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Dry rot in buildings:

What is dry rot and why should I be concerned about it?

A Church Growth Trust Practical Guide
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CONTACT DETAILS

Church Growth Trust

1 Manor Farm Barns, Baines Lane, Seaton, Oakham, Rutland, LE15 9HP

01536 201339

enquiries@churchgrowth.org.uk

www.churchgrowth.org.uk

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Triton Systems, Units 3-5 Crayford Commercial Centre, Greyhound Way, Crayford, Kent DA1 4HF Tel: 01322 318830 www.tritonsystems.co.uk

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1.0 Introduction

Dry rot is just about the most serious kind of decay that can be experienced in a building. In the UK it is caused by the fungi *Serpula Lacrymans* (formerly known as *Murulius Lacrymans*) Dry rot occurs when wood is allowed to remain damp over long periods.

Left unattended and ignored, dry rot can spread from the source of the outbreak to other parts of the building, or even to adjoining buildings, where new outbreaks can occur; thus, substantially increasing the extent and effects of the decay. If the outbreaks are not eradicated fully or correctly, new outbreaks can occur at a later date.

A large portion of the cost associated with eradication is not the treatment or eradication itself, but the consequential costs of having to replace infected materials and finishes within the building, such as floor finishes, plaster, decorations etc to prevent further outbreaks.

If dry rot is found or suspected, it is important to act quickly before the scale of the problem escalates to a greater level. The main problem when discovering dry rot is not knowing how serious or extensive the outbreak is, until further investigations are made. Like ice-bergs, the initial visible signs of dry rot can sometimes only be the tip, with the decay having spread substantially in non-visible areas, including spreading through or across non-timber materials, such as concrete floors, brick walls, or behind plaster.

The actual treatment and sterilization of infected areas is a specialized activity involving chemicals. Such remedial work is best left to specialist contractors, who usually offer an insurance-backed guarantee and should not be tackled by inexperienced persons.

2.0 The difference between dry rot and wet rot

Most people will be familiar with the effects of wet rot. Rotting fence posts caused by prolonged exposure to damp ground are the classic example. Timber subject to wet rot will usually be sodden and break away by hand or with a tool. For wet rot, cutting out and replacing the infected timber and eradication of the source of moisture will usually suffice. For dry rot, greater care and more drastic measures are required.

Dry rot is very different to wet rot in that it can readily spread to surrounding materials and other parts of the building, whereas wet rot remains localised to the affected area. After timber infected with dry rot has been removed new and further outbreaks can occur again, if the building is not correctly sterilised.

Most timber within buildings in the UK will have an air-dry moisture content of 18% to 20%. Decay will not generally occur in timber with a moisture content of less than 20%. For dry rot to develop, the optimum moisture content is between 30% to 40%. Other wet rot fungi generally have a higher optimum water content, such as 40% to 50%. If timber has a very high moisture content (e.g. saturated timber), the moisture content can be too high for dry rot to commence but, where the moisture begins to reduce, e.g. along the length of a saturated timber, the moisture can drop to the optimum for dry rot to develop. This is why the name of dry rot is apt, as it causes decay in timber at lower moisture levels than wet rot. It is also known as dry rot because it seeks out dry timber to attack.

In cases where it is difficult to assess if an outbreak is dry rot or wet rot, the use of a specialist moisture meter with probes pressed into the timber will assist by determining the moisture content of the timber.

3.0 The effects of decay by dry rot

Dry rot digests the part of the wood which gives it strength and stiffness. In the advanced stages of decay caused by dry rot, the timber will crumble readily into dry powder. The timber no longer has the fresh or resinous smell of sound wood. The wood will often shrink and become light and will split. Characteristic of splitting through dry rot are deep longitudinal and cross cracks which form a cuboidal appearance of cracking (appendix figures 2 & 5). However, some wet rot fungi can produce a very similar cuboidal cracking.

Soundness of the timber may not be a concern for such items as door frames, architraves, skirtings or similar parts of the building. It goes without saying that the cracking, distortion and, eventually, breaking down to dust will be of major concern for structural elements such as floor boards, floor and ceiling joists, roof structures, staircases etc.

4.0 Causes of dry rot

The primary cause of an outbreak of dry rot occurring is when the moisture level of the wood rises above the norm of 20%, often accompanied by poor ventilation and sometimes condensation.

