

Black Plague or Osmosis in Swimming Pools

What is Black Plague?

Black Plague is a black or brown staining of the gelcoat or poolcoat surface and typically manifests itself in the shape of a comet. Closer inspection reveals a blister through which a black tar-like liquid oozes.

The black stains will appear when the following conditions prevail:

- Porosity or air voids in the laminate and / or poolcoat caused by poor consolidation of the laminate. This condition is aggravated if the resin gels too fast or entrapped air cannot be seen because the laminating resin is pigmented.
- Free chlorine in the pool that diffuses into the voids with the water. Unfortunately shock treating the pool with high concentrations of Chlorine would only aggravate the problem.
- Presence of unreacted cobalt accelerator. Usually caused by under cure of the laminate or poolcoat. When too little catalyst is used e.g. on a hot day then unreacted cobalt accelerator remains in the laminate. All room temperature cured unsaturated polyester resins contain a cobalt accelerator. When this accelerator reacts with the chlorine from pool treatment chemicals it forms the black tar-like compound.
- High water temperature will speed up the osmosis and chemical reaction. Heated pools will therefore be more susceptible to the problem especially if the incorrect resin system is used.

The black plague or osmosis will only occur under certain conditions as listed above.

The following recommendations are advised.

Causes

The main cause of the black plague or osmosis are conditions that would result in premature blistering of the gelcoat or poolcoat through accelerated osmosis.

The following factors will affect the formation of the Black Plague:

1. Quality of materials

The type of gelcoat, poolcoat, resin and glass can affect the blister resistance of the coated laminate. Under normal room temperature conditions (under 30°C) blistering is best prevented by using Iso / NPG gelcoats or Poolcoats followed by a similar Iso "skin-coat" and then a good quality laminating resin. For the best result use a resin, which is a thixotropic Iso laminating resin.

A good quality general purpose laminating resin can also be used. It is recommended that when doing so care must be given when rolling out the air bubbles as this is where the problem starts and that a NPG poolcoat or gelcoat is used as this product has a higher chemical resistance.

The use of powder-bound glass fibre is recommended as well as the use of tissue with the skin-coat.

2. Technique of Construction

The manner in which the laminate is constructed is critical to its blister resistance.

- Ensure that the temperature of the resin and coating is above 15°C before commencing. Below this temperature the laminate will not cure sufficiently and a permanent state of undercure may result.

- The material should be missed prior to use but excessive and turbulent mixing should be avoided to prevent the incorporation of air.
- Catalyst levels should be maintained between 1.5 to 2.5% of the resin or coating. The catalyst should be mixed in thoroughly to ensure even cure.
- The thickness of the coating is proportional to its blister resistance. A minimum wet film thickness of between 600 – 800 microns of gelcoat or poolcoat is recommended. Double gelcoating or poolcoating is not recommended as this could result in air entrapment or voids in the middle of the gelcoat or poolcoat.
- The gelcoat should be allowed to cure for at least two hours before laminating. Leave longer in cold weather. Gelcoat is used in a mould and is applied before the resin and fiberglass, where when relining a pool one would lay the fiberglass and resin before the poolcoat.
- The resin laminate should be thoroughly consolidated to remove all the air. It should be noted that air bubbles are most noticeable if the resin is not pigmented. The use of pigmented resin for laminating is not recommended, as entrapped air is difficult to see and therefore remove. It is also not possible to see where the gelcoat or poolcoat has been applied too thin.
- The whole system should then be left for at least one week to cure before filling with water.

3. Maintenance

The maintenance and operating conditions of the pool cannot be controlled by the manufacturer and is left entirely to the owner. Unfortunately, ignorance or neglect by the owner can result in conditions conducive to accelerated blister formation.

- **Elevated temperatures**
Osmotic blistering will be accelerated if the pool water is heated and the temperature of the water is allowed to go above 30°C. The heated water softens the coating and increases all chemical reactions as well as the rate of osmosis. To minimize this the pool water temperature should not be allowed to exceed 30°C. For conditions where the water temperature is maintained continuously above 30°C only heat and chemical resistant resins (e.g. based on vinyl ester) and coatings (e.g. based on NPG) should be used.
- **Laminate construction**
All polyester resins shrink during cure. At elevated temperatures the curing of the laminate is accelerated and with it, the shrinkage of the laminate. It is therefore advisable that pool linings should be constructed with at least one layer of 450gsm glass mat. Cosmetic linings applied directly onto marbelite or concrete surfaces will have poor adhesion with rapid shrinkage of the resin and will delaminate if not done in the proper way. If water gets behind the laminate reverse osmosis will occur with the result that blistering will be accelerated.
- **Excessive use of chlorine containing chemicals**
Excessive use of chlorine compounds in water treatments together with elevated temperature conditions will accelerate the formation of black plague. The use of strong alkali cleaners will also attack and weaken the coating surface.

Cure

Unfortunately the only solution for a pool that has black plague is to remove all the material containing air entrapment and voids and re-do the lining.

Or

Leave the pool until more black stains cease to appear. This is to allow all the unreacted cobalt accelerator to react. If a new layer of poolcoat is applied pre-maturely then the reaction underneath will continue and eventually the black stains will re-appear.

Grind off the poolcoat and completely remove all evidence of the black stains. Apply a skin coat layer using an Iso / NPG resin and a fiberglass tissue of minimum weight of 25gsm. Then apply an Iso/NPG poolcoat.

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