Pool Tip #36: Hydrogen Peroxide Oxidation

Many pools across the country, particularly warm water therapy pools, have installed UV light / hydrogen peroxide, or polyhexametamethylene biguanide / hydrogen peroxide sanitation - oxidation systems for the primary purpose of avoiding the use of halogens (chlorine, iodine or brominated compounds) when treating patients who are sensitive to commonly used pool chemicals.

Hydrogen peroxide (H$_2$O$_2$), used for pool water treatment in a 35% concentration by weight in solution, is an unstable, highly reactive, non flammable, colorless liquid primarily used as an oxidizing agent in pools in combination with ultraviolet light or PHMB sanitizers. Hydrogen peroxide should not be used as a stand alone water sanitizer or bactericide, even though it is commonly used in 3% concentration as a topical antiseptic to combat selected microorganisms. Hydrogen peroxide has a relative oxidation power, based on chlorine as a reference, of 1.3. There is a synergistic effect when used with UV in which high oxidation potential hydroxyl free radicals (with a relative oxidation power, based on chlorine as a reference, of 2.05) are created. Through oxidation, hydrogen peroxide reduces organic nutrients in pool water which then prevents bacterial establishment and growth. Its use improves pool water clarity by reducing, breaking down or eliminating some suspended and dissolved organic matter in the water.

A hydrogen peroxide residual is usually maintained in the 30 to 40 ppm range in most low use pools, but as high as 100 ppm in some heavily used, high bather load to water volume ratio therapy pools and spas. Water can also be shocked with hydrogen peroxide to react with organic matter, improve clarity and eliminate odors. Levels must be closely monitored, because hydrogen peroxide dissipates rapidly from aerated or agitated pool water.

A few words of caution -- hydrogen peroxide cannot be used as an oxidizer in a pool with D. E. filters. Hydrogen peroxide will cause diatomaceous earth to dissolve. Hydrogen peroxide will also remove chlorine from pool water, so it should not be used in pools treated with chlorine. Concentrations in excess of 100 ppm in combination with long contact times can lead to corneal irritation. Hydrogen peroxide can decompose in the presence of contaminants, high temperatures or sunlight. Although hydrogen peroxide is non flammable, if it is allowed to decompose or it comes in contact with organic contaminants and oxidizable material, oxygen may be liberated, spontaneous combustion or explosions may occur and materials may burn -- but this is unlikely with proper storage and handling. Hydrogen peroxide should be stored in a mechanically ventilated chemical storage room.
with ample space to allow air circulation, in clean approved containers which are secondarily contained, stored away from heat and in a way that prevents contamination with dirt, metals or organic matter. According to the American Conference of Governmental Industrial Hygienists (ACGIH), the threshold limit (TVL) is 1 ppm. Precautions should be taken when handling (use safety goggles, wear protective clothing, and