Alum in Water

1902

[Reprinted from TECHNOLOGY QUARTERLY, Vol. XV, No. 4, December, 1902.]

ALUM IN WATER.

A. H. LOW'S MODIFICATION OF THE LOGWOOD TEST.

BY ELLEN H. RICHARDS.

IN Volume 4 (1891, p. 194) of this journal, a method was described for detecting alum in water by the use of a freshly prepared solution of logwood.

With the increasing use of mechanical filters the test has become of an importance little dreamed of at the time. Various workers have spoken for and against the method. Professor J. W. Mallet, of the University of Virginia, suggested in 1899 the use of hæmatoxylin, which now may be had of considerable purity — by which one part of alum in 5,000,000 could be detected.

As early as 1898, Mr. A. H. Low (M. I. T. 1876), of Von Schulz & Low, Denver, Colorado, having occasion to test the effluent from the mechanical filters of the Denver Union Water Company, began experimenting with the logwood test with especial reference to the interfering substances.

At that time one part in 4,000,000 was his claim for the test.

Mr. Low has continued his experiments and has given his permission for the publication of his method, which appears to be a distinct contribution to the accuracy and delicacy of the determination, since one part in 8,000,000 may be detected. The exclusion of carbon dioxide up to a certain stage in the process, when it is required, and the prevention of access of alkali from glass vessels by the use of platinum are essential points.

Mr. Low has kindly supplied the following directions: —

Directions for the Alum Test. — The logwood solution is made as follows: Take two grams of logwood chips and boil one minute in a platinum dish with 50 c.c. of distilled water. Decant the solution and boil again for one minute with 50 c.c. of water. Decant this and similarly boil a third time with 50 c.c. of water. Decant this into a plati-

num receptacle for use. Take three drops for each test. Kept in platinum, the solution will last for several days at least.

Test the water as follows: Boil 50 c.c. of the water in a platinum dish for a short time to expel carbon dioxide. Add three drops of the logwood solution and continue boiling for a few seconds to develop the color. Decant into a glass flask and cool quickly under the tap (so as not to keep the hot solution too long in the glass). Transfer to a No. 2 beaker and blow in carbon dioxide from the breath by means of a glass tube until there is no further decolorization. Pour the water into a Nessler tube for comparison with standards similarly prepared. Allow them to stand several hours before taking the final reading. No wash water is used at any of the decantations. The test shows one part of aluminum sulphate in 8,000,000 parts of water.

A blank made with distilled water, if not completely decolorized by the CO_2, will show a tint perceptibly fainter than that produced by one part in 8,000,000 of aluminum sulphate.

It should be noted that carbon dioxide must be kept absent until the point prescribed. The solution is therefore transferred to a beaker in order to keep the flask free from carbon dioxide for the next test.

The main points are:—

1. Any kind of logwood appears to answer.
2. The solution is good for several days, at least, if kept in platinum.
3. The use of platinum instead of glass for boiling the test.
4. The use of carbon dioxide instead of acetic acid.

Aluminum hydrate, as pointed out by the late Professor A. R. Leeds in 1893, will produce a tint almost as strong as if it were in solution. The removal of the hydrate is a difficult matter.

Mr. Low's method of procedure is as follows: first, test the water as above described. If no tint, or none exceeding that of the blank, remains after standing several hours, or over night, that is sufficient. If, however, a tint persists, or a colored precipitate settles out, it is necessary to determine if this is due to aluminum hydrate. Pour a sample of the water several times through a double Swedish filter and finally test the filtrate. If the tint produced is weaker than that given by the unfiltered water, repeat the operation on a fresh portion of the water, using the same filter, and continue repeating with new portions of the water and always using the same filter, until it is apparent that no further diminution of the tint can be effected. The

tint finally remaining may be assumed to be due to a salt of aluminum in solution.

An alternative method is to clog a filter with a little aluminum hydrate, wash until no test is given, and then filter the sample of water. The writer does not agree with Mr. Low's suggestion to allow the filtered water to stand several hours and then refilter. The filtrate from a mechanical filter which uses alum should be tested at once. A slow decomposition appears to take place by which aluminum hydrate separates out. While it may be said that consumers do not use the water until after the lapse of some hours, the chemist should be able to say whether any undecomposed alum comes through the filter.

Mr. Low gives the following directions for the use of hæmatoxylin:

Dissolve 25 mg. in 25 c.c. of warmed water. Add one drop to 50 c.c. of the water to be tested, boil in a platinum dish until the color appears to be fully developed — about thirty seconds. Pour into a flask, cool under the tap. Blow carbon dioxide from the breath through the solution so long as any color due to alkali seems to be discharged.