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September 24, 1941

Dr. Melvin Calvin
Department of Chemistry
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My dear Dr. Calvin:

Referring to Dr. Gilliland's letter to you of September 13, I feel it very desirable to call your attention to what we feel is the real problem connected with this compound.

It is true that, if the compound is properly prepared, it apparently desorbs rapidly and completely, and the absorption and desorption are reversible, in the sense that the operation can be repeated indefinitely without deterioration. However, our work certainly indicates that the compound possesses one disadvantage which, from a practical point of view, seems extremely serious; namely, its rate of absorption is extraordinarily slow, particularly from air when one is anywhere near equilibrium. It is true that absorption rate increases at low temperature, but low temperature is a condition difficult to guarantee under the limitations of use. It is also true that absorption rate can be increased by increasing the pressure. The practicability of this is not out of the question, but it is certainly a disadvantage. Furthermore, the action is slow even under pressure. It seems to me extremely important to try to overcome this disadvantage.

Does your work offer promise of solving this phase of the problem? Should effort not be focused in this direction? Unless you are reasonably sure that this problem can be solved in the case of this compound, is it not desirable to attempt to synthesize other compounds of the same general type in the hope that one can be found with more promising properties? The advantages of this sort of a compound are extraordinarily great, provided

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Dr. Melvin Calvin

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these limitations can be overcome. They are so great that a large expenditure of time and effort are justifiable in trying to overcome them. However, if they cannot be overcome, I doubt if the use of such a compound can compete with other methods of solving the general problem.

Don't you think it might be well to get a number of laboratories working on the problem of synthesis? It seems to me that a careful study of the mechanism of the absorption might throw real light on the factors which are giving trouble. Once those factors are understood, the synthesis of highly desirable compounds might well become relatively easy.

We are now starting to build a unit for pressure absorption. We are doing this because we feel that even with the present limitations of the compound, it may turn out to be competitive despite the disadvantages of having to compress. It is my understanding that arrangements are being made for you to furnish active material for this work. We are going to push the work just as strenuously as possible, but it will be a great help if you will give us your recommendations as to the best pressure to employ for absorption (assuming normal temperatures) and your estimate of the absorption rates and absorption capacities which we can safely anticipate.

In this connection, let me remind you that if we try to hold a high partial pressure of gas being absorbed by discarding the gas while it still contains a considerable percentage of the desired constituent, we are suffering under the handicap of having to compress an excessive quantity of the original gas and to furnish the corresponding compression equipment. If, on the other hand, we try to avoid this difficulty by reasonably complete absorption, our cleanup must occur at very low partial pressures at presumably correspondingly low rates.

If we could operate at ambient pressures, we could hold the partial pressure at practically the initial value without difficulty. The advantage would be very great, so great that I feel that effort to overcome the disadvantages of this compound is extraordinarily important.

Most sincerely yours,

Warren K. Lewis

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