FEATURE

The Launder-O-Meter

The following, based on a talk presented by J.L. Berna, was prepared by J.L. Berna, A. Moreno and L. Cohen of PETRESA, Madrid, Spain.

The American Association of Textile Chemists and Colorists (AATCC) was founded in 1921 with the purpose of promoting knowledge of the application of dyes and chemicals in the textile industry. That group's interest in testing the fastness of dyed textile material to washing and laundering led to the development of the Launder-O-Meter, a standard machine for conducting laboratory washing tests. The association and the Atlas Electric Devices Co. drew up an agreement giving Atlas exclusive rights to manufacture and sell this washing machine.

The Launder-O-Meter consists of a mounted reservoir with a 15-gallon capacity. Inside the tank is a rotor which has the capacity to hold 20 metal containers. Five types of stainless-steel specimen containers—three of which are normally used only in the high-temperature model—are available for use in the rotor. The rotor is driven at a uniform rate of 42 rpm. This machine is operated by a control panel which is usually placed over the preheating loading table. Metal balls are put in the containers when in use to produce a desired abrasive action. Thus, the machine permits the testing of 20 samples under controlled temperature and mechanical agitation. Launder-O-Meter procedures are described in the *Technical Manual* of the AATCC.

Wash techniques

Test pieces of soiled fabric 10 × 10 centimeters in size are cut from the roll of test fabric and marked for identification. Five quarter-inch stainless steel balls, 250 ml of test solution at 30°C, and three swatches (two jars for test solution) are placed in each pint Launder-O-Meter jar. The closed jars are tested for leaks, transferred to the loading table for 10 minutes to attain temperature, and then loaded into the machine. The jars are rotated for 20 minutes at 42 rpm.

After the wash period, the washed swatches are dropped into a pail of tap water and rinsed. They are then laid out on an aluminum sheet and dried in an air circulating oven at 65°C. Finally, the swatches are ironed and the reflectance reading made.

It is a normal procedure to read the reflectance of the soiled fabrics before washing and then giving the detergency performance results by Δ R (reflectance increase) values.

Materials used

Soiled fabrics for detergency testing are very difficult to standardize because of the possibility of combining different soils, as well as the large variety of available textile supports. EMPA (Swiss Federal Laboratories for Materials Testing and Research, St. Gallen, Switzerland) fabrics were used in our experiments because they are commonly used in Europe and therefore there is a considerable set of data available on tests performed by other laboratories.

Two EMPA fabrics have been used: EMPA-101 (100% cotton) and EMPA-104 (65% cotton, 35% polyester). The soiling of these fabrics is done with carbon black and olive oil.

Surfactants tested

Three surfactant systems have been considered for the detergency testing evaluation. They are:

- L.A.S. (Na salt) solution of 20% active ingredient concentration. The starting linear alkylben-

TABLE 1

Detergency Performance (ΔReflectance)[a]

		Use level			
		0.6 wt%		1.5 wt%	
		Water hardness (ppm $CaCO_3$)			
	Fabric	150	300	150	300
Launder-O-Meter					
	EMPA-101	7	1.5	10	12.6
	EMPA-104	15.7	4.5	19.5	22.5
Terg-O-Tometer					
	EMPA-101	28.5	21.5	31.2	32.0
	EMPA-104	39.0	27.5	41.5	42.5

[a]LAS-Na 20%.

TABLE 2

Detergency Performance (Δ Reflectance)[a]

		Use level (0.6 wt%)	
		Water hardness (ppm $CaCO_3$)	
	Fabric	150	300
Launder-O-Meter			
	EMPA-101	14.5	11.8
	EMPA-104	27.8	19.5
Terg-O-Tometer			
	EMPA-101	40.0	38.3
	EMPA-104	48.7	45.2

[a]Commercial H.D.P. (Las, 5%; N.I., 5%; soap, 2%; STPP, 15%).

zene was a commercial one representing the most widely used grade in Western Europe (molecular weight: 242). This solution was used at two use levels—6 gr/lt and 15 gr/lt.

• Heavy-duty powder (H.D.P.). The mixed active ingredient system used was 5 weight percent LAS, 5 weight percent N.I., 2 weight percent soap and 15 weight percent STPP. To avoid interference and to have a detergency result due exclusively to the surfactant system, no other ingredients were considered.

• Unbuilt heavy-duty liquid (H.D.L.). The composition used was 15 weight percent LAS, 20 weight percent N.I. and 10 weight percent soap.

TABLE 3

Detergency Performance (Δ Reflectance)[a]

		Use level			
		0.6 wt%		1.5 wt%	
		Water hardness (ppm $CaCO_3$)			
	Fabric	150	300	150	300
Launder-O-Meter					
	EMPA-101	3.4	3.5	8.1	4.9
	EMPA-104	7.9	8.7	16.3	8.0
Terg-O-Tometer					
	EMPA-101	19.9	19.3	31.3	22.9
	EMPA-104	28.5	29.5	42.5	32.0

[a]Unbuilt H.D.L. (LAS, 15%; N.I., 20%; soap, 10%).

Results and discussion

We also have included the detergency results obtained using not only the Launder-O-Meter but also the Terg-O-Tometer. Both pieces of equipment are used for detergency testing worldwide, and we feel it is more interesting to compare the data on a standard deviation basis than simply to give a reflectance value on a single piece of equipment.

Tables 1-3 depict the Δ R values obtained. The main conclusions are:

• The primary detergency performance in the Terg-O-Tometer is significantly higher than in the Launder-O-Meter.

• The relative standard deviation of the reflectance readings for the Launder-O-Meter is ten times the one found for the Terg-O-Tometer.

This can be summarized briefly as follows:

$$\text{Relative Standard Deviation} = \frac{\text{Standard Deviation} \times 100}{\text{Average of 6 readings}}$$

Terg-O-Tometer = 2%

Launder-O-Meter = 20%

We must point out, however, that this conclusion is valid only with the conditions used for the tests performed.

Radiotracer detergency method

The following is based on a talk given by Nelson E. Prieto of Shell Development Co., Houston, Texas.

The use of radioisotopes in detergency studies goes back many years. Shell Development has used radiolabeled soils and surfactants to study the various processes involved in detergency since the mid-1960s. The radiotracer detergency method makes use of mildly radiolabeled soils for quantitative determination of soil removal, among other properties, by simple standard radiochemical techniques (1). The method has been well developed to include a wide variety of available soils and provide enough flexibility to mimic natural soils and contemporary washing conditions. In general, the method involves soiling fabric swatches with the labeled soil(s), washing the fabric and determining soil removal by counting techniques.

Soil preparation and application

Many suitable labels are available for detergency studies. However, several conditions need to be considered when selecting the label. The choice is usually limited to the chemical elements present in the material of interest. The main determining factors that will affect your decision when selecting an isotope are ease of detection and labeling, purity, commercial availability, half-life, and safety/regulatory considerations. These are discussed in detail by Shebs (1).

Several radioisotopes can be used as labels, depending on the type of soil to be prepared, making the method very flexible, versatile and selective. Polar soils, such as fatty acids and alcohols, are labeled with Carbon-14, whereas nonpolar oily soils, such as mineral oil and triglycerides, use tritium as the label (2). Fabrics are soiled with these materials by applying an aliquot of a toluene carrier solution and allowing them to air-dry.

A particulate soil is also available. It is prepared by mixing a purified kaolinite clay with a clay fraction which has been activated by neutron bombardment (3). Fabric is padded with clay by agitating it in an aqueous suspension. This procedure avoids the difficult task of fixing the radiotracer into