

The reversal of 'irreversible' hydrosols aggregated by traces of 'protective' colloids : (preliminary communication) / by G. Stanley Walpole.

Contributors

Walpole, George Stanley.
Royal College of Surgeons of England

Publication/Creation

[London] : [publisher not identified], 1913.

Persistent URL

<https://wellcomecollection.org/works/m8tt6uka>

Provider

Royal College of Surgeons

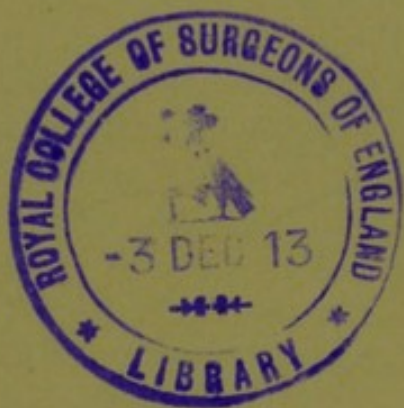
License and attribution

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. Conditions of use: it is possible this item is protected by copyright and/or related rights. You are free to use this item in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s).

**wellcome
collection**

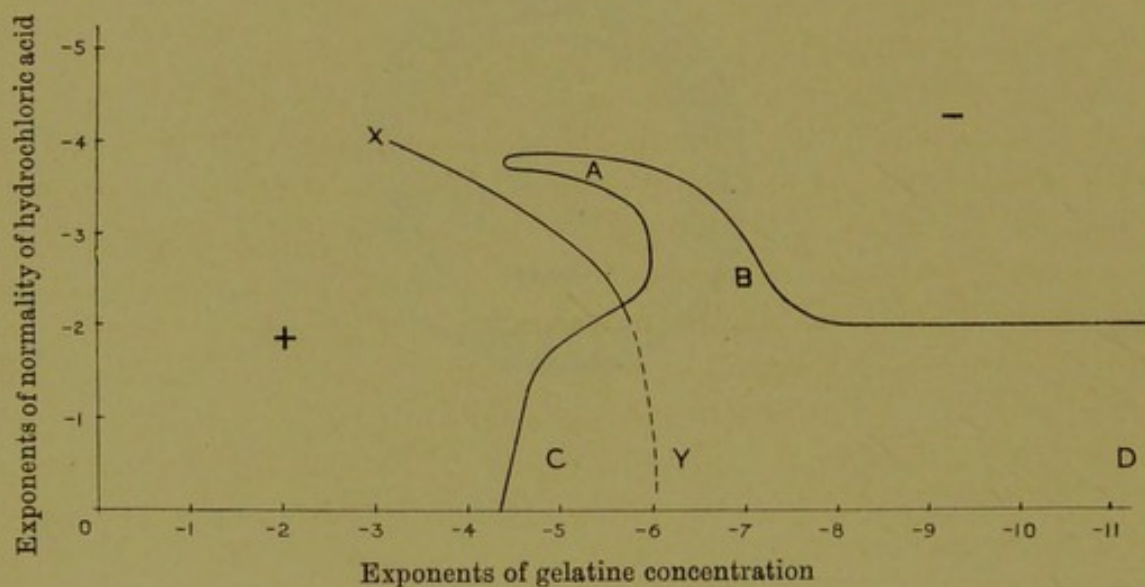
Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

11



The reversal of "irreversible" hydrosols aggregated by traces of "protective" colloids. By G. STANLEY WALPOLE. (Preliminary communication.)

The observation that an irreversible hydrosol of gold, mastic or oil could be aggregated immediately by a minute trace of albumen, globulin, or gelatine in the presence of hydrochloric acid insufficient in amount to aggregate the sol alone, even after many hours, has led to a further investigation of the phenomenon. The following diagram represents as a typical case the relationship between the concentrations of gelatine and of hydrochloric acid, and the state of aggregation of the particles of a particular oil sol two hours after mixing equal volumes of all three.



The negative exponents of the normality of the hydrochloric acid and of the concentration of the gelatine are plotted as ordinates and abscissæ respectively. The area *ABCD* includes all points where aggregation of the oil particles takes place.

It will be seen at once from the diagram that

(1) With pure water all strengths of acid up to 10^{-2} N fail to produce a change. (The actual normality of the acid in the mixture is $10^{-2.48}$ N since equal volumes of the three constituents are taken. $\log 3 = .477$.)

(2) If now 1 in 100,000,000 gelatine be used instead of pure water, aggregation is observed with less acid than is required to produce aggregation using pure water.

(3) Increasing the quantity of gelatine from $10^{-8.0}$ to $10^{-4.4}$ involves a corresponding decrease in the amount of acid necessary to produce a change of the state of the sol. Beyond this strength of gelatine no amount of acid from infinite dilution to normal can induce aggregation.

(4) With gelatine solutions of concentration $10^{-6.0}$ to $10^{-4.4}$ a new phenomenon is observed. An intermediate zone is established where with some acid concentrations above that required to bring about aggregation no such change occurs. In this case where the acid concentration is more than $10^{-2.0}$ N the phenomenon is the ordinary one of "protection." At the limiting point where aggregation occurs with the maximum possible quantity of gelatine ($10^{-4.4}$) the conditions are sharply defined. Acid of concentration $10^{-3.8}$ N produces complete aggregation rapidly; concentrations $10^{-3.7}$ N and $10^{-3.9}$ N of acid have no visible effect.

It was anticipated that aggregations due to a "protective colloid" acting in this way would be reversible—those in the region *B* by the action of alkali only, and those in the region *A* by either alkali or acid. The alkaline reversal is readily obtained. The addition of a trace of alkali to an "irreversible" hydrosol aggregated in this manner brings about disaggregation at once. A blue gold sol, for example, turns red again, while a flocculated mastic suspension disperses. The acid reversal has not yet been realised.

Microscopic and ultra-microscopic investigation of various aggregations demonstrated that those in region *A* are of a different nature to those in region *D*. Examination of oil sols showed that in the former case the particles consisted of agglomerations of numbers of the original minute particles, while in the latter they were drops of oil.

There is no change of sign of the electric charge of the disperse phase involved in aggregations brought about by traces of gelatine, globulin, etc. In the diagram a line *XY* has been drawn dividing it into two parts, one embracing all points where the charge on the particle is $-$, as it is in the original sol; the other taking in all points where the sign of the charge on the particle is reversed.

In other experiments where NaCl, CaCl₂ and La(NO₃)₃ were used instead of HCl similar results were obtained. The Na⁺, Ca⁺⁺, La⁺⁺⁺ ions resemble the H⁺ ions in that a trace of gelatine accompanying them may accelerate aggregation enormously.