Common causes of water penetration or raised moisture levels are:

- Broken or leaking gutters or downpipes - This may not just affect the area immediately adjoining the gutters. The leak could cause water to splash onto or run down walls at a lower level, thus saturating brickwork.
- Blocked gutters - These too can overflow saturating the structure at a lower level.
- Leaking roof flashings or valley gutters
- Inadequate damp-proof course - Causing rising damp to affect lower floors etc
- High ground levels - Adjoining ground levels which are higher than the floor level or damp-proof course of the building can give rise to lateral damp penetration through walls.
- Poor or broken render - Walls which rely upon render or similar finishes to provide waterproofing of walls can also suffer from lateral damp penetration if render is cracked, broken, or becomes pervious.
- Porous or broken chimneys and their flashings.
- Poor pointing of brickwork or perished brickwork.

Common Causes of lack of ventilation:

- Insufficient air bricks to ventilate floors provided in original construction - Note that plastic airbricks will usually give a much greater free vent area than older terracotta air bricks.
- Air bricks have become blocked - Blocked by debris, blocked by raised ground levels or planting beds, blocked by subsequent extensions, alterations, porches etc.
- Lack of roof ventilation - Installation of additional roof insulation without introduction of ventilation above can give rise to condensation within the roof.

5.0 How dry rot develops and spreads

Where wetting of timber has occurred, still air will encourage establishment and spread of the fungus, particularly where these conditions are maintained for long periods.

The fungus *Serpula Lacrymans* requires wood or other cellulosic materials as a food source and sets out to find it.

5.1 Mycelium

The fungus grows by elongation and by the branching of delicate filaments known as hyphae, which can often resemble cob-webs. These initially penetrate the wood and exude substances to break down and dissolve the walls of the wood cells which form the structural elements of the wood tissue. The products of this breakdown are then absorbed and used as food. It will also then seek to spread to find other sources of nutrient.

The overall mass of the hyphae is known as the mycelium. It can appear as fluffy white growths resembling cotton wool. It can also present itself in sheets or skins of grey or white matted material (appendix figure 5). The mycelium can also often have tinges of lilac or patches of lemon-yellow colouring.

5.2 Strands

As the mycelium advances further from the initial outbreak, branching strands are formed behind it. These can be 2 to 8mm diameter and grey or white in colour (appendix figure 3). The strands transport the nutrients from the original food source to the advancing edge of the mycelium. This enables the fungus to traverse over in-organic materials from which it can extract no nutrients. The mycelium can therefore traverse across solid floors, through brickwork and stonework and particularly through hidden voids. Extensive spreading can take place behind plaster and similar finishes, without being visually detected by users of the building (appendix figure 4).

The life-line of the branching strands can mean that the edge of the outbreak can often spread many metres, from one floor level to another, or from roof down to lower rooms. It can also spread through party walls into adjoining buildings.

If the food source of the original outbreak becomes exhausted, the advancing fungi would die, but this is rarely the case as the advancing fungi will usually find another food source in other timber it encounters in its path.

The strands can be very similar in appearance to strands generated by some wet rot fungi, such as Cellar Rot, which are generally not as thick. However, if dry-rot strands are dried overnight they become brittle, a useful way of identification against wet rot strands.

5.3 Fruiting bodies

When well established and other conditions are suitable its flowers by producing fruiting bodies. These are fleshy plate-like brackets or pancakes, similar in appearance to those seen on trees in woodland. They develop a series of shallow folds, which bear the seeds or spores. The centre becomes rusty red as the spores develop (appendix figure 6).

The fruiting bodies develop on the face of the infected timber but can often form under floors and in concealed spaces. They may then first visually appear from behind skirting boards or on ceilings.

Spotting the fruiting body can often be one of the first signs of dry rot that a building owner may notice, as the initial outbreak and mycelium are usually in concealed spaces. The bad news is that, once a fruiting body has developed, the outbreak is usually well-established.

5.4 Spores

The spores are microscopic and very light. When they are released by the fruiting body, they can travel considerable distances within a building, through floor and roof voids, up soil pipe and pipe boxings etc.

Being small and light they are easily carried and distributed by wind, drafts, on clothing, shoes and small animals such as rats, mice and insects. Within a few days, the spores can be rapidly transported throughout the building and to other buildings by footwear and clothing etc.

Upon reaching their new location, should the conditions be right, the spores fall onto a piece of wood, germinate, send off hyphae into the wood, and the whole process regenerates again, but potentially in many more locations. Cases of spores generated from fruiting bodies in the cellar have been known to travel up three floor levels to the roof via pipe boxings and voids for services.

