bodies which constitute their bases.

In speaking of novel methods of investigation, I shall not fear to be minute. When the common means of chemical research have been employed, I shall mention only results. A historical detail of the progress of the investigation, of all the difficulties that occurred, and of the manner in which they were overcome, and of all the manipulations employed, would far exceed the limits assigned to this Lecture. It is proper to state, however, that when general facts are mentioned, they are such only as have been deduced from processes carefully performed and often repeated.

## II. *On the Methods used for the Decomposition of the fixed Alkalies.*

The researches I had made on the decomposition of acids, and of alkaline and earthy neutral compounds, proved that the powers of electrical decomposition were proportional to the strength of the opposite electricities in the circuit, and to the conducting power and degree of concentration of the materials employed.

In the first attempts, that I made on the decomposition of the fixed alkalis, I acted upon aqueous solutions of potash and soda, saturated at common temperatures, by the highest electrical power I could command, and which



was produced by a combination of VOLTAIC batteries belonging to the Royal Institution, containing 24 plates of copper and zinc of 12 inches square, 100 plates of 6 inches, and 150 of 4 inches square, charged with solutions of alum and nitrous acid; but in these cases, though there was a high intensity of action, the water of the solutions alone was affected, and hydrogen and oxygen disengaged with the production of much heat and violent effervescence.

The presence of water appearing thus to prevent any decomposition, I used potash in igneous fusion. By means of a stream of oxygen gas from a gasometer applied to the flame of a spirit lamp, which was thrown on a platina spoon containing potash, this alkali was kept for some minutes in a strong red heat, and in a state of perfect fluidity. The spoon was preserved in communication with the positive side of the battery of the power of 100 of 6 inches, highly charged; and the connection from the negative side was made by a platina wire.

By this arrangement some brilliant phenomena were produced. The potash appeared a conductor in a high degree, and as long as the communication was preserved, a most intense light was exhibited at the negative wire, and a column of flame, which seemed to be owing to the development of combustible matter, arose from the point of contact.

When the order was changed, so that the platina spoon was made negative, a vivid and constant light appeared at the opposite point: there was no effect of inflammation round it; but aeriform globules, which inflamed in the atmosphere, rose through the potash.

The platina, as might have been expected, was considerably acted upon; and in the cases when it had been negative, in the highest degree.

The alkali was apparently dry in this experiment; and it

seemed probable that the inflammable matter arose from its decomposition. The residual potash was unaltered; it contained indeed a number of dark grey metallic particles, but these proved to be derived from the platina.

I tried several experiments on the electrization of potash rendered fluid by heat, with the hopes of being able to collect the combustible matter, but without success; and I only attained my object, by employing electricity as the common agent for fusion and decomposition.

Though potash, perfectly dried by ignition, is a non-conductor, yet it is rendered a conductor, by a very slight addition of moisture, which does not perceptibly destroy its aggregation; and in this state it readily fuses and decomposes by strong electrical powers.

A small piece of pure potash, which had been exposed for a few seconds to the atmosphere, so as to give conducting power to the surface, was placed upon an insulated disc of platina, connected with the negative side of the battery of the power of 250 of 6 and 4, in a state of intense activity; and a platina wire, communicating with the positive side, was brought in contact with the upper surface of the alkali. The whole apparatus was in the open atmosphere.

Under these circumstances a vivid action was soon observed to take place. The potash began to fuse at both its points of electrization. There was a violent effervescence at the upper surface; at the lower, or negative surface, there was no liberation of elastic fluid; but small globules having a high metallic lustre, and being precisely similar in visible characters to quicksilver, appeared, some of which burnt with explosion and bright flame, as soon as they were formed, and others remained, and were merely tarnished, and finally covered by a white film which formed on their surfaces.

These globules, numerous experiments soon shewed to be the substance I was in search of, and a peculiar inflammable principle the basis of potash. I found that the platina was in no way connected with the result, except as the medium for exhibiting the electrical powers of decomposition; and a substance of the same kind was produced when pieces of copper, silver, gold, plumbago, or even charcoal were employed for completing the circuit.

The phenomenon was independent of the presence of air; I found that it took place when the alkali was in the vacuum of an exhausted receiver.

The substance was likewise produced from potash fused by means of a lamp, in glass tubes confined by mercury, and furnished with hermetically inserted platina wires by which the electrical action was transmitted. But this operation could not be carried on for any considerable time; the glass was rapidly dissolved by the action of the alkali, and this substance soon penetrated through the body of the tube.

Soda, when acted upon in the same manner as potash, exhibited an analogous result; but the decomposition demanded greater intensity of action in the batteries, or the alkali was required to be in much thinner and smaller pieces. With the battery of 100 of 6 inches in full activity I obtained good results from pieces of potash weighing from 40 to 70 grains, and of a thickness which made the distance of the electrified metallic surfaces nearly a quarter of an inch; but with a similar power it was impossible to produce the effects of decomposition on pieces of soda of more than 15 or 20 grains in weight, and that only when the distance between the wires was about  $\frac{3}{8}$  or  $\frac{1}{16}$  of an inch.

The substance produced from potash remained fluid at the temperature of the atmosphere at the time of its pro-