

Discoloration of House Paint – Causes and Cures

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Under normal conditions paint deteriorates by first soiling or by a slight accumulation of dirt. Next, a flattening stage develops when the coating gradually starts to chalk and erode away. Unfortunately, paint is sometimes discolored by mildew, blue stain, wood extratives and metals long before repainting is necessary. In these cases, a simple repainting will not correct the problem for long. Furthermore, excessive painting is expensive, and a build-up of paint on the wood surface may lead to cross-grain cracking or other severe paint failures. If the old paint surface is not properly cleaned before repainting, intercoat peeling may also result.

MILDEW

Mildew is probably the most common cause of house paint discoloration (Figure 1). Mildew is a form of stain fungi or microscopic plant life. The most common species are black, but some are red, green, or other colors. It grows most extensively in warm humid climates but is also found in cold northern states. Mildew may be found anywhere on a building, but it is most common on walls behind trees or shrubs where air movement is restricted. Mildew may also be associated with the dew pattern of the house. Dew will form on those parts of the house which are not heated and will cool rapidly such as eaves and the ceilings of carports and porches. This dew then provides a source of moisture for the mildew.

Mildew fungi can be distinguished from dirt by examination under a high-power magnifying glass. In the growing stage, when the paint surface is damp or wet, the fungus is characterized by its threadlike

growth. In its dormant stage, when the surface is dry, it has numerous egg-shaped spores; by contrast, granular particles of dirt are irregular in size and shape. A simple test for the presence of mildew on paint can be made by applying a drop or two of household bleach solution (5 percent sodium hypochlorite) to the stain. Mildew will usually bleach out in one or two minutes. Stain that does not bleach is probably dirt. It is important to use fresh bleach solution. Bleach deteriorates upon standing and loses its potency.

How Paint Makeup Affects Mildew

Some paints are more vulnerable than others to attack by mildew fungi. Zinc oxide, a common paint pigment in top coats, inhibits the growth of mildew. Titanium dioxide, another common paint pigment, has very little inhibiting effect on mildew.

Considering oil-base paints, mildew progresses more readily on exterior flat house paint than on exterior enamel. Paints containing linseed oil are very susceptible to mildew. Of the available water-base paints, acrylic latex is the most mildew resistant. Porous latex (water-base) paints without a mildewcide applied over a primer coat with linseed oil will develop severe mildew in warm, damp climates.

Mildewcides are poisons for mildew fungi. The paint label should indicate if a mildewcide is present in the paint. If it is not present, it can sometimes be added by the local paint dealer. Paint containing mildewcides, when properly applied to a clean surface, should prevent mildew problems for some time.



Figure 1. Mildew is most common in shaded or protected areas.

Prevention and Cure

New Wood Surfaces

In warm, damp climates where mildew occurs frequently, use a paint containing zinc oxide and a mildewcide for top coats over a primer coat which also contains a mildewcide. For mild cases of mildew, use a paint containing a mildewcide.

Painted Wood Surfaces

Before repainting, the mildew must be killed, or it will grow through the new paint coat. To kill mildew and to clean an area for general appearance or for repainting, use a bristle brush or sponge to scrub the painted surface with the following solution:

1/3 cup household detergent*

1 quart (5 percent) sodium hypochlorite (household bleach)

3 quarts warm water

*See warning on last page.

When the surface is clean, rinse it thoroughly with fresh water from a hose. Avoid splashing the solution on yourself or on shrubbery or grass as it may have harmful effects. Before the cleaned surface can become contaminated, repaint it with a paint containing a mildewcide.

WATER-SOLUBLE EXTRACTIVES

In cross section, many trees contain a dark central core called heartwood and a light colored outer band called sapwood. Dark colored heartwood contains water-soluble extractives, while sapwood does not. These extractives can occur in both hardwoods and softwoods. Western red cedar and redwood are two common softwood species used in construction. They both contain large quantities of

extractives. The extractives give these species their attractive color, good stability and natural decay resistance, but they can also discolor paint. Woods such as Douglas-fir can also have occasional extractive staining problems.

