



Extension FactSheet

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Rayon—The Multi-Faceted Fiber

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Of all the fibers, rayon is probably the most perplexing to consumers. It can be found in cotton-like end uses, as well as sumptuous velvets and taffetas. It may function successfully in absorbent hygiene and incontinence pads and equally well providing strength in tire cords. What is this fiber that has so many faces?

Rayon was the first manufactured fiber. It was developed in France in the 1890s and was originally called “artificial silk.” In 1924, the term rayon was officially adopted by the textile industry. Unlike most man-made fibers, rayon is not synthetic. It is made from wood pulp, a naturally-occurring, cellulose-based raw material. As a result, rayon’s properties are more similar to those of natural cellulosic fibers, such as cotton or linen, than those of thermoplastic, petroleum-based synthetic fibers such as nylon or polyester.

Although rayon is made from wood pulp, a relatively inexpensive and renewable resource, processing requires high water and energy use, and has contributed to air and water pollution. Modernization of manufacturing plants and processes combined with availability of raw materials has increased rayon’s competitiveness in the market.

At one time, rayon and cotton competed for similar end uses. Although rayon is a relatively inexpensive fiber, cotton prices are considerably lower, giving it a competitive advantage over rayon. Rayon’s versatility as a fiber and relatively low cost have increased its use in blending, but also encouraged its use in lower quality fabrics and garments—the performance of which has sometimes tarnished the image of rayon. Rayon’s many desirable properties, however, have made it a choice for some designer and high-end apparel.

Types of Rayon

There are four major types or modifications of rayon. Understanding each type should help clarify differences in product performance.

“**Regular rayon**” has the largest market share. It is typically found in apparel and home furnishings and identified on labels by the term “viscose.” The distinguishing property of regular rayon is its low wet strength. As a result, it becomes unstable and may stretch or shrink when wet. Dry cleaning is usually recommended to preserve the appearance of fabrics made from this fiber. If machine washed, untreated regular rayons can shrink as much as 10 percent.

High Wet Modulus (HWM) rayon is a modified viscose that has virtually the same properties as regular rayon, plus high wet strength. HWM rayons can be machine washed and tumble dried and perform much like cotton in similar end uses. HWM rayons can also be mercerized, like cotton, for increased strength and lustre. The terms frequently used to describe HWM rayon in apparel include “polynosic” rayon or the trade name MODAL™.

High Tenacity Rayon is a modification of “regular rayon” to provide exceptional strength (two times that of HWM rayon). High tenacity rayon is primarily found in tire cord and industrial end uses. It may be finished, chemically coated, or rubberized for protection from moisture and potential loss of dimensional stability and strength during use.

Cupramonium Rayon is another type with properties similar to those of viscose or regular rayon. The manufacturing process differs somewhat from that of regular rayon and is less environmentally friendly. As a

result, cupramonium rayon is no longer produced in the United States.

Other types of rayon have been developed for specialized end uses. These include disposable, non-woven markets, and high-absorption rayon fibers with moisture-holding properties for disposable diapers, hygiene and incontinence pads, as well as medical supplies.

Microfibers are not a type of rayon, but rather a very fine fiber that can be manufactured from either regular or HWM rayons. Microfibers are generally less than one denier in diameter. A denier is about one-half the thickness of a fine silk fiber. Most fine rayons are 1.1 to 1.5 denier. Rayon microfibers have been successfully produced at 0.9 denier. Fabrics from microfibers are very drapable and silk-like in hand and appearance. Those made from HWM rayons will be machine washable, while those made from regular rayons will require dry cleaning or very gentle hand-washing.

Currently, two major companies manufacture rayon fiber for U.S. markets. Accordis, a British company, manufactures viscose rayon in short staple lengths and microfibers. Lenzing, based in Austria, produces viscose rayon, high wet modulus or polynosic rayon, microfibers, and long filament fibers which are used in linings and dress fabrics like taffeta. Lenzing is the only company currently manufacturing rayon in the United States. Overall, rayon is manufactured primarily in Europe and Japan.

Characteristics of Rayon

Rayon's cellulosic base contributes many properties similar to those of cotton or other natural cellulosic fibers. Rayon is moisture absorbent (more so than cotton), breathable, comfortable to wear, and easily dyed in vivid colors. It does not build up static electricity, nor will it pill unless the fabric is made from short, low-twist yarns. Rayon is comfortable, soft to the skin, and has moderate dry strength and abrasion resistance. Like other cellulosic fibers, it is not resilient, which means that it will wrinkle. Rayon withstands ironing temperatures slightly less than those of cotton. It may be attacked by silverfish and termites, but generally resists insect damage. It will mildew, but that generally is not a problem.

