On-site institutional laundry

The following is based on a talk by Linda Marquardt of the Institutional Division of Ecolab Research Center, St. Paul, Minnesota.

Detergency testing in the institutional market, as in any other, is a function of gearing test conditions to simulate final use conditions as much as possible. Differences in the institutional marketplace versus the consumer marketplace that can influence this include the following:

- High soil levels in some classifications require stronger, more alkaline detergents to remove the soil in one cycle. Some examples of the heavier soil classifications are food service, commercial, and some health care applications.
- Machines require lower foaming products than consumer machines and typically are more flexible with respect to wash formula programming.
- The fabric-to-liquor ratio is higher. A ratio of fabric to liquor of 1:4 is typical.
- Higher water temperatures are commonplace. The range is typically 120-160°F, although lower and higher temperatures are also encountered.
- There is an emphasis on production efficiency which makes short wash cycles and reduced labor requirements preferable and, in many cases, a necessity. For instance, pre-spotters (although used) are somewhat impractical to a large portion of this marketplace. Washwheel additives are preferred.
- Automatic dispensing of products is commonplace and expected. This requires compatibility between products being dispensed simultaneously and allows a systems approach.
- The market is fairly segmented (restaurant, hotel/motel, health care and commercial are some of the major market categories). This allows the targeting of a narrower range of soil categories and fabric types. For instance, a product whose objective is the restaurant market need not be overly concerned with dirty motor oil, dust/sebum soil, or grass stains. However, it does need to be a fairly heavy-duty detergent that is effective on animal and vegetable fats as well as other food stains and make-up.

The detergency process follows a progression from Terg-O-Tometer/Launder-O-Meter testing, to washwheel testing, field testing and market testing.

Terg-O-Tometer/Launder-O-Meter testing

The Terg-O-Tometer/Launder-O-Meter testing starts after specific performance and cost objectives have been set. An example of these objectives could be a low-alkaline, low-temperature product that would be effective on restaurant soils from 0-12 grains per gallon at a specific-use cost. Testing that follows would be run to address these objectives. Effective is usually defined as performance equal to or better than a standard product. The standard products used are a combination of current internal products and competitive products.

These tests are run on both purchased soiled fabrics and artificially soiled fabrics that are prepared in the laboratory. The initial screening work is usually run on purchased soiled fabrics. Both soil removal and antiredeposition are evaluated.

The soil removal testing basically follows ASTM procedure D-3050. Specific modifications can be the use of higher temperatures, using natural soft city and well water instead of artificially prepared hard water, and using cotton, polyester and cotton/polyester blend (with and without durable press finish) fabrics. Nylon is not a significant factor in this marketplace and is not usually tested. The specific soils chosen are dependent on the objectives of the project.

When soil removal results are evaluated, a difference of at least 5% soil removal is judged as a reliably significant difference. Internal studies have shown standard deviations of 0.5-5% soil removal between samples within the same Terg-O-Tometer pot, from one pot to another, and from one Terg-O-Tometer bank to the other. It is preferable to have a difference of closer to 10% soil removal versus a standard to justify expansion of the product for an improved performance claim. We usually find it takes a fairly large performance difference to allow the end user to actually see the improvement. Showing equality at a lower use concentration also is a significant advantage to the institutional marketplace. Consistent use concentration is controlled by automatic dispensing and, therefore, waste is avoided and use cost is a sellable advantage.

The anti-redeposition test used is ASTM D-4008.

Designed experiments are often used in evaluating the components of formulations via Terg-O-Tometer testing as well. Fractional factorial designs are typically used. These designs have shown the capability of pinpointing the most significant factor in removing a particular soil and showing interaction effects between the various components.

Washwheel testing

The next step is washwheel testing. Since this testing is more time-consuming, the number of formulations being tested compared with a standard is narrowed down to 1-3 test prototypes. The testing itself typically involves 20 cycles in a 35-pound Milnor C6M using 25 pounds of fill. Soft, city and well water (hot and cold) are plumbed into the laboratory for use in both the Terg-O-Tometer/Launder-O-Meter and washwheel testing.

Test swatches used in the washwheel testing can include unsoiled swatches used for anti-redeposition

testing, soiled swatches used to evaluate soil removal, and tensile strength swatches to evaluate tensile strength reduction. Five to 10 swatches of each type are used per cycle to allow for the increased variability seen in washwheel tests. Standard deviations of 5-10% soil removal can be seen in washwheel tests versus the 0.5-5.0% seen in Terg-O-Tometer tests. When anti-redeposition is being measured, additional soil is added to each cycle.

The wash formula is chosen based on the soil classification that is the product's main objective. The typical light soil formula is shown in Table 1. Both low and high ends of the temperature and water hardness ranges are tested.

Soil removal and anti-redeposition (in both Terg-O-Tometer and machine tests) are evaluated spectrophotometrically using a Hunterlab Ultrascan. Tensile strength has been evaluated using an Instron Model 1011 and ASTM Method D-1682. The use of fluidity measurements (ASTM method 82-1984) is also available.

An alternate procedure that has been used for machine testing is to obtain soiled linen from a local account, divide the load in half, and run the two halves on the standard and an experimental product. If possible, it is preferable to cut some of the actual articles in half as well. The linen is then evaluated for stain removal and overall background color. These results are usually evaluated by a panel, although instrumental methods also can be applied in some cases.

Field testing

If the product is successful throughout these phases of testing, a field test is initiated. This typically involves 5-15 test accounts and a one-month pre-survey, followed by a three- to six-month product test. It is handled by a field-test engineering group whose primary function is the field testing of new institutional products and equipment. Local accounts (preferably) are obtained and the one-month pre-survey is initiated. During this time period, usage rates of current products are obtained, account procedures are identified, machine or wash formula problems are identified and fixed, background readings of whiteness index are taken each week on a specific linen classification (20 random readings), reject or stain levels are attained, and test swatches (similar to those used in the lab testing phase) are run as baseline data.

TABLE 1

Wash Formula (typical light soil formula)

Step	Time (minutes)	Water level
Flush	2-3	High
Suds	6-8	Low
Bleach	6-8	Low
Rinse	2	High
Rinse	2	High
Sour/Soft	4-6	Low

Once the pre-survey is completed and a good baseline of data is obtained, the test product is started. Accounts are monitored on a weekly basis (sometimes more often) to ascertain any changes that have taken place. Usage rates of the product continue to be monitored, as well as whiteness readings, stain levels and customer observations on the performance of the product. Test swatches similar to those run in the lab are run again and compared to the pre-survey swatches. This allows a correlation of lab performance to field performance. Conditions and procedures at the account are observed closely in order to see if any changes are a result of changing practices and conditions within the account or a result of product performance changes. Product stability and dispensability as chemical engineering scale-up takes place are also followed during this phase.

For some projects, there is not a sufficient number of accounts locally in which to test the product or system. This complicates the procedures since a field test representative cannot be at the account as frequently. Therefore, the actual measurements take place at longer intervals and the local salesman is more involved with the testing process than is the case during local field tests.

Market testing

The market test is typically geared towards sales appeal and marketability of the product. Performance characteristics in this case are largely ascertained by contacting the salesmen in the area being tested for their input. They are usually surveyed either by phone or questionnaire. Selected accounts are also followed more closely for opinions and performance input.

This is an overall look at the testing procedures used in evaluating the performance of new institutional products from the initial product concept stage through market expansion. The procedures outlined have usually provided a reliable judgement of final end-use performance. However, they are under constant reevaluation and are updated as further knowledge is gained.