When extractives discolor paint, moisture is usually the culprit. The extractives are dissolved and leached from the wood by water. The water then moves to the paint surface, evaporates and leaves the extractives behind as a reddish-brown stain.

Diffused discoloration from wood extractives is caused by water which comes from rain and dew that penetrates a porous or thin paint coat. It may also be caused by rain and dew that penetrate joints in the siding or by water from faulty roof drainage and gutters.

Diffused discoloration is best prevented by following good painting practices. Apply a water-repellent preservative or water repellent to the bare wood before priming. Use an oil-based, stain-resistant primer or a latex primer especially formulated for use over staining woods. Do not use porous paints such as flat alkyds and latex directly over the staining-type woods. If the wood is already painted, clean the surface, apply an oil-based or latex stain-resistant primer and then top coat. Before priming and repainting, apply a water-repellent preservative or water repellent to any wood left bare from peeling paint.

A run down or streaked type of discoloration can also occur when water-soluble extractives are present (Figure 2). This discoloration results when the back of the siding is wetted, the extractives are dissolved, and then the water runs down the face of the painted boards from the lap joint.

Water which produces a run down discoloration can result from water vapor within the house moving to the exterior walls and condensing during cold weather. Major sources of water vapor are humidifiers, unvented clothes dryers, showers, normal respiration, and moisture from cooking and dishwashing. Run down discoloration may also be caused by water draining into exterior walls from roof leaks, faulty gutters, ice dams, and wind driven rain and snow at louvers.

Run down discoloration can be prevented by reducing condensation or the accumulation of moisture in the wall. New houses or those undergoing remodeling should have a vapor barrier (continuous 6 mil polyethylene sheet) on the inside of all exterior walls. If a vapor barrier is not practical, the inside of all exterior walls should be painted with a vapor resistant paint. Water vapor in the house can be reduced by using exhaust fans vented to the outside in bathrooms and kitchens. Clothes dryers should be vented to the outside and not to the crawl

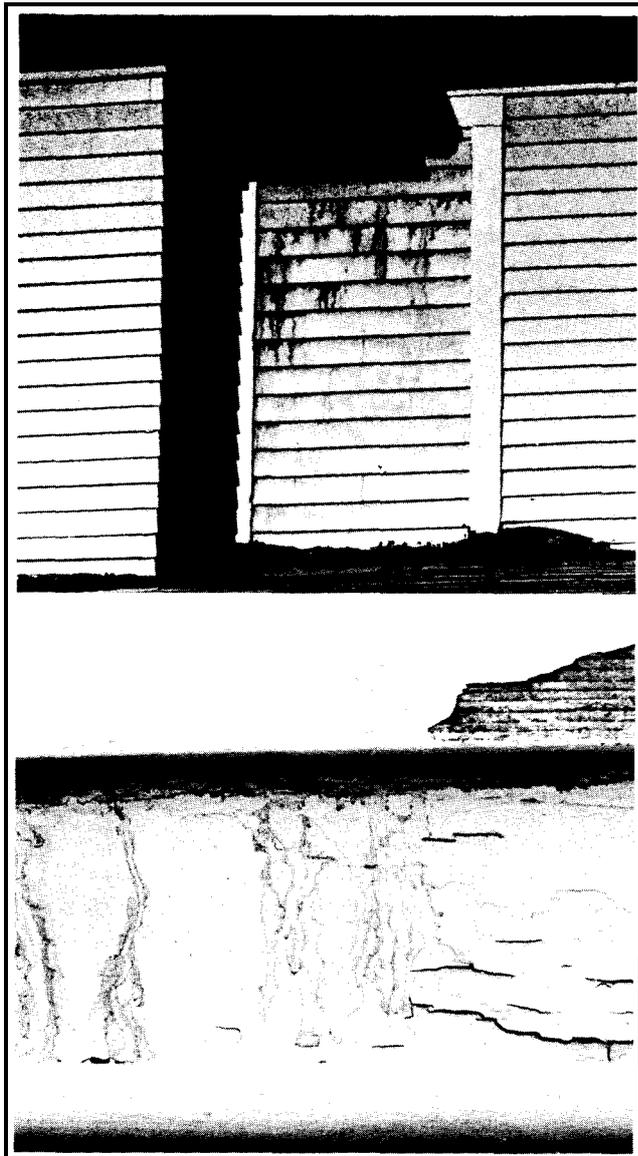


Figure 2. A streaked type of water soluble extractive discoloration can result from water wetting the back of one piece of siding and then running down on the front of the next piece,

space or attic. Avoid the use of humidifiers. If the house contains a crawl space, the soil should be covered with a vapor barrier to prevent migration of water into the living quarters.

