1954

EC477 Man Made Fibers and Fabrics

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Man Made Fibers and Fabrics
MAN-MADE FIBERS AND FABRICS
Helen Rocke

As science produces new fibers and develops new finishes for the old ones, it is almost impossible to tell by look or feel what kind of fiber makes the fabrics we wear and use.

In order to get real satisfaction and service from the modern fabrics, all of us need to know more about these fibers and the cloth made from them. What are their special qualities, what can we expect from them, how should we care for them?

How the Fibers are Made
The first man-made fibers, rayon and acetate, were made from cotton linters or wood chips. The newer ones are made from a combination of chemicals. These fibers are nylon, Orlon, Dacron, Dynel and Acrilan. Another, Vicara, is made from the protein of corn.

Although each of these fibers is made from different substances, the basic processes in making them are similar:

First the material is made into liquid form;

Next the liquid is forced through a spinneret to draw it into a fine stream;

Then the streams of liquid are forced into a chamber of air or into a hardening bath and are changed into solid form, called filaments.

Kinds of Yarn
From these filaments different yarns are made. A single filament may be used and is known as monofilament yarn. Several filaments may be twisted together to form multifilament yarn.

The long filaments can be cut into short uniform lengths, called staple fibers. These are spun together to make spun yarn. Fabrics made from them are spoken of as spun nylon, rayon, etc. Spun fabric is usually softer, may have a wool-like feel or napped effect, while fabric made from filament yarn is smooth and even in texture. With the exception of Dynel, Acrilan and Vicara, all man-made fibers may be used in either filament or spun yarns. These three are used only in spun yarns.

A new process called texturing may be applied to many textile yarns. Tiny loops are mechanically introduced in each filament. The process adds bulk to filament yarns and makes them more opaque.

Fibers Have Different Qualities or Characteristics
While the man-made fibers are alike in some ways, each has some special characteristics which makes it better for some uses than others. There is no one perfect fiber--natural or man-made. Nor do we wear or use fibers as such. They must be made into cloth and clothes, or home furnishings. The development of man-made fibers has come rapidly. Their best use in fabrics and for wear purposes is still being determined.

Often the advertising and sales promotion of new fabrics is based on laboratory tests and performance of the fiber. How these products will perform in actual wear depends upon more than the fiber used. Factors that determine the performance are: the construction of the yarns and the way the cloth is made, the finishing processes used, the dyes, and the actual construction of the garment or article itself. Sometimes mistakes are made by spinners, weavers, finishers, dyers, or cutters, but it is usually the fiber that is blamed.
Blended and Combination Fabrics

Blended fabrics are made from yarns in which two or more fibers are mixed together before the yarn is spun.

Combination fabrics are those made of a combination of yarns. Each yarn is spun entirely of one fiber.

All of the man-made fibers can be blended with natural fibers or with other man-made fibers. This makes it possible to choose and combine fibers whose properties supplement and complement each other and make a fabric which has more desirable qualities than that made of a single fiber.

Nylon, blended with rayon, improves the wearing quality of the fabric and makes it easier to care for; while the rayon makes it more absorbent, easier to dye, and lowers cost.

The amount of a fiber to be used in a blend must be worked out individually for each fabric by the manufacturer, depending on the qualities wanted in the fabric, and its end use. For example, 10% of nylon mixed with wool may be enough to increase the strength of the wool appreciably, while it may take 50% of Orlon blended with the wool to give it the property of "permanent" pleating.

Progress in blending fibers means that fabrics can be made to certain specifications which will give them properties that fit them for a definite purpose or use. In the future, it will probably be more important for the consumer to find on the label such statements as "washable, shrink resistant" or "wrinkle resistant, moisture repellent" than to know the exact fiber content.