One of rayon's strengths is its versatility and ability to blend easily with many fibers—sometimes to reduce cost, other times for lustre, softness, or absorbency and resulting comfort. HWM rayons readily take finishes such as mercerization, Sanforization™ (shrink resistance), and permanent press.

Rayon has moderate resistance to acids and alkalis and generally the fiber itself is not damaged by bleaches;

however, dyes used in the fabric may experience color change. As a cellulosic fiber, rayon will burn, but flame retardant finishes can be applied.

Cautions

Consumers should be aware of several cautions in relation to proper use and care of fabrics made from rayon fiber. Regular or viscose rayon has *low wet strength*, resulting in loss of stability or the tendency to shrink or stretch easily when wet. Although resin-treated rayons can sometimes be hand or machine washed with success, regular rayon normally requires dry cleaning to maintain appearance and shape.

There is a finish that can be applied to make viscose rayon fabrics washable and limit shrinkage to 3 percent. It is formaldehyde-free and will not affect the hand, width, or length of treated fabrics. It can be used on challis, failles, and other fabrics that otherwise would require dry cleaning to maintain appearance.

Consumers should also note that HWM or polynosic rayon has high wet strength. Fabrics made from this fiber can usually be machine washed and tumble dried. Polynosic rayon functions and handles during use and care similarly to cotton. Unfortunately, it is often difficult to identify whether a garment is made from polynosic or viscose rayon unless identified on the label. Read labels, look for trade names, and follow care recommendations.

In some instances, polynosic or HWM rayons may be “low labeled.” This means that manufacturers have recommended dry cleaning when hand washing or machine washing would be satisfactory. Sometimes the fabric may be washable, but trims, linings, or other aspects of the garment may not be. Unfortunately, consumers take a risk when they care for a rayon garment in a manner other than that recommended by the care label.

Moisture-Sensitive Sizing and Dyes—Sizings or starches applied to rayon during finishing give body, sheen, lustre, shape, and control relaxation shrinkage. In some instances, they may enhance strength. Unfortunately, some of the sizings and dyes used on rayon are sensitive to moisture. When moisture contacts them, the sizing or dye migrates to the edge of the wet spot, and forms a “ring” on the fabric. Rain drops, splashes from tap water, as well as water-based food substances will form dark rings on these fabrics. The rings may be difficult to remove without submerging the entire garment in water. This process can cause further damage to viscose rayons, which have low wet strength.

The migration of dyes and sizings from moisture further complicates stain removal in dry cleaned garments.

Dry cleaning solvents are designed to remove oil-based stains. Water-based stains such as fruit juice and beverages, and certain foodstuffs require moisture for stain removal. While this process removes the stain, it may also cause dye or sizing migration in the rayon fabrics, leaving a water spot ring. Also, as a result of the general dry cleaning process, swirls or waves may occur on the fabric surface. This is caused by a disturbance in the sizing from moisture in steam pressing, compounded by heat and pressure associated with the process. Generally these surface disturbances cannot be completely removed.

Loss of Body—Rayon fabrics may lose body or become limp over time from abrasion or general removal of sizing during dry cleaning. Dry cleaners can apply sizings, but they seldom duplicate the effect achieved during commercial processing. Application of sizing also reduces seam slippage, ravelling, and fraying of fabrics. Since the finish is not permanent, it can result in changes in fabrics and their performance, such as loss of body, lustre, seam slippage, and ravelling.

The consumer should note that moisture-sensitive dyes or finishes are generally not applied to polynosic rayons and should not cause problems during use and care of these fabrics.

Also related to sizing application is *yellowing* of fabrics over time. Some sizings or starches oxidize and yellow with age. The problem is most noticeable on exposed areas such as collars, shoulders, and outside sleeves, especially on white or light-colored fabrics. Wet cleaning, often accompanied by bleaching will correct the problem; however, this treatment may cause additional damage from shrinkage or loss of body.

Other cautions related to rayons are *pilling*, *relaxation shrinkage*, and *fusing* of blends. Short, low-twist fibers, which contribute a soft hand to garments, rub or abrade during wear. These fibers mat together and form fiber balls or pills on the fabric surface. Pills may be “shaved” or clipped off; however, as this is done, fibers are being removed, creating a thinner layer of fabric. The problem is less likely to occur on fabrics with a hard surface and those made from longer, or higher twist yarns.

