

1.1 Reasons for textile testing

The testing of textile products is an expensive business. A laboratory has to be set up and furnished with a range of test equipment. Trained operatives have to be employed whose salaries have to be paid throughout the year, not just when results are required. Moreover all these costs are non-productive and therefore add to the final cost of the product. Therefore it is important that testing is not undertaken without adding some benefit to the final product.

There are a number of points in the production cycle where testing may be carried out to improve the product or to prevent sub-standard merchandise progressing further in the cycle.

1.1.1 Checking raw materials

The production cycle as far as testing is concerned starts with the delivery of raw material. If the material is incorrect or sub-standard then it is impossible to produce the required quality of final product.

The textile industry consists of a number of separate processes such as natural fibre production, man-made fibre extrusion, wool scouring, yarn spinning, weaving, dyeing and finishing, knitting, garment manufacture and production of household and technical products. These processes are very often carried out in separate establishments, therefore what is considered to be a raw material depends on the stage in processing at which the testing takes place. It can be either the raw fibre for a spinner, the yarn for a weaver or the finished fabric for a garment maker. The incoming material is checked for the required properties so that unsuitable material can be rejected or appropriate adjustments made to the production conditions. The standards that the raw material has to meet must be set at a realistic level. If the standards are set too high then material will be rejected that is good enough for the end use, and if they are set too low then large amounts of inferior material will go forward into production.

1.1.2 Monitoring production

Production monitoring, which involves testing samples taken from the production line, is known as quality control. Its aim is to maintain, within known tolerances, certain specified properties of the product at the level at which they have been set. A quality product for these purposes is defined as one whose properties meets or exceeds the set specifications.

Besides the need to carry out the tests correctly, successful monitoring of production also requires the careful design of appropriate sampling procedures and the use of statistical analysis to make sense of the results.

1.1.3 Assessing the final product

In this process the bulk production is examined before delivery to the customer to see if it meets the specifications. By its nature this takes place after the material has been produced. It is therefore too late to alter the production conditions. In some cases selected samples are tested and in other cases all the material is checked and steps taken to rectify faults. For instance some qualities of fabric are inspected for faulty places which are then mended by skilled operatives; this is a normal part of the process and the material would be dispatched as first quality.

1.1.4 Investigation of faulty material

If faulty material is discovered either at final inspection or through a customer complaint it is important that the cause is isolated. This enables steps to be taken to eliminate faulty production in future and so provide a better quality product. Investigations of faults can also involve the determination of which party is responsible for faulty material in the case of a dispute between a supplier and a user, especially where processes such as finishing have been undertaken by outside companies. Work of this nature is often contracted out to independent laboratories who are then able to give an unbiased opinion.

1.1.5 Product development and research

In the textile industry technology is changing all the time, bringing modified materials or different methods of production. Before any modified product reaches the market place it is necessary to test the material to check that the properties have been improved or have not been degraded by faster production methods. In this way an improved product or a lower-cost product with the same properties can be provided for the customer. A large organisation will often have a separate department to carry out research

and development; otherwise it is part of the normal duties of the testing department.

1.2 Standardisation of testing

When a textile material is tested certain things are expected from the results. Some of these are explicit but other requirements are implicit. The explicit requirements from the results are either that they will give an indication of how the material will perform in service or that they will show that it meets its specification.

The implicit requirement from a test is that it is reproducible, that is if the same material is tested either at another time, or by another operator or in a different laboratory the same values will be obtained. In other words the test measures some 'true' or correct value of the property being assessed. If the test results vary from laboratory to laboratory then the test is not measuring anything real and it is pointless carrying it out. However, the values that are obtained from testing textile materials are not expected to be exactly the same, so that appropriate statistical criteria should be applied to the results to see whether they fall within the accepted spread of values.

The lack of reproducibility of test results can be due to a number of causes.

1.2.1 Variation in the material

Most textile materials are variable, natural fibres having the most variation in their properties. The variation decreases as the production progresses from fibres to yarns to fabrics, since the assembly of small variable units into larger units helps to smooth out the variation in properties. The problem of variable material can be dealt with by the proper selection of representative samples and the use of suitable statistical methods to analyse the results.

1.2.2 Variation caused by the test method

It is important that any variations due to the test itself are kept to the minimum. Variability from this source can be due to a number of causes:

- 1 The influence of the operator on the test results. This can be due to differences in adherence to the test procedures, care in the mounting of specimens, precision in the adjustment of the machine such as the zero setting and in the taking of readings.
- 2 The influence of specimen size on the test results, for instance the effect of specimen length on measured strength.

- 3 The temperature and humidity conditions under which the test is carried out. A number of fibres such as wool, viscose and cotton change their properties as the atmospheric moisture content changes.
- 4 The type and make of equipment used in the test. For instance pilling tests can be carried out using a pilling box or on the Martindale abrasion machine. The results from these two tests are not necessarily comparable.
- 5 The conditions under which the test is carried out such as the speed, pressure or duration of any of the factors.

It is therefore necessary even within a single organisation to lay down test procedures that minimise operator variability and set the conditions of test and the dimensions of the specimen. Very often in such cases, factors such as temperature, humidity and make of equipment are determined by what is available.

However, when material is bought or sold outside the factory there are then two parties to the transaction, both of whom may wish to test the material. It therefore becomes important in such cases that they both get the same result from testing the same material. Otherwise disputes would arise which could not be resolved because each party was essentially testing a different property.

This requires that any test procedures used by more than one organisation have to be more carefully specified, including, for instance, the temperature and humidity levels at which the test takes place. The details in the procedure have to be sufficient so that equipment from different manufacturers will produce the same results as one another. This need for standard written test methods leads to the setting up of national standards for test procedures so making easier the buying and selling of textiles within that country. Even so certain large organisations, such as IWS or Marks and Spencer, have produced their own test procedures to which suppliers have to conform if they wish to carry the woolmark label or to sell to Marks and Spencer.

Most countries have their own standards organisations for example: BS (Britain), ASTM (USA) and DIN (Germany) standards. The same arguments that are used to justify national standards can also be applied to the need for international standards to assist world-wide trade, hence the existence of International Organization for Standardization (ISO) test methods and, within the European Union, the drive to European standards.