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MILDEW

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HOW TO PREVENT AND REMOVE MILDEW

Mildew is a persistent problem and a nuisance in warm, humid climates, and in many other parts of the country where the humidity level is high during summer months. It can also be a problem during the winter months when conditions are just right. To prevent mildew and eliminate it after it has formed, it is necessary to have an understanding of what mildew is, what causes it to develop, and how to stop its growth and prevent it from returning.

Although there are many varieties of mildew with many variations in growth and appearance, the information that follows is generally true for most mildew types.

WHAT IS MILDEW?

Mildew is a mold. A mold such as mildew has the capacity to decompose cellulose and therefore may ruin paper and cellulosic fabrics such as cotton, linen, ramie, and rayon if they are not protected.

Even though silk and wool fibers are resistant and most synthetic fibers are very resistant to mildew, they can be attacked by mildew if certain conditions are present.

Wood, paint, glue, and leather are also susceptible to an enzyme that decomposes organic matter and uses it for growth and reproduction. Mildew is unsightly, produces an unpleasant odor and often acts as an allergen, which can create health problems.

What is necessary for mildew to grow?

Mildew spores, or seed-like forms of mildew, exist almost everywhere. They will not grow and spread, however, unless certain conditions are met. There are many varieties of mildew, but generally the following conditions contribute to mildew growth:

-Molds thrive on organic materials like paper, leather, natural fibers, or surfaces coated with the slightest amount of organic matter such as food, grease and soil.

-The optimal temperature range for molds to grow is 77 to 86 °F (20 to 30 °C), though **some growth may occur anywhere between 32 to 95** °F (0 to 35 °C).

-Mildew requires moisture. The optimal growth range for mildew is 70 to 93 percent relative humidity (RH). RH below 70 percent inhibits most mold growth. A lower RH delays spore germination of molds, reduces the rate of mold growth, and lowers the number of cells produced, but does not stop growth and development entirely.

-Molds are aerobic in nature. That is, they require oxygen for growth.

-Light is not required for mold growth. Mold growth can continue indefinitely without light.

- Mold growth is promoted by a slightly acid condition.

CLEMSON EXTENSION

- Mold growth is inhibited by a variety of fungicides such as chlorinated phenols, copper naphthenate, or oleate.

Mold growth is slow to start and can take several months or seasons to get established. After growth begins, however, it is very rapid.

Identifying Mildew

Mildew on textiles, books, and other household materials will often be recognized by an unpleasant musty odor as well as by discoloration. Dirt on some hard surfaces such as paint, tile, or wood resembles the discoloration caused by mildew. To distinguish between dirt and the discoloration produced by mildew, put a few drops of household chlorine-bleaching solution on the discolored surface. Mildew is bleached within a minute or two, but most dirt will not bleach. Green stains on the exterior surface of buildings that appear below the shade line are usually a type of algae rather than mildew, and might require a different type of treatment to remove it. However, these will also disappear with an application of chlorine bleach. Treatment of mildew outside a home will need to be repeated from time to time in warm, humid environments.

PREVENTING MILDEW GROWTH

Since mildew spores are almost always present, the three best ways to control mildew growth are to eliminate the source of food, deprive the mildew of sufficient moisture, and/or to keep the temperature too low for fast mildew growth (below 77 °F).

Keeping Things Clean

Many materials in homes provide a ready source of nutrients that mildew can feed upon. Mildew can feed on natural fibers used in clothing and furnishings, paper materials that have not been treated, and glues such as those sometimes used in book bindings, starch left in clothing, and materials in some grout. Some other materials such as ceramic tile, glossy paint, and glass do not support mildew growth when they are clean. However, the slightest amount of soil on their surface will supply the necessary nutrients for mildew growth. The organic residue of some soaps left on shower stalls and shower curtains provide the required nutrients for mildew growth. Smoke and volatile cooking oils also settle on walls and furnishings to provide a soil on which mildew will grow.

Walls, closets, basement areas, clothing, and other textiles where mildew is likely to grow should be kept clean.

Controlling the Temperature

Since mildew thrives at temperatures between 77 and 86 °F, summer conditions will encourage mildew growth. Air conditioning will reduce the interior temperatures of homes; however, these temperatures may not be uniformly low enough to stop mildew growth if the air is fairly humid. Areas within cabinets and closets or behind draperies may be warmer, and humidity will be trapped unless the doors are louvered or left ajar— for improved ventilation.