Rayon fabric is especially susceptible to relaxation shrinkage, which occurs over a period of time from routine laundering or dry cleaning. Consumers should consider this tendency when selecting garments, particularly those that are more fitted.

Because viscose rayon is less stable when wet, uneven hemlines may occur in full bias skirts or dresses made from rayon crepe fabrics. The problem can be especially bothersome in damp climates. Bias hemlines

are notorious for stretching and changing length over time, but especially so if garments are made from viscose rayon crepe. Hems in these garments may need to be re-marked and evened-up over time.

Rayon is a versatile fiber and is frequently found in blends with polyester, nylon, and acrylic—all of which are synthetics and heat sensitive. These fibers generally contribute strength, wrinkle resistance, and ease of care to rayon blends. During care, iron temperatures safe for rayon can be too hot, melting or fusing the heat-sensitive synthetic fibers. This process cannot be reversed and results in slits, tears, brittleness in the fabric, or shiny areas.

Care of Rayon

The critical element in successful care of rayon is the type of fiber. Regular or viscose rayons usually require dry cleaning for best results, while high wet modulus, high wet strength or polynosic rayons, will normally machine wash and tumble dry satisfactorily (see Fiber Types and Cautions sections). The low wet strength of untreated viscose rayon is likely to cause shrinkage and loss of body if fabrics made from these fibers are hand or machine washed. Viscose rayons are usually labeled “dry clean only.” Check and follow garment labels for care and instructions. Consumers who do not follow care instructions will have no recourse to manufacturers should damage occur during laundering.

Since many dyes and finishes applied to viscose rayon are moisture-sensitive, consumers should protect garments from contact with moisture. Raincoats should be worn on stormy days. Also, care should be used when washing hands or working in the kitchen to avoid splashing water. The problem with sizing or dye migration increases the longer the area remains damp. Spills or moisture should be blotted with absorbent cloth to remove moisture. Avoid spilling acid or alkali, such as foodstuffs or perfume, as certain dyes used on rayon are especially sensitive to these substances. Use caution or avoid treating stained areas with water. Take the garment to a dry cleaner for stain removal. Rings or darker shading caused by sizing migration and lighter areas resulting from dye migration may be permanent.

When viscose rayons can be hand washed, do so with care. Always support wet fabrics, since rayon has low wet strength and is unstable when wet. Avoid wringing moisture from fabrics. Gently squeeze out moisture and roll in a towel. Smooth and shape, then lay flat to dry. If the garments are not too heavy when wet, they can be hung on a non-rusting hanger.

When pressing regular rayon garments at home, guard against spitting by steam irons that may cause water

spots. Also, if possible, press on the wrong side or use a press cloth on the right side to avoid shine or iron imprints. Use a rayon or synthetic setting on the iron. When pressing blends, use the iron temperature for the most heat-sensitive fiber. Normally, a synthetic setting will be satisfactory.

High wet modulus or polynosic rayons can usually be machine washed or dried without special care. Blends, dark colors, and permanent press fabrics should be washed on a gentle cycle with warm water; however, 100 percent high wet modulus rayons are normally not damaged by hot water temperatures (more than 140°F). Tumble dry on a warm setting and remove immediately, or while slightly damp. Smooth and hang to reduce wrinkling. Polynosic rayons can be line dried; however, heavy items should be supported by clotheslines to avoid stretching or loss of shape.

Summary

Rayon is probably the most misunderstood of all fibers. It is not a natural fiber, yet it is not synthetic. It is

a fiber formed by regenerating natural materials into a usable form. As an inexpensive fiber, rayon has often been used in low-end, poorly constructed garments that have tarnished its reputation. The two major types of rayon, regular viscose and high wet modulus or polynosic, have created further confusion and contributed to improper care practices by consumers not aware that two fabrics with the same fiber content might require totally different methods of care.

Rayon fibers and fabrics made from them have many desirable properties. However, consumers sometimes expect performance characteristics beyond those for which rayon fibers were designed. Although rayon can look like wool, silk, cotton, or linen and is a manufactured fiber like polyester, this does not mean it behaves like or has the same properties or care requirements of these fibers. Rayon is a fiber unto itself. Consider each garment made from rayon individually when determining use and care practices.

And, always read and follow care labels for best performance.

Trade names are used for educational purposes only and with the understanding that no discrimination is intended nor endorsement implied.

The author wishes to acknowledge and express appreciation to the International Fabricare Institute, Courtaulds Fibers (now Accordis), and BASF (now Lenzing Fibers) for the reference materials prepared and supplied by these organizations, and used in the development of this fact sheet.

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