Properties of Man-Made Fibers

All man-made fibers are alike in the following ways;

- The quantity of fiber can be controlled
- Quality of any one fiber does not vary
- Fibers may be of any desired length, and the thickness or diameter of fibers may be varied
- The luster of fibers may be controlled, so they are bright or dull
- Fibers may be smooth or crimped

The newer man-made fibers have these common qualities:

- Are light weight
- Absorb little moisture—wash easily—dry rapidly
- Resist moths, mildew, insects
- Are damaged by high heat in ironing
- Resist wrinkling
- Produce static electricity
- Are difficult to dye
## SOME PROPERTIES OF MAN-MADE FIBERS

<table>
<thead>
<tr>
<th></th>
<th>Outstanding</th>
<th>Limitations</th>
<th>Use in Blends</th>
</tr>
</thead>
</table>
| **Rayon** | Comparatively inexpensive  
Good draping qualities  
Easy to dye  
Comfortable to wear  
Absorbs moisture | Weak when wet  
Dries slowly  
Wrinkles easily unless specially treated | Adds comfort because it absorbs moisture  
Reduces cost |
| **Acetate** | Absorbs little moisture  
Lighter in weight and dries faster than rayon  
White remains white  
Comfortable to wear | Melts at moderate temperature | Adds softness, draping qualities, and stability  
Unusual color effects through cross dyeing |
| **Nylon** | Strong  
Resists wear and abrasion  
Exceptional elastic recovery  
Non-flammable  
Can be heat-set for permanent pleats, etc. | Weakened by sunlight  
Yellows  
Pills in spun goods  
May wear other fabric against which it rubs | Adds strength and abrasive resistance |
| **Orlon** | Excellent resistance to weather and sunlight  
Acid resistant  
More permanent white than nylon  
Soft texture  
Can be heat set | Difficult to bleach and dye  
Less resistant to alkalies than nylon | Adds bulk without weight  
Gives crease and shape retention |
| **Dacron** | Stretch resistant  
Shape retention and wrinkle resistance, wet or dry  
Crisp—good elastic recovery  
More comfortable than nylon in hot weather | Hard to dye  
Tendency to pill  
Difficult to mold | Helps to hold shape  
Adds wrinkle resistance |
### SOME PROPERTIES OF MAN-MADE FIBERS

<table>
<thead>
<tr>
<th>Fiber</th>
<th>Outstanding</th>
<th>Limitations</th>
<th>Use in Blends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynel</td>
<td>Wrinkle resistant&lt;br&gt;Resilient&lt;br&gt;Doesn't flame&lt;br&gt;Warm, soft to the touch&lt;br&gt;Resistant to acids and alkalies</td>
<td>Melts at lower temperature than any other&lt;br&gt;Not available in bleached form</td>
<td>Adds warmth and bulk without weight</td>
</tr>
<tr>
<td>Acrilan</td>
<td>Light in weight&lt;br&gt;Soft and warm to the touch&lt;br&gt;Holds pleats when wet&lt;br&gt;Good weather resistance&lt;br&gt;Resists spotting and perspiration&lt;br&gt;Resists pilling&lt;br&gt;Doesn't sag or stretch</td>
<td>Hard to dye and bleach&lt;br&gt;Burns readily</td>
<td>Adds strength and bulk without weight</td>
</tr>
<tr>
<td>Vicara</td>
<td>More like animal fiber than most man-made&lt;br&gt;Softness&lt;br&gt;Especially adapted to blending&lt;br&gt;Easy to dye—easy to sew&lt;br&gt;Comfortable to wear</td>
<td>Weak when wet&lt;br&gt;Used only in blends</td>
<td>Adds softness, absorbency, drape&lt;br&gt;Increases wrinkle resistance&lt;br&gt;Reduces static</td>
</tr>
<tr>
<td>Fiberglas</td>
<td>Fireproof—strong&lt;br&gt;Good electrical resistance&lt;br&gt;Absorbs practically no moisture</td>
<td>Brittle—difficult to dye&lt;br&gt;Irritating to skin</td>
<td>Used for curtains, draperies, industrial uses</td>
</tr>
</tbody>
</table>
Special Finishes

All fabrics are given finishes to improve certain qualities. In addition, many types of special finishes are being used to give new and different characteristics to some fibers and fabrics. Good textile finishes add to the durability and usefulness of the fabric and simplify its care. Other finishes may produce a fabric which requires special care, or may decrease the strength of the fabric or make it uncomfortable to wear, while increasing its glaze, stiffness, etc., for the sake of appearance.