Water from rain and snow can be prevented from entering the walls by proper maintenance of gutters and the roof. Ice dam formation can be prevented by installing adequate insulation in the attic and by providing proper ventilation. For gable roofs, vents should be provided at the gable ends and should be about 1/300 of the ceiling area. More positive air movement can be obtained if additional openings are provided in the overhang. Hip roofs should have air inlet openings in the louvers and several smaller roof vents located near the edge.

Removing Discoloration

If discoloration is to be stopped, moisture problems must be eliminated. Run down discoloration will usually weather away in a few months. However, discoloration in protected areas can become darker and more difficult to remove with time. In these cases, wash the discolored areas with a mild detergent soon after the problem develops. Paint cleaners are effective on darker stains.

BLUE STAIN

Blue stain is caused by microscopic fungi that commonly infect the sapwood of all woody species. Although microscopic, they produce a blue-black discoloration of the wood. Blue stain does not weaken wood structurally, but conditions which favor stain development are also ideal for serious wood decay and paint failure.

Wood in service may contain blue stain, and no detrimental effects will result so long as the moisture content is kept below 20 percent. Wood in properly designed and well maintained houses usually has a moisture content of 8-13 percent. However, if the wood is exposed to moisture such as rain, condensation or leaking plumbing, the moisture content will increase, and the blue stain fungi will develop.

To prevent blue stain from discoloring paint, follow good construction and painting practices. First, do whatever is possible to keep the wood dry. Provide an adequate roof overhang, and properly maintain the shingles, gutters and downspouts. Window and door casings should slope out from the house, thus allowing water to drain away rapidly. Use a vapor barrier on the interior side of all exterior walls to prevent condensation in the wall. Vent clothes dryers, showers and cooking areas to the outside, and avoid the use of humidifiers. Untreated wood should be treated with a water-repellent preservative, then a nonporous mildew-resistant primer and finally at least one top coat also containing a mildewcide. If the wood has already been painted, remove the old paint and allow the wood to dry thoroughly. Apply a water-repellent preservative, and then repaint as described above.

A 5 percent sodium hypochlorite solution (ordinary household bleach) may sometimes remove blue stain discoloration, but it is not a permanent cure. Be sure to use fresh bleach since its effectiveness can diminish with age. The moisture problem must be corrected if a permanent cure is expected.

IRON STAIN

Rust may be one type of staining problem associated with iron. When standard ferrous nails are used on exterior siding and then painted, a red-brown discoloration may occur through the paint

and immediate vicinity of the nail head. To prevent rust stains, use corrosion-resistant nails. These include high quality galvanized, stainless steel and aluminum nails. Poor-quality galvanized nails can corrode easily and, like ferrous nails, can cause unsightly staining of the wood and paint. The galvanized heads on nails should not "chip loose" as they are driven into the wood. If rust is a serious problem on a painted surface, the nails should be countersunk, caulked, spot primed and then top coated.

Unsightly rust stains may also occur when standard ferrous nails are used in association with any of the other finishing systems such as solid color or opaque stains, semitransparent penetrating stains and water-repellent preservatives. Rust stains can also result from screens and other metal objects or fasteners which are subject to corrosion and leaching (Figure 3).

