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METHOD OR APPARATUS

RESULTS AND CRITICISM (OVER) STANFORD RESEARCH INDEX CARD

A form for use in the making of abstracts of scientific literature.

importance. The makeup of the article as a presentation of scientific material is indicated by way of number of tables, figures, size of bibliography and any special features. It may be one specific part of the article or problem that is of interest, in which case this may be stated. Possibly the abstractor can word the problem more accurately than the title of the paper gives it. The data are not always collected by the author of the paper; hence the short line provided for a note here. The card is so arranged that "material" or "method" may expand into more space if necessary. The back is for the statement of results, criticisms or whatever is pertinent.

A space for everything, but no need to fill in every space! Gaps in such a case are worth while; they provide room to add something later; the having of space for certain notes makes for more careful analysis of the materials under review. Different things will be filled in at different times. First the author and journal may be discovered probably in some topical bibliography. Later, perhaps, the exact title, and the page and volume items will be checked when the periodical is actually consulted. Gradually there is produced a rather complete working abstract, accurate in details concerning the article, with not too much trusted to memory. Uniform arrangement makes for ready reference when using the cards on lectures or otherwise. On printed forms abstracts are more understandable to a second party.

The card described may aid librarians who have charge of scientific collections as well as assist the student or research worker in making "enough of a note" as to save repeats in looking up references. It will promote the making of more exact and practically useful abstracts and perhaps may thus reduce a little the scientific literature burden.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

ABSOLUTE MEASUREMENT OF AVERAGE SIZE OF DROPLETS OF THE DISPERSE PHASE OF AN EMULSION

IT was desired to find a method for measuring in absolute units the average size of droplets of the disperse phase in a permanent emulsion of the oil-in-water type. It was found that if a single drop of an emulsion of this sort is deposited on the surface of clean water in such a way as not to break the surface film, it will spread on the water like an oil. The spreading takes place with extreme rapidity and may be considered as being almost a two-dimensional explosion.

The mechanism of the spreading is not yet entirely clear, but if the concentration of the emulsion is suf-

ficiently high, none of the oil phase goes below the surface. Assuming that the layer on the surface is one particle deep and that the droplets are small enough in diameter to hold their shape, the average diameter of the particles can be measured by the same method as used by Langmuir[1] for measuring the cross-section of oil molecules. By this method, measurements of the same emulsion at two different concentrations are consistent with each other and with measurements made with varying quantities of emulsion.

Measurements are made as follows: An enameled iron tray about eight inches wide, thirty inches long and two inches deep is filled about half full of water. A piece of parafined Al foil is floated on the surface at one end of the tray and attached to a balance exactly as in the Langmuir apparatus. The rest of the water surface is then swept free of monomolecular layers of grease, oil, etc., and a drop or two of the emulsion is caused to spread on this clean surface. Voids are eliminated by pushing the film up against the Al foil by means of a paper sweeper, and the area of the film is determined exactly as in Langmuir's experiments with oil films.

The calculation of particle size requires a knowledge of the total volume of the droplets of the disperse phase *as they exist in the emulsion.* Although, in our experiments to date, this volume is the same as that of the same mass of undispersed material, it would be premature to say that this must always be the case. This volume may be obtained by curdling a known volume of emulsion with a known volume of a solution of a suitable electrolyte, removing any included water from the curd and adding it to the rest of the water-phase. The total volume of the water-phase is then measured and the volume of the disperse phase is found by difference. This gives at once the concentration C of the emulsion. Then the average diameter of the droplets of the disperse phase in the emulsion is

$$d = \frac{CV}{A}$$

where V is the volume of the emulsion which was spread on the water and A is the area which is covered.

This method was developed at the Research Laboratory of the General Electric Company. It is a pleasure to express my thanks for their permission to publish it.

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[1] Proc. Nat. Acad. Sci. *3*, 251, 1917.

A SURFACE TENSIOMETER AND AN OSMOMETER FOR CLASS WORK

APROPOS of articles in recent numbers of SCIENCE (June 11 and July 2) on the ring method of measuring surface tension and, in the latter article, on the application to this purpose of a chainomatic balance, it may be of interest to add a note descriptive of a piece of apparatus, based on the principles of the above, which we devised over a year ago and which was successfully used by our class in general physiology during the past session. Our problem was to contrive something so cheap and simple that a class of well over a hundred students doing individual work might each be supplied with an outfit. The diagram will explain the general features. The balance lever is a thin strip of bamboo of which more than a sufficient number for the whole series was obtained from a small Japanese mat. Strips of aluminum clipped on to each end and to the center of the bar were punched to a standard pattern. A piece of platinum wire bent to form a circular loop of known circumference is suspended from one arm and from the other a white metal chain of suitable length and known weight per linear unit, terminated by a piece of thread as illustrated. The wooden support is graduated behind the chain and, for the rest, a few pins serve to suspend and confine the balance arm. The dish containing the liquid to be tested is most simply held in the hand but may be supported at the proper level for greater accuracy.

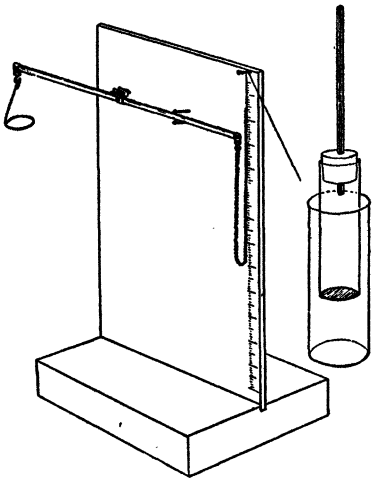

FIG. 1

With a little care individual readings of the surface tension of water do not vary more than $\pm$ .3 to .4 per cent. ($= \pm$ .5 mm on the actual scale).

As illustrating the type of results obtained in class we include a curve taken from a student's notes. Among other relations set for investigation we may mention those of surface tension to the time factor