Trade names for special finishes are often used on garment labels. Sometimes the trade name includes more than one special quality in the finish. For example, a fabric with a certain trade mark might be crease and spot resistant, and resistant to shrinkage and stretching.

There are many different finishes with as many different trade names. As new ones are continually coming into use, it is difficult for the consumer to know the meaning and purpose of each. If the trade name for a finish is not familiar to you, read the label on the article, which may give an explanation of the purpose of the finish—or ask the salesperson for the meaning of the trade name. If you buy a fabric or garment with a specified finish, check its performance during use or wear, to help you decide if such a finish is satisfactory for the use you expect of it.

Finishes to Control Shrinkage

These are among the first special finishes and are used on a number of fabrics so that shrinkage will be less than 1% or 2%.

For cotton this may be a purely mechanical process, and with cotton a shrinkage of not more than 1% can be guaranteed.

With rayon the shrinkage control is a chemical process through the use of resin or caustic soda which stabilizes rayon against shrinking or stretching.

Shrinkage is controlled in wool with either a chemical or resin finish. The shrinkage process is used on wool fabrics and garments (especially knitted garments) which are intended to be washed.

Crease-resistant Finishes

These are applied to give resistance to creasing and wrinkling in fibers and blends which otherwise have little or no resistance to wrinkling. Some crease-resistant finishes are more durable than others, and some add other qualities, as resistance to soil and spotting, shrink resistance, and easier laundering.

Embossed Finishes

Embossing is used to add interest to the texture of cotton fabrics. Various embossed effects on cotton result from the application of resin coatings to the fabric.
Insulating Finishes

These are made by spraying a coating of tiny, metallic particles in a colorless plastic solution on the back of coat lining. The purpose is to add warmth without weight.

Gas-Fading Inhibitors

Acetate fabrics are sometimes treated with a finish to prevent change of color in the fabric from action of gas fumes.

Anti-static Finishes

These are used to reduce static electricity generated by the newer man-made fibers. Resins used for crease-resistant finishes and shrinkage control on cotton, linen, and rayon also cause static.

Some anti-static finishes are only temporary, while others are more permanent. Anti-static rinses for home use are available.

Moth-resistant Finishes

These are used both commercially and in the home to prevent moth damage of wearing apparel and blankets.

A mothproof rinse for home use has recently been developed by the U.S.D.A. This rinse was originally named "EQ-53" and is now being sold under various trade names. Washable woolens rinsed with EQ-53 and stored away will remain mothproof for a year. If clothing is worn, the protection will last one season--unless washed or dry cleaned.

Flame-retardant Finishes

These finishes are still in the experimental stage. Fabrics treated with such a finish will char, but not burst into flames. Legislation is now in effect which requires dangerously flammable fabrics to be treated with a flame-retardant finish.

Water-repellent Finishes

These are made in both a durable and non-durable finish. The durable withstand dry cleaning and laundering.

Water-repellent finishes do not change the appearance of fabrics or make them as uncomfortable as waterproof finishes do.

Waterproof Finishes

These finishes coat the fabric and fill the spaces between the yarns so air and moisture cannot penetrate. Coatings may be of latex or vinyl resins.

Other New Developments in Fibers and Fabrics

A new type nylon yarn which stretches to fit and conform to almost any shape--used for socks, underwear, gloves.
Opaque nylon, a new opaque dull nylon yarn to be used in both knit and woven fabrics.

"Fiber E" - a form of rayon which is permanently curled and crimped into a fuzzy, wool-like fiber by treating it with a chemical. It is used for coatings, suitings, sweaters, upholstery, slippers, and in plush used for toys.

Dope-dyed and spun-dyed are terms used for a method of dyeing in which dye is added to the solution before the fibers are formed. Spun-dyed fibers are said to have better color fastness to washing, sun, sea water, and gas fading than the same fibers dyed after weaving.