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TEST PROGRESS REPORT

ON

STUDIES OF KAYLO

TO

OWENS-ILLINOIS GLASS COMPANY

C-57231

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October 9, 1947

Arthur D. Little, Inc.

CHEMISTS • ENGINEERS



CAMBRIDGE, MASSACHUSETTS

HLX/1000

October 9, 1947

Owens-Illinois Glass Company
Toledo, Ohio

Attention: Mr. U. E. Bowes

Gentlemen:

C-57334

We transmit herewith our Tenth Progress Report
on Studies of Kaylo. This report concludes our studies
on the possibility of replacing part or all of the asbestos
by paper pulp or other vegetable fiber.

In the previously reported phase of this study,
it was found that kraft paper in conjunction with Dixie
clay could be utilized for preparing Kaylo of sufficient
strength to compare satisfactorily with the present stan-
dard formulation using 4X28 asbestos.

Further extension of these studies has shown
that paper reinforced Kaylo is much more sensitive to
heat treatment over 200°C. than asbestos-filled Kaylo,
while mixtures of asbestos and Kaylo lead to intermediate
properties. Certain improvements appear possible by
using clay calcined at about 600°C. instead of uncalcined
clay, where previous formulation called for clay addi-
tions.

Since the heat stability of paper-filled Kaylo
is definitely limited and generally asbestos would be

preferred, it is felt that any further investigations should be deferred and only reopened if a definite need for using paper pulp in production should occur.

In such an event, it is suggested that experimentation should be made on a pilot plant scale starting from the best formulations reported previously.

Respectfully submitted,

Arthur D. Little, Jr.

I. INTRODUCTION

While Kraft paper pulp was found to be a satisfactory substitute for asbestos when used in conjunction with clay additions, it has been now established that such products are definitely inferior when subjected to temperatures substantially above 200°C.

It is also felt that Kraft is definitely superior to other vegetable fibers and in view of the above findings, it is not deemed worthwhile to continue the search for other potentially useful vegetable fiber reinforcing agents.

Should the use of paper pulp become of interest commercially, it is believed that pilot plant experimentation based on our previously reported results should be the next step. In view of the results reported in the following, paper-asbestos mixtures might be resorted to where intermediate heat resistance is required.

II. SUMMARY

1. Kaylo, reinforced with Kraft and Dixie clay loses all strength when heated to 250°C.

2. Kaylo, containing Kraft and asbestos has properties intermediate between Kaylo containing Kraft or asbestos respectively.

3. Calcined (600°C.) clay appears to give better results with respect to strength than untreated clay.

4. Wood pulp and news print appear to be materially inferior to Kraft.

5. Future experimentation with paper-filled Kaylo should be on pilot plant scale.

6. The present investigation should be considered as concluded.

III. DISCUSSION OF RESULTS

The study of heat resistance necessitated the preparation of a large number of samples (about 150) to warrant sufficient statistical material for evaluation of data. Even then, the results indicate general trends rather than absolute values. However, the results as summarized in the figure appear to be sufficiently consistent with theoretical assumptions to permit definite conclusions.

All batches shown in the table were made from standard formulations as given in the previous report, whereby clay additions were calculated in the C/M ratio as indicated there. Batches marked "Kraft, asbestos" contained 6% of each. "M-Kaolin" indicates the use of Dixie clay calcined at 600°C.

In studying the figure, it can be seen that Kaylo of standard formulation (marked "Blank") retains considerable strength even after being heated to 500°C. Some individual test pieces retained as much as 90% strength up to this temperature. The difference between the standard Kaylo and Kaylo containing Dixie clay is not considered to be significant and can be assumed to be identical for all practical purposes.

While Kaylo, reinforced with Kraft pulp and having 10% clay addition, gives equal to better strength than standard Kaylo, it loses its entire strength when heated to 250°C. Replacement of Dixie clay by calcined Dixie clay (600°C.) appears to help to retain some strength (about 30%). The curve as shown, however, is not a fair

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representation since several pieces heated to 250°C. broke prior to test and were not included in the average represented. Calcined clay appears to give better inherent strength of the matrix, but, as to be expected, after failure of the fiber reinforcement results are more scattered.

Asbestos plus Kraft (6% + 6%) reinforced Kaylo regardless of the other variables tested drop to about 55% of the original strength when heated to 250°C. At 500°C. differences due to the matrix appear to become noticeable. Again a marked improvement due to the use of calcined clay appears to be apparent.

While these studies were made without attention to absolute strength, and formulation was not varied to allow for changes in raw material, it appeared that samples formulated with calcined clay were definitely superior in strength.

Previous experience with news print pulp (see Ninth Progress Report) and some tests on fine wood pulp (OKUF, West Virginia Pulp and Paper Company) were definitely inferior to Kraft. While the OKUF material gave some indication of usefulness its high price (over \$200 per ton) did not warrant further investigation.

Where retention of strength is not of major importance, the usefulness of Kraft pulp as a replacement for asbestos appears definitely established. Products of intermediate heat resistance can be made by suitable mixtures of asbestos and Kraft.



It is believed that the information obtained is sufficient to form a suitable basis for pilot plant investigation if and when asbestos shortage should necessitate the use of substitutes for all or part of the asbestos.