Controlling Moisture in the Air

Since a high relative humidity (RH) is required for mildew growth, we need to understand what RH is and how it is related to temperature. Technically, RH is the ratio of the partial pressure of the actual water vapor in the air to the pressure of totally saturated air at the same temperature.

Warm air can hold more moisture than cool air. For example, air at 80 °F can hold twice as much moisture as air at 60 °F. If air in a house was 60 °F and saturated with moisture (100 percent RH), and then was heated to 80 °F without a change in moisture, the RH would be about 50 percent.

Reducing Moisture in the House

An ounce of prevention is worth a pound of cure, and with mildew problems this is especially true. Water vapor moves quickly from a high humidity area to a low humidity area. Think about how rapidly condensation forms on a jar taken from a refrigerator.

Vapor pressure differences cause moisture to move through cracks, down the fireplace chimney, through open doors and windows as well as walls, ceilings and floors. It continues moving into closets, cabinets, and drawers. Once moisture is diffused into wood or other materials it is very difficult to drive out.

Reducing Moisture from Outside

Most of South Carolina, and especially the Coastal area, is very humid. The temperature and humidity levels are often high enough to cause mildew to flourish. When this warm, humid air enters a house, it has the capacity to support mildew growth. For example, if 85 °F outside air with 60 percent RH or higher enters a house and is cooled by walls and furnishings without air conditioning to 80 °F, the RH will be 70 percent or higher. These conditions are right for mildew growth.

Reducing Moisture Produced Inside

Moisture accumulates inside a home from normal household activities: breathing, bathing, cooking, and cleaning. A family of four at home for 12 hours a day would produce12 pints of water as moisture by breathing. A shower would add another half-pint of water directly to the air, and moisture left in the shower stall and on towels would add even more. A bath in a tub would add a little less moisture than a shower.

Cooking might add another five pints. Washing clothes, dishes, and floors would also add moisture. The total amount of moisture a family of four would add to a house each day is about 50 pints or 6¼ gallons. Ways to reduce some of the moisture from these sources can come from common sense, such as cooking with covers on pans, taking cooler, shorter baths or showers, and use of properly sized and installed exhaust fans or other ventilating and vapor removal methods.

Air Treatment

Air conditioners remove moisture from the air as the air is cooled. Air is blown over cooling coils, and since cool air can't hold as much moisture, some of the moisture condenses on the coils and runs to a drain. The heat absorbed from the air by the air conditioner is carried by a refrigerant to coils outside the house where the heat is released.

The longer an air conditioner is operated, the greater the amount of moisture that will be removed. While air conditioning during humid weather, do not set the air conditioner fan to run continuously. This is because moisture just removed by the cooling coils will be put back into the air, therefore keeping the air more humid.

An air conditioner unit too large for the area it cools might not operate long enough to remove much moisture. Even though the home is cool, enough moisture might remain to produce mildew in areas with little air movement.

Where no air conditioning is provided, a dehumidifier can be used. When using an air conditioner or a dehumidifier, windows and doors must be kept closed. A dehumidifier collects moisture from the air in much the same manner an air conditioner does. However, a dehumidifier has both the heating and cooling coils inside, so there is little temperature change in the air. The moisture removed is collected either in a container that must be emptied periodically or by a hose that runs into a drain.

Ventilation

The function of ventilation in inhibiting mildew growth is to replace moist air with dry air. Open windows and doors or exhaust fans will serve this purpose, if the outside air is drier than the inside air.

When trying to control moisture during the air conditioning season, windows and doors probably should not be opened at night unless the outside air is at least 15 °F lower than inside temperatures. As much as 7 or 8 pints of water can be brought into the house. The air conditioner would have to work much harder the following day to remove the moisture.

In the home, moisture will get into closets, cabinets, and drawers during humid, non-air-conditioned periods. The moisture is released very slowly when room air dries out, either from drier outdoor air or air conditioning. Louvered doors on closets help, but where there is a moisture problem doors and drawers should be left ajar to allow them to ventilate. If a closet, cabinet, or drawer space reaches the point of smelling musty, it and its contents should be cleaned and thoroughly dried.

