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CHEMISTRY
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BY
E. SUTERMEISTER
CHIEF CHEMIST
S. D. WARREN COMPANY
1923

TO the casual visitor to our mill it is not quite obvious why the services of a chemist are essential to the manufacture of standard papers. That such is the case however is proved by the fact that our laboratory has been in operation for twenty-nine years, and that it is becoming the rule rather than the exception for pulp and paper mills to employ chemists. To show in what way the chemical laboratory aids in making paper, and particularly in maintaining standards, the following brief outline of its activities has been prepared.

The most obvious need of chemical knowledge is in the testing of the raw materials which enter directly or indirectly into the finished product. The former class includes alum, clay, fibres, coloring matters, etc., and each must be carefully examined as to its quality. Clay we test for color and grit because variations in color affect directly the color of the paper, and because we do not wish to put into the paper gritty matter which is likely to injure the type and plates used by the printer. Coloring materials are always a source of variation and if each lot is not tested for strength and hue before it is used much paper may be spoiled before the proper correction can be made. The fibres, of which the sheet of paper is largely composed, have

a great influence on its quality and these are regularly examined for color and the quantity of dirt specks present. In addition physical tests are made which indicate how the fibres will act in the beating engine.

When it comes to the coating of paper still more raw materials have to be tested. Every lot of casein is examined before it is unloaded and it is upon the report submitted that the Coating Department bases its judgment of the grade of paper in which to use the casein. Formerly many lots of casein were rejected upon the basis of the laboratory tests but during the last few years the quality has improved and no rejections have been necessary. Glue, which is used in certain grades of paper, has to be tested for grease and acidity, since they have an important bearing on the quality of the paper, acidity being particularly bad for certain colored papers. Satin white, clay and blanc fixe are the chief pigments which form the coating, and their chemical and physical properties all have to be carefully noted. With satin white, for instance, the amount of alkalinity must be kept within certain limits if it is to work well, and the average length of the crystals should not be over 0.00015 inch.

Still more numerous are the raw materials

which indirectly affect our product. Coal is vital because of the great quantities of steam required and every lot received is tested in a calorimeter to determine its heating value. The lime and sulphur used in the sulphite mill, the salt for the electrolytic plant, and the lime and soda ash used in the soda pulp mill all have to be analyzed or tested in some way to show their quality.

The next point where the chemist is of assistance is in testing the intermediate products during manufacture. The salt for the electrolytic plant is dissolved to a brine and each lot of this has to be tested chemically so that the proper purification can be made before it goes to the cells. The caustic liquor, black liquor, waste lime mud, black ash, and waste wash waters in the soda mill must all be analyzed to see that they are of the proper strength, to locate losses or to enable proper cost figures to be obtained. Bleach solutions must be adjusted to proper strength if uniformly bleached fibre is to be made, and this can only be done after a chemical analysis. Rosin size and clay mixture are both measured into the beaters from tanks and very frequent tests are necessary to see that these mixtures are maintained at the desired strength. In both pulp mills the liquor entering the

digesters is tested by the foreman in charge, but the solutions which he uses are prepared in the laboratory and the chemist is responsible for their accuracy.

So much for the routine tests which are made daily or at definite intervals. Next comes a still more varied line of work which includes tests of processes, studies of various portions of the plant with a view to their improvement, investigations of new materials, etc. This might be considered more or less in the line of research work, and while it might not always seem to have a direct bearing on the production of standard papers yet it is all in line with more efficient operation of the plant and increased knowledge of its capabilities.

The work carried out under this classification is too varied to be described in complete detail, but among the items handled in the last few years are the following:

Tests of various materials proposed as fillers.

Manufacture of satin white from new materials or in new ways.

Studies of the losses of soda in the pulp mill.

Development of a more satisfactory paste for case labels.

Tests of asbestos paper for electrolytic diaphragms.

Bleaching investigations.

The use of rubber latex in body stock and coating.

A study of washing powders for cleaning felts.

The use of hard woods by the sulphite process, etc.

The wood used has received considerable attention, studies having been made of the rate of growth of spruce and poplar trees, while the yield and quality of fibre obtainable from many different species and by different cooking processes have been determined. More recently studies have been made of the loss sustained from decay of wood in the storage piles. The coating of paper is always a problem and it is in part because of the work done in the laboratory that our increased knowledge of casein enables us to make better coated paper. The use of rosin sizing in the beaters is another perpetual source of trouble which our research work has eliminated to a considerable extent.

Coming more directly to paper itself we have made studies of the durability of paper extending over a number of years; this has included both coated and super papers and

has thrown much light on the changes which may be expected under certain conditions of storage. A special apparatus was constructed to permit the measurement of the dimensions of paper under different conditions of humidity. While it did not prove possible to make paper which would not expand or contract with changing humidity, which was what we were trying to do, this apparatus has helped materially in the study of cases of poor register. The selection of proper waterproof papers for case linings was based on tests made in the laboratory. Very careful studies were made of the effect of manufacturing conditions upon the printing results obtained on Cameo paper, and much helpful information was obtained. One of our standard lines, Silkote, was even developed very largely through the efforts of the laboratory.

This gives briefly a general idea of the usual activities of the laboratory along more or less standard lines but there are a thousand and one things which are continually being put up to us and which are not readily classified under any of the foregoing heads. It is quite common for samples of paper to be returned to see if they are of our make. Printed samples are sent in to see why they did not print well. Comparisons are required of the


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folding properties of paper. Totally new and strange materials are submitted to see if they cannot be used in the manufacture of paper. All sorts of troubles are brought in from the plant itself, dirty paper stock; gummed up wires; spots in coated paper; dust from the calenders; and the laboratory is expected to act as a sort of detective bureau in locating causes.

In handling all this work considerable special equipment is necessary, and we have available the following apparatus.

Digesters for cooking by either the soda or sulphite process.

Beater for use in sizing, coloring or loading tests.

Hand molds and a sheet machine for making sheets of paper or pulp.

Bleaching apparatus.

Equipment for studying the foaming of coating mixtures.

A miniature satin white mill.

Crushers and grinders.

Pebble mills for testing fibres for beating properties.

A steam heated dryer for hand mould sheets.

A small filter press.

A "Daylight lamp" for color comparisons.



An apparatus for determining the gloss of paper in numerical terms.

A calorimeter for testing coals.

Instruments for determining thickness, bursting strength, tensile strength, tearing strength and folding endurance of papers.

A wire stitcher for studying the folding and stapling properties of papers.

If space permitted, a much more detailed account of laboratory activities could be given, but the foregoing suffices to show the variety, interesting nature and importance of the work carried out by the laboratory.



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