Some Thoughts on a Recent Definition of the Word "Detergent"

Sir: Bourne and Jennings (1) proposed a new definition of the word "detergent" based on the concept of work requirement for cleaning process after considering the various existing definitions of "detergent" and finding them apparently inconsistent and therefore, unsatisfactory. Their definition and explanation are reproduced below:

Definition: "A detergent is any substance that, either alone or in a mixture, reduces the work requirement of a cleaning process."

Explanation: "The definition is consistent with the meaning of the word "detergency." It does not specify any special chemical group of compounds. It includes soap. It includes the surface-active compounds that have some power of detergency, and excludes those that do not. It includes substances (such as sodium hydroxide) that have a strong power of detergency but are not surface-active; substances (such as the polyphosphates) that may have a synergistic effect; and substances (such as sodium carboxymethyl cellulose) that restrict redeposition of removed soil. It is broad enough to include detergents that are used in nonaqueous systems. It includes solvents and also cleaners that function by chemical degradation (such as strong acids), since these reduce the work requirement to zero. It does not include abrasives, which do not reduce work requirement but merely increase efficiency with which the work is applied to the soil."

The definition of "detergent" given by Bourne and Jennings appears to be simple and comprehensive. It affords yet another tool, as that of Kubelka-Munk equation, for a quantitative evaluation of performance of different detergents for comparison.

It is also interesting as it involves some semantics when, for example, they state that their definition is consistent with the meaning of the word "detergency." According to them, while the meaning of the word "detergency" is clear, that of "detergent" is not. That is, we are supposed to be clear in our meaning or concept of the abstraction of the noun "detergent" or its function but experiencing difficulty in choosing the concrete form of the abstraction.

The definition is too broad and delegates power of detergency to substances which might not strictly possess such power. The confusion sought to be removed by the definition still remains in another form. If, earlier, the meaning of "detergency" was clear and that of "detergent" was not, as assumed by them, now, the meaning of "detergent" may be clear but that of "detergency" is not because detergency might be the result of any substance according to their definition. The new definition makes mechanistic what might be a physicochemical phenomenon. Reactions or operations might require work and therefore one does not define them in terms of work. Otherwise, one will have to define a knife as a substance, that either alone or with any other substance reduces the work requirement of the cutting process. It could, therefore, be argued that it would be desirable not to base a definition on work requirement since the latter is invariably behind any process. For, if it is to be interpreted that it is work that cleans, and detergents reduce the work involved in cleaning, work by itself should be capable of removing soil from a substrate (soiled cloth, for example). It would be interesting to have a practical example in which soil removal from a substrate is effected by application of work alone. Removing dust and dirt from a carpet by beating it with a stick is such an example. Another negative instance is that no amount of work can remove adhering soot from a fabric. It might be argued that the process of cleaning, when work is not reduced by detergent, is infinitesimally slow and that it is the presence of detergent that would make the rate of process perceptible. This is giving the role of catalyst to a detergent. This would mean that if it takes an infinite amount of work to clean, a detergent would reduce the work of cleaning to an infinitesimally small amount. That is, the detergent has accomplished cleaning. If cleaning can be done even when the work requirement is zero (see their explanation in the quoted passage), it might follow that detergent has accomplished cleaning process in which other physicochemical factors might actually be involved.

The reduction of work itself might be due to the physicochemical action of the detergent. Thus the observed work x might be reduced by the detergent to x-1, x-2, x-3 . . . . x-x. In the latter case, it is the physicochemical action that is all in evidence as the work involved is zero.

Abrasives are stated not to reduce work requirement but merely increase efficiency with which the work is applied to the soil. On the other hand, it may be that abrasives do not only fail to reduce the work requirement, but that they might increase the work requirement, by their very nature, generating frictional forces. If in the presence of abrasives, work requirement is neither reduced nor increased but remains the same, then the work applied might be partly used up to overcome frictional forces due to abrasives and partly utilized in the cleaning process. It also strikes one that abrasives could reduce the work requirement as, for example, using emery paper to remove soil (cleaning process) from the surface of wood by the rubbing method since in the absence of emery paper, soil removal would involve a considerable work requirement. Further, one would not be clear about the exact difference between the work-reducing requirement of a process and increase of efficiency.

Taking the definition of "detergency" as meaning cleaning or removal of soil (or dirt or foreign matter) from a substrate by a liquid medium as given in the opening sentence of their article, will it not be enough if "detergent" is defined as a substance whose function is detergency, the process of removal of soil from a substrate by a liquid medium?

R. K. Viswanadham and S. D. Thirumala Rao,
Oil Technological Research Institute,
Anantapur, India

REFERENCE

1. Bourne, M. C., and W. G. Jennings, JAOCS *40*, 212 (1963).

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