Moisture Absorbent Chemicals

In small, enclosed areas where temperature and humidity cannot be controlled by air conditioning or dehumidifying, desiccants can be used. Desiccants are materials such as silica gel or alumina that can be placed in an open container and used on the floor or a shelf of a closet. The closet door should be kept closed when using desiccants. These materials absorb moisture up to half of their weight. Once they become saturated they will still feel dry, but will remove no more moisture. To be used again desiccants must be heated in a vented oven at 300 °F for several hours. They will then be dry and can be cooled and replaced in the closet to continue removing moisture.

Calcium chloride granules also can be used to remove excess moisture from an enclosed area. Granular calcium chloride can hold twice its weight in water. As it absorbs water, it liquifies and cannot be reused. The granules should be placed on a screen over a container that can catch the liquid as it forms. Calcium chloride will damage fabrics with which it comes in contact. Calcium chloride is sometimes combined with other materials to keep it from liquifying as it absorbs moisture. Follow package instructions when using.

CHEMICAL MILDEW GROWTH INHIBITORS

Commercial fungicidal products in pressurized cans provide some mildew protection. Check the label on the container to see what it claims to do and for instructions on how to use it safely and effectively.

PROTECTIVE SPRAYS

Water-repellent and soil-resistant spray treatments inhibit mildew growth by reducing moisture or food available. Carefully read instructions on the label to understand the claims made, and to know how to use the product safely and productively. Avoid over-wetting, which could add to the problem.

SUMMARY

The two most effective methods of avoiding mildew problems are keeping things clean and dry. Ventilation moves air and water vapors around rather than allowing stagnation and condensation. It assists evaporation and also removes spores.

Once mildew appears, it should be removed as soon as possible and precautions should be taken to prevent its return. The chart on pages 5-7 contains instructions for dealing with mildew problems on commonly affected surfaces.

FOR MORE INFORMATION

Mildew may indicate excessive moisture levels under and around a house, which could lead to more serious problems of damage to the house structure. For more information, see the leaflets listed in the "Publications Directed Toward Moisture Control in Residences," available from your county Extension office.

CAUTION!

When cleaning with chlorine bleach solution, wear rubber gloves and protect skin and nearby surfaces. Rinse well with clean water. Avoid contact of the solution with the skin and eyes or prolonged breathing of the vapors. Protect plants from these chemical solutions.

WARNING!

Do not mix bleach with ammonia or with any detergents or cleansers containing ammonia! Mixed together the two are a lethal combination, producing chlorine gas, the effects of which are similar to mustard gas. In several instances people have died from breathing the fumes from such a mixture. Many household cleaners contain ammonia, so be extremely careful with what types of cleaners you mix bleach.