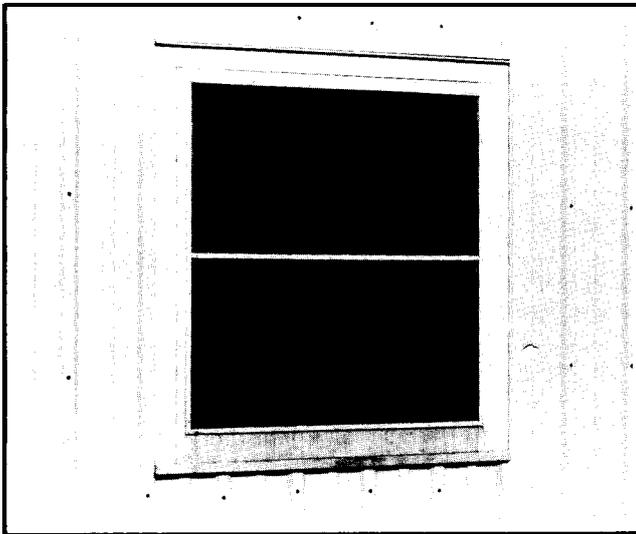


Figure 3. Metal screens and fasteners can corrode and later discolor paint as leaching occurs.

A chemical reaction with iron resulting in an unsightly blue-black discoloration of wood can also occur. In this case, the iron reacts with certain wood extractives to form the discoloration. Ferrous nails are the most common source of iron for chemical staining (Figure 4), but problems have also been associated with traces of iron left from cleaning the wood surface with steel wool or wire brushes. The discoloration can sometimes become sealed beneath a new finishing system.

Oxalic acid will remove the blue-black chemical discoloration providing it is not already sealed beneath a finishing system. The stained surface should be given several applications of the solution containing at least one pound of oxalic acid per gallon of water, preferably hot. After the stains disappear, the surface should be thoroughly washed



Figure 4. Blue-black discoloration resulting from the use of ferrous nails.

with warm, fresh water to remove the oxalic acid and any traces of the chemical causing the stain. If all sources of iron are not removed or protected from corrosion, the staining problem may reoccur. Caution should be exercised when using oxalic acid since this chemical is toxic.

CHALKING

Chalking results when a paint film gradually weathers or deteriorates, releasing the individual particles of pigment. These individual particles act like a fine powder on the paint surface. Most paints chalk to some extent. This phenomenon is desirable since it allows the paint surface to be self-cleaning. However, chalking is objectionable when it washes down over a surface with a different color (Figure 5) or when it causes premature disappearance of the paint film through excess erosion.

Discoloration problems from chalking can be prevented by selection of a paint with the appropriate chalking tendencies. The manner in which a paint is formulated may determine how fast it chinks. Therefore, if chalking is likely to be a problem, select a paint which the manufacturer has indicated will chalk slowly.

When repainting surfaces which have chalked excessively, proper preparation of the old surface is essential if the new paint coat is expected to last. Scrub the old surface thoroughly with a detergent solution to remove all old deposits and dirt. Rinse thoroughly with clean water before repainting. The use of a top quality oil-based primer may be necessary before latex top coats are used. Otherwise, the new paint coat will peel. Discoloration or

