

in concentration; so that one would expect the distribution to be very one sided, and measurable only under special conditions. These considerations suggest that instances of the distribution of colloids between two solvents are most apt to be discovered by working with colloids of marked diffusibility, and with "immiscible solvents" of almost identical composition—such as the 'critical solutions' in two component systems (phenol, water) or the two phases at the plait point of the binodal curve in three component systems (water, chloroform, alcohol, etc.).

The experiments of Winkelblech on colloids and immiscible solvents made the probability of realizing the ideas set out in the preceding paragraph seem somewhat remote. In a paper published in 1906<sup>1</sup> that author describes "a hitherto unknown reaction for dissolved colloids" which consists in shaking the colloidal solution with petroleum, benzene, chloroform, carbon disulphide, or other immiscible solvent, whereupon the colloidal coagulates and collects in the emulsion which is formed at the surface of separation of the two solvents. This reaction leads to a delicate method for the quantitative determination of gelatine, and succeeds also with gluten, albumen, tannic acid, soluble starch, soap, wine, beer, water-glass, alkaline solutions of colophonium and of sulphur, and solutions of silicic acid in ammonia.

This reaction, if general, would make the experimental study of equilibrium in heterogeneous systems involving colloidal solutions difficult if not impossible. Winkelblech himself, however, has discussed an exception: shaking gelatine solutions with ether does not produce coagulation and it seemed possible that among the colloidal suspensions (none of which were studied by Winkelblech) others might be found.

#### **Silver, water, isobutyl or amyl alcohol**

Our first experiments were tried with colloidal metals prepared by the methods of Bredig<sup>2</sup> and of Svedberg.<sup>3</sup> Silver

<sup>1</sup> *Angew. Chem.*, **19**, 1953 (1908).

<sup>2</sup> *Phys. Chem.*, **32**, 127 (1902).

<sup>3</sup> *Chem. Ges.*, **38**, 3616 (1905).