MILDEW REMOVAL AND PREVENTION

ITEM	TO REMOVE MILDEW	TO PREVENT MILDEW GROWTH
• Clothing	Begin as soon as mildew is discovered. Brush it off outdoors. Sun and air clothes before laundering or dry-cleaning. To remove mildew stains that remain, try one of the following. Test fabrics for colorfastness first. 1. Moisten the stain with a mixture of lemon juice and salt. Lay the garment in the sun to bleach. Rinse thoroughly. 2. Mix 1 to 2 tablespoons of a powdered non-chlorine bleach containing sodium perborate or potassium monopersulfate with one pint of water. Use the water temperature recommended for the fabric or color. Sponge or soak the stain. Let stand 30 minutes or longer, then rinse well. Old stains may need to soak overnight. 3. Mix 2 tablespoons of liquid chlorine bleach with 1 quart warm water. Sponge or soak stain for 5 to 15 minutes and then rinse. Do not use chlorine bleach on silk, wool, or spandex fibers.	Keep fabrics dry. Never let damp or wet clothes lie around. Dry or wash them. Spread out damp towels and washcloths to air. Stretch out wet shower curtains. Dry washed clothes quickly. Clean clothing before storing. Soiled clothes are more likely to mildew than clean ones. Do not leave starch in clothes for long storage periods since molds feed on starch. Air the clothes in closets by opening doors and shifting them to provide air space around them. Commercial mildew inhibitors are available in hardware and other paint stores. In severe cases, these inhibitors may prove to be effective. Since strong chemicals are used, read the label instructions carefully to see what the inhibitors can do and how they can be used safely.
• Leather Goods	After testing for colorfastness, wipe leather with a cloth moistened with diluted alcohol* (1 cup denatured alcohol to 1 cup water). Dry where the air is circulating. If mildew remains, wash quickly with thick suds made from a mild soap or detergent, or saddle soap. Wipe with damp cloth and air dry. Polish leather shoes, etc., with a good wax dressing. After removing mildew, air or sun the leather product thoroughly.	Store shoes in a dry, well-ventilated place. Buy a commercial mildew-inhibitor spray and use it regularly as directed. Apply a thin coat of wax dressing to cleaned leather goods. Some waxes have anti-fungal ingredients. (These may discolor white or light colored leathers.) Never put away damp leather shoes or other damp leather items. If one piece becomes mildewed, remove it from others until cleaned.
•Books, Paper	If books or paper are damp, dry in a breezy place. Take outside and brush off any loose mold with a clean, dry cloth. For damp wall paper, heat or air condition the room to thoroughly dry plaster and paper. Remove stains by wiping gently with a cloth that was soaked with suds and wrung out, and then rinse the stain with clear water. After removing the stain, pat the area dry with a soft, dry cloth. For stubborn stains, a chlorine bleach and water solution can be used. Rinse with clear water on a cloth and dry with a soft cloth as above. Try not to wet paper and do not scrub. Spread pages of books fan-wise to dry in an airy place. If still damp sprinkle cornstarch between leaves to dry. Leave on several hours, then brush.	Air circulation and heat help keep books and paper dry. Use a small light bulb or hang a mildew inhibitor or desiccant inside an enclosed bookcase. Sprays containing fungicides can be used. If books are not kept in dry shelves or boxes, respray frequently. Avoid over-wetting with spray, as extra moisture could add to the problem.
•Upholstery, Mattresses and Rugs	Vacuum or dust off mildew. Be sure to dispose of vacuum bag, as it will contain mildew spores. Dry the item in the sun if possible. If mildew remains, sponge with a cloth moistened with 1 cup denatured or rubbing alcohol* mixed	Periodically dust and air your mattresses and upholstery and inspect for mildew. Spray with a fungicide aerosol spray that gives mildew protection and dry thoroughly.

* Test for colorfastness before using the alcohol/water sponge.

MILDEW REMOVAL AND PREVENTION

ITEM	TO REMOVE MILDEW	TO PREVENT MILDEW GROWTH
	with 1 cup water. Dry thoroughly. Rugs and carpets that still show mildew should be shampooed and dried as quickly as possible. Sunning is a big help. Sometimes the cause of mildew on carpets is moisture from the floor or padding underneath. If this is the case, the carpet should be removed and the cause of the moisture determined and corrected.	Sunlight is a mildew inhibitor. A good sunning is an excellent idea for mattresses, rugs, and upholstery whenever possible. Upholstered furniture, drapery fabrics and carpets are often treated at the factory with fluorocarbons that repel water. These fabrics will stay drier and inhibit mildew growth.
• Painted Surfaces	**INSIDE** -- Scrub mildewed paint or plaster with a solution of 3/4 cup household bleach to 1 gallon water. Rinse with clean water and allow to dry thoroughly before painting or papering. Size paper and use a wallpaper paste that is mildew resistant.	Select a paint that has a mildewcide added to it by the manufacturer. Paint can be even more mildew resistant by adding commercial mildewcides, which are available at local paint stores. Be sure to follow directions on the product label.
	FOR WOODEN* FURNITURE: Remove mildew with vacuum cleaner. Clean with a soft cloth dipped in a mild detergent and water solution and wrung almost dry. Work with a small area at a time, rinsing with a cloth dipped in clean water and wrung almost dry. Dry each area thoroughly before going on to the next area. Mildew often feeds on the dirt and greasy film that accumulates on furniture. If a white film develops after this cleaning, wax buildup has probably occurred. Use a furniture cleaner to remove the layers of wax. Finally, re-apply a thin coat of paste wax.	Use heat and air circulation to keep clean wood dry. Keep furniture clean. Dust and soils in the air from food cooking and automobiles settle on furniture. These provide food for mildew. Oil-based paints mildew more readily than water-based paints, while soft latex paints mildew much more readily than hard enamel paints. Flat paints mildew much more easily than gloss paints. Latex paints can be applied to damp surfaces, permit moisture below to evaporate and withstand mildew. Alkyd paints can withstand scrubbing (to remove mildew) better than latex, but must be applied to perfectly dry surfaces. Alkyd paints are also better on any surface where water may collect. Paints with zinc oxide inhibit mold growth more than paints with titanium pigments.
	FOR WOODEN* WALLS: Scrub wood with a mixture of 4 to 6 tablespoons washing soda to 1 gallon of water. Do a small area at a time. Rinse with clear water and dry quickly. If mildew still appears, use a mixture of 4 to 6 tablespoons trisodium phosphate and 2 tablespoons household ammonia per gallon of water. Be sure to test for colorfastness. Never mix ammonia and bleach. It produces a deadly gas.	
	OUTSIDE -- Scrub mildewed paint with 1/3 cup detergent, 1 quart household bleach, and 3 quarts warm water. Then treat the surface with a commercial fungicide. Repaint with a mildew-resistant paint. Spraying asphalt-shingle roofs with ordinary household chlorine bleach and water not only prevents algal discoloration on new roofs, but also cleans roofs that are already discolored. The same simple, inexpensive treatment is also effective on fiberglass roof panels like those used on greenhouses.** Clean roofs can be kept free of discoloration by spraying them annually with a mixture of one part liquid chlorine bleach (5.25 percent sodium hypochlorite***) and nine parts water, at the rate of 1 gallon per 30 square feet. Discolored roofs can be cleaned immediately by using	Outside, get rid of damp soil or heavy vegetation near walls. Rearrange plantings so that there is good air circulation between them and the house. Make sure cement blocks or wood walls are sealed to prevent moisture buildup.