6.0 First signs of dry rot: What to look for

- Splitting, shrinking, cracking of wood, particularly cuboidal cracking, although some wet rots also exhibit cuboidal cracking (appendix figure 2)
- Wood becomes soft, crumbly and changes colour to brown. Blunt instruments can readily be pushed into the surface or body of the wood.
- On painted timber surfaces, such as skirtings, the paintwork may remain intact but the surface behind becomes wavy, warped and deformed (appendix figure 1).
- Floor boards can dip into corners or edges
- Mycelium and strands can be found to be spreading behind concealed surfaces, such as plaster, wall panelling etc (appendix figure 4).
- Fruiting bodies appear growing through plaster, in corners, on timber surfaces, or from behind timber surfaces (appendix figure 6). They can also form in masonry joints or voids, internal and external.
- Presence of a damp, musty smell or mushroom-like odour.
- The presence of red/terracotta coloured dust suggests the spores have already been released from fruiting bodies. This can often go un-noticed or is cleaned up/vacuumed by cleaning staff, unaware of the implications. The spores can also be found in concealed areas such as airing cupboards, behind bath panels, in cupboards or pipe boxings.

7.0 Determining the full extent of the outbreak

To facilitate full eradication, it is absolutely essential that the full extent of the outbreak is determined without doubt. This will usually involve substantial intrusive investigation and exposure of the building structure. Typically, this will include taking up of skirtings, taking down of ceilings, removal of wall plaster or external render, breaking through into concealed voids or roof spaces. Depending upon the nature and location of the outbreak the stripping out can also extend to fixtures and fittings such as kitchen units and will often involve isolations of service installations, such as plumbing, heating and electrical installations to enable the safe stripping out to proceed.

Once what is considered to be the full extent of the outbreak has been determined, finishes such as plaster etc must be removed for at least 1m beyond the furthest visible extent (appendix figure 4); firstly, to ensure the full extent has been determined and secondly to facilitate treatment in the area surrounding the outbreak.

Removal of any infected timber, mycelium, strands, fruiting bodies or spores encountered during the stripping out is not advised until the property has been inspected by an eradication specialist. Removal before they have had opportunity to inspect would lead to a loss of evidence or information as to the nature and extent of the outbreak.

8.0 Treatment of dry rot

Successful treatment is achieved by firstly eliminating the cause of moisture which allowed the outbreak to establish, drying out the building, removing infected materials, dealing with the fungus and then, finally, repairing the damage it has caused.

8.1 Eliminate causes of dry rot

It is essential that the building defects which have caused the outbreak of dry rot are identified and remedied. The most common causes have been previously identified in Section 4, but this is not an exhaustive list.

Sources of damp penetration need to be eliminated. This may be a simple matter of replacing defective gutters or downpipes but, in the case of rising damp, a new damp-proof course may be required, which will often take the form of chemical injection by a specialist. Where lack of ventilation has contributed to the outbreak, this also needs to be addressed and additional ventilation introduced. If the outbreak is in a suspended timber floor it will often be necessary to install additional air bricks or air ducts to improve ventilation.

The extent of the work to remedy the cause of the outbreak will obviously vary from property to property, but after remedial work has been carried out the area needs to be fully dried out. If timber floors are affected, drying out can be assisted by temporarily removing some of the floor boards to provide cross ventilation.

8.2 Remove and dispose of infected materials

All timber which has come into contact must be carefully removed. As a precaution timber within one metre of the extent of the outbreak is usually removed. This is why ascertaining the full extent of the outbreak is so important. As a general rule infected timber beams, joists, rafters etc are cut back to approx 450mm beyond the infected section, if they are not being completely removed.

In older buildings it was common to install timber blocks into the brickwork, to provide fixings for skirting boards, dado rails, picture rails etc and their removal should not be overlooked. If they are left in position, as the building dries out, they can reach the critical moisture content for a new outbreak of dry rot to develop. Similarly, it was common to use timber lintels in older properties and timber lintels in the vicinity of the outbreak will need replacement, usually with more modern in-organic materials such as concrete or steel.

Where possible any decayed timber should be removed and bagged before being carried through the building to avoid spreading the fungus. This is particularly important where spores or fruiting bodies are present. Cases have been known where, eighteen months after removal, new outbreaks of dry rot have manifested themselves along the route by which decayed timbers were carried through the building.

Decayed timbers should be burnt, preferably on site if space and regulations permit.

Any organic debris such as paper, cardboard etc within floor zones, or other cavities should also be removed.

As a general rule no materials which have come into contact with the fungus should be re-used elsewhere in the building, unless expert advice is taken. Any bricks removed which bear live fungus should not be re-used elsewhere or broken up for hardcore unless they have been sterilised or stored until all fungus has died off.

