

# THE PROTECTIVE ACTION OF SOAPS ON ARSENIOSULPHIDE SOLS

BY B. PAPA-CONSTANTINOU

In another paper<sup>1</sup> an account has been given of the protective action of a number of soaps on gold sols. It is desirable to ascertain how far the order of the protective action of the different soaps depends on the nature of the suspensoid. In the present paper the results are given for the protective action of some soaps on arsenious sulphide sols.

Zsigmondy has suggested the use of the gold number to characterise colloids of biological importance, like gelatine, peptones, etc. The sensitiveness of the coagulation of suspensoids to the protective action of traces of these colloids affords a promising method of detecting minute traces of these substances. It is also of interest in this connection to determine the protective action of such colloids on different suspensoids. The opinion has been expressed that the system suspensoid-protective colloid shows more the properties of the latter than those of the suspensoid. It will be seen from the sequel that the order of the protective action of the various soaps is not identical for the two sols, arsenious sulphide and gold. At the same time, certain regularities are noticeable. Thus, it is not possible to characterise one soap as having more or less protecting power than another, as the protective action depends on the nature of the suspensoid, and even for the same suspensoid the protective action depends on the temperature.

## Experimental

The minimum amount of a soap necessary to prevent a perceptible change, in the arsenious sulphide sol by a N/6 solution of sodium chloride in 15 minutes, was taken as the measure of its protective action. 5 cc of arsenious sulphide sol were put in each of six dry test-tubes. The test-tubes were carefully cleansed with hot chromic acid and conductivity water. Measured volumes of a solution of the soap (containing 0.1 to 0.2 gr. of soap in 100 cc of water) regularly varying from one tube to another over a range of 0.5 cc to 3.0cc were added to these six test tubes. The volume of the mixture of sol and soap was then made up to 10 cc by the addition of the requisite amount of pure water. In each of another series of six test-tubes were put 5 cc of a N/3 solution of sodium chloride. The electrolyte was then added to the mixture of the sol and the protective colloid and the contents of the test-tubes thoroughly mixed by shaking.

The series of six tubes containing the same amount of suspensoid and electrolyte, but varying amounts of the protective colloid (in a given volume), were then compared after 15 minutes with a blank containing 5 cc of the sol

<sup>1</sup> J. Phys. Chem. **29**, 319 (1925).

diluted to 15 cc with pure water. The minimum amount of soap which just sufficed to stop any perceptible change in the sol was determined in this manner. Each experiment was repeated three times and the results were concordant. Arsenious sulphide sols change in properties with time. This change is more rapid during the first few days after they have been prepared. When a certain amount of time has passed, the sol changes more slowly; sols which were about a month old were used. The comparison of the protective action of the different soaps was made on the same sol. Three different preparations of arsenious sulphide sol have been tried and the order of the protective action has been found to be the same. In the following table the minimum amounts in milligrams of the different soaps necessary for protection against perceptible change in 15 minutes are given.

<i>At Room Temperature</i>	
Sodium Linoleate	2.1
Potassium Linoleate	2.5 to 2.6 (3.2-3.4)
Sodium Oleate	2.2 to 2.3
Potassium Oleate	2.4 to 2.5 (2.8-3.0)
Sodium Myristate	2.0
Potassium Laurate	2.7 (4.2-4.4)
<i>At 50°</i>	
Na- and K-Laurates	2.5
Sodium Oleate	2.0
Potassium Oleate	2.1
Sodium Stearate	1.3 to 1.4
Potassium Stearate	1.6 to 1.7
Sodium Myristate	1.3 to 1.4
Potassium Myristate	1.8 to 1.9
Sodium Palmitate	1.4 to 1.5
Potassium Palmitate	1.6 to 1.7
Sodium Linoleate	4.8 to 5.0
Potassium Linoleate	4.2

(Note: In the brackets are given for comparison the results obtained with another arsenious sulphide sol).

### Discussion of the Results

A comparison of the values given in the above tables with those observed with gold sols shows that the order of the protective action of the soaps is dependent on the nature of the suspensoid and on the temperature. The protective power of the other soaps, excepting laurates and linoleates, is nearly the same, although there is a slight but perceptible difference between them. The following similarities are, however, observed with both suspensoids:—

- 1) The effect of temperature is to increase the protective action.
- 2) Linoleates form an exception and with both sols show a decrease in protective action.

3) Laurates have a decidedly lower protective power, though the difference is more pronounced with gold sols than with arsenious sulphide sols.

Zsigmondy noticed that two colloids of the same family have roughly speaking gold numbers of the same order of magnitude. In the case of myristates, palmitates and stearates the difference in the protective action is light.

With arsenious sulphide sols the protective effect of the different soaps varies within narrower limits than is the case with gold sols. It is important in this connection to draw attention to the great protecting action of minute traces of alkali on arsenious sulphide sols.<sup>1</sup> Arsenious sulphide dissolves in alkali to form arsenites and thioarsenites. In the case of soaps, McBain and his co-workers have shown that the concentration of the free hydroxyl ions is very small and it may be assumed that this disturbing effect is not of any great importance. This assumption is justified by the fact that the sols do not show any perceptible clearing up on addition of the soap, an effect which can be easily perceived even when the amount of colloid dissolved is small. The protective effect of slight traces of alkali is, however, very great and the narrow limits of variation of the protecting power on arsenious sulphide suggest that the protecting action of the soap may be partly due to the small amount of alkali.

Such an effect would mask the actual difference in the protecting powers of the colloidal micelles of the different soaps.

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*The William Ramsay Laboratories of Physical and Inorganic Chemistry,  
University College, London.*

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<sup>1</sup> Mukherjee and Sen: J. Chem. Soc. 115, 461 (1919).