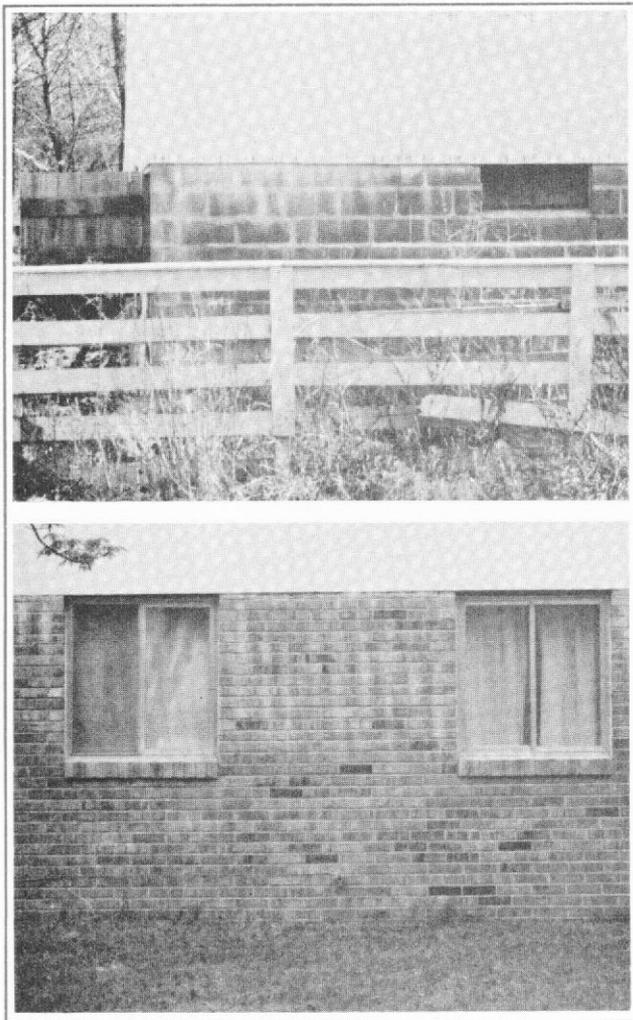


Figure 5. Some paints or stains chalk badly and can discolor a lower surface as they wash down over it.



Figure 6. Brown discoloration of paint from resin exudation from a knot.

chalk which has run down on a lower surface may be removed by vigorous scrubbing with a good detergent. This discoloration will also gradually weather away if the chalking problem on the painted surface has been corrected.

BROWN STAIN OVER KNOTS

The knots in many softwood species, particularly pine, contain an abundance of resin. This resin can sometimes cause paint to peel or turn brown (Figure 6). In most cases, this resin is "set" by the high temperatures used in kiln drying construction lumber.

Good painting practices should eliminate or control brown stain over knots. Apply a good primer to the bare wood first. Then follow with two top coats. Do not apply ordinary shellac or varnish to the knot area first as this may result in early paint failure.

ADDITIONAL READINGS

(Available from the Forest Products Laboratory, Box 5130, Madison, Wisconsin, 53705)

1. "Forest Products Laboratory Natural Finish." *USDA Research Note FPL-046*. 1979 (revised). 8 pp.
2. Painting and Finishing - Chapter 16 from the *Wood Handbook: Wood as an Engineering Material*. USDA Agr. Handbook No. 72. 1974. 13 pp.
3. "Wood Finishing: Finishing Exterior Plywood, Hardboard and Particleboard." North Central Regional publication 132 or Forest Products Laboratory publication, number to be assigned.
4. "Wood Finishing: Selection and Application of Exterior Finishes for Wood." North Central Regional publication 135 or Forest Products Laboratory publication, number to be assigned.
5. "Wood Finishing: Paint Failure Problems and Their Cure." North Central Regional publication 133 or Forest Products Laboratory publication, number to be assigned.
6. "Wood Finishing: Water Repellents and Water-Repellent Preservatives." *USDA Research Note FPL-0124*. 1978. 8 pp.
7. "Wood Finishing: Weathering of Wood." *USDA Forest Service Research Note FPL-0135*. 1975 (revised). 4 pp.

Slide Presentation

Exterior Finishes for Wood. Bureau of Audio Visual Instruction, Box 2093, Madison, Wisconsin 53701. (Purchase Price \$23.00).

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WARNING

Do not mix bleach with ammonia or with any **detergents or cleansers containing ammonia!** Mixed together the two are a lethal combination, 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.

Use caution with wood finishes which contain pesticides. When used improperly they can be injurious to man, animals and plants. For safe and effective usage, follow the directions, and heed all precautions on the labels. It is advisable to wear unlined protective gloves and to cover nearby plant life when using any material containing pesticides. Do not use any wood finish containing pentachlorophenol indoors.

Avoid spraying a pesticide wherever possible. Drift from a pesticide, applied as a spray, may contaminate the surrounding environment.

Store finishes containing pesticides in original containers under lock and key—out of reach of children and pets — and away from foodstuffs. Follow recommended practices for the disposal of surplus finishing materials and containers.

Note: Registrations of pesticides are under constant review by the Environmental Protection Agency and the Department of Agriculture. Use only pesticides that bear a Federal registration number and carry directions for home and garden use. Since the registration of pesticides is under constant review by State and Federal authorities, you should consult with a responsible State agency as to the current status of the pesticides discussed in this report.

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