8.3 Treatment and sterilisation

It is strongly recommended that the treatment and sterilisation process is undertaken by a specialist who has appropriate experience and equipment. For this reason, this paper will not discuss in detail the chemical and fungicides used or the methods or rates of application.

Any structural timbers in the vicinity which it has not been possible to remove must be sterilised, with particular attention to cut ends.

Brickwork and other masonry affected by dry rot needs to be sterilised. Sterilisation by heating e.g. with a blow lamp is one method but is now rarely used as it is very time consuming and there is an obvious fire risk. Sterilisation is usually undertaken by chemicals.

Surface application of a water-based solution by brush or spray is the simplest method. Where walls are very thick, or dampness cannot be fully eradicated the wall can be treated by irrigation, involving drilling a series of holes into the wall and irrigating with a chemical solution, either under gravity or by pressure injection. Another method of sterilisation is to drill holes in the wall and insert plugs or paste which then diffuses into the wall but, if the wall is too dry, there may be insufficient moisture for the chemical to fully diffuse into the wall.

8.4 New replacement materials

Any new timbers installed after eradication of a dry rot outbreak must be preservative treated prior to installation. Failure to install treated timber could nullify any warranty given by the specialist remedial contractor. Again, particular attention should be given to treating any ends which have been cut on site with a compatible brush-applied treatment.

If damp conditions are expected to persist, e.g. in cellars, timber should be impregnated with a copper/chrome/arsenic solution. If dampness is not expected to persist, then treatment with an organic solvent by dipping or double vacuum process can be used. These processes are standard industry processes in the UK and should therefore be readily available.

Most developers and builders in the UK will not use treated timber for internal joinery, such as door frames, skirtings, architraves and the like as these are not structural items. For replacement after dry rot eradication, care should be taken to ensure that such secondary joinery has also been preservative treated.

All new timber should be dried, having a moisture content of less than 22%.

9.0 Warranties and approved contractors

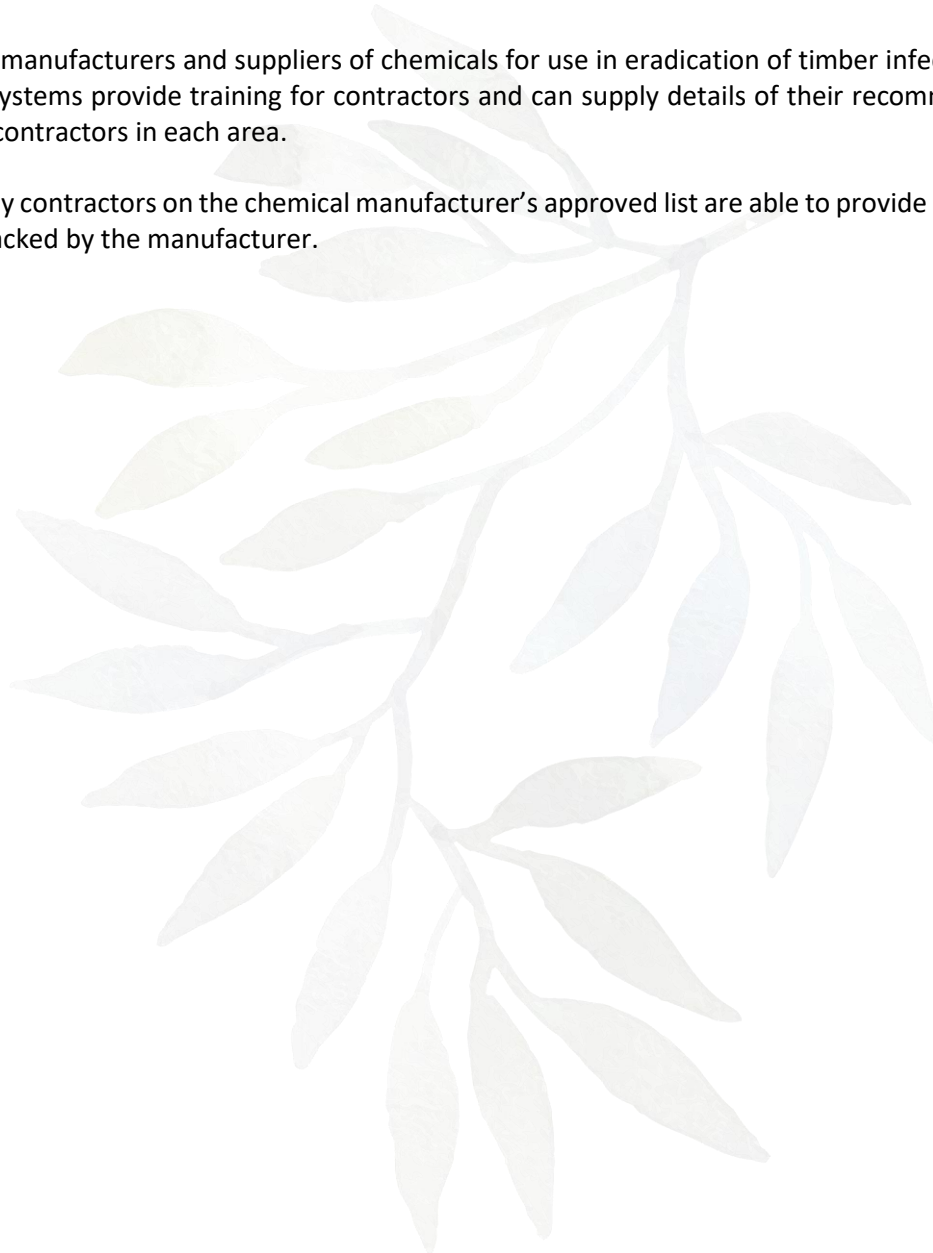
Most reputable specialist companies undertaking dry rot eradication will offer a warranty against further outbreaks. Details should be checked. Check whether the warranty is given only by the company concerned; in which case it becomes of no value if the company ceases to trade. Better warranties are backed by an insurance policy against this eventuality.