* Water will damage wood if allowed to stay on it. Always test the cleaner before using. Work with small areas that can be rinsed and dried before moving on.

** Chlorine bleach damages some roofing materials. Test before using.

*** Important—not all liquid chlorine bleaches are of this strength. This strength must be used in these formulas.

MILDEW REMOVAL AND PREVENTION

ITEM	TO REMOVE MILDEW	TO PREVENT MILDEW GROWTH
	a mixture of three parts liquid chlorine bleach (5.25 percent sodium hypochlorite***) and one part water at the rate of 1 gallon per 30 to 50 square feet. Furthermore, the roofs will remain free of discoloration if sprayed annually with the 10 percent solution, beginning the third year after the concentrated treatment. Another solution for roof staining: Shingles containing small zinc granules are available. Zinc granules are a fungicide as they dissolve. Good for new and replacement roofs. About $2 per square more than other shingles. Discolored roofs should be treated in strips, starting at the peak and working toward the eaves. Treated roofs are slippery when wet, so workmen should walk on a ladder or other suport laid on the roof and secured at the peak. They should also be careful to avoid skin contact with the liquid chlorine bleach solution. Any shrubs or plants below the eves should be draped with plastic to prevent contact with the solution that drips from the roof, and any solutin reaching the ground should be diluted by spraying it with water. If the house has rain gutters along the eaves, a garden hose laid in the gutters can be used to dilute the solution as it drips from the roof. When cleaning with chlorine bleach use rubber gloves. Avoid contact with the skin and eyes or prolonged breathing of the vapors. Remember to protect plants from these chemical mixtures.	Commercial fungicidal products will inhibit mildew growth but may be toxic for humans and pets. Follow instructions for using carefully. Sealants are available to put on clean, dry wood. They penetrate the wood surface and prevent moisture from penetrating wood.
•Unpainted Wood	DECKS AND WOOD SHINGLES - Scrub surfaces with a solution of 1 quart of bleach to 3 quarts of water. Rinse thoroughly. Commercial cleaners are also available. Read directions carefully to know what the cleaners will do, how to use them, and what precautions should be taken.	Keep the area as clean and dry as possible. Use a vented exhaust fan to pull moist air out of the bath after showering or bathing. Be sure the fan is vented to the outside, not into the attic or crawl space. If it is cool outside, open a window in the bathroom. If humid outside, it will be better to use the fan to pull air conditioned air through the bathroom to dry it out after bathing.
•Bathroom and Basement	Scrub surfaces with a solution made from 1 quart liquid chlorine (household) bleach, 2 tablespoons liquid detergent that does not contain ammonia and 9 quarts of water. Use a brush or old toothbrush to clean grout. Let surface dry, then rinse with plenty of water. If shower curtains can be washed by machine add chlorine bleach with the detergent. Use a warm water rinse for plastics and hang while warm for wrinkles to fall out.	

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