Also check exactly what the warranty covers. Some warranties only cover the cost of re-sterilising or re-treating. If this is the case, does the warranty only cover the area which has been treated, or does it cover future outbreaks in other areas?

Some warranties do not cover consequential costs e.g. the cost of removing and re-instating plaster, fixtures or fittings, redecoration, floor finishes etc. Put together, these can considerably more cost than the sterilisation itself, particularly if there are consequential costs of not being able to use the building for several weeks or months, such as the need to have temporary accommodation, whilst remedial work is carried out.

Reputable manufacturers and suppliers of chemicals for use in eradication of timber infection, such as Triton Systems provide training for contractors and can supply details of their recommended or approved contractors in each area.

Usually only contractors on the chemical manufacturer's approved list are able to provide a warranty which is backed by the manufacturer.



10.0 Appendix



Figure 1

Dry rot often develops in areas out of sight, such as behind door frames or skirting boards. One of the first visible signs of dry rot can be the warping or distortion of the surface of timbers as the timber is attacked from behind.

Figure 2

Cuboidal cracking of the wood into brick-shaped pieces with cracks both along the grain and across the grain is characteristic of dry rot, although some wet rot can have a similar appearance. The wood appears as if charred but not as darkly coloured.

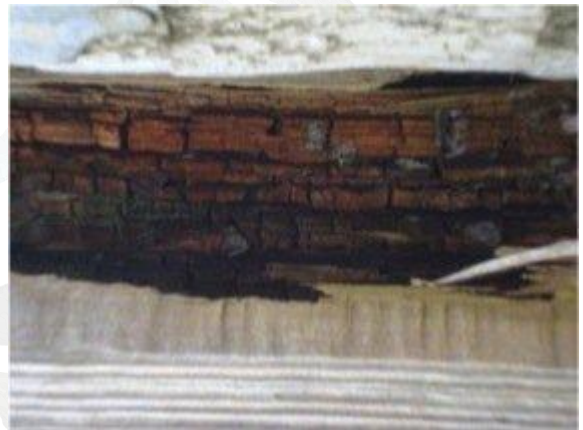


Figure 3

Dry rot mycelium and strands extend across or through inorganic materials such as brickwork in search of timber as a food source.



Figure 4
Dry rot strands often travel in hidden areas, such as behind plaster. It is necessary to remove the plaster to ascertain the full extent of the outbreak

Figure 5
The mycelium develops as thick silver-grey sheets or skins as shown here, usually showing patches of lemon yellow or tinges of lilac. In damper or darker locations, it may appear as soft white cushions with cotton wool appearance. Note the cuboidal cracking of infected timber in the lower section of the photograph.



Figure 6
Fruiting bodies are fleshy and soft shaped like pancakes or brackets. When they are ready to fruit, they bear masses of tiny rusty red spores which settle on surfaces with the appearance of rust-coloured dust.

Photographs kindly supplied by Triton Systems, manufacturers and suppliers of chemicals and materials for timber and damp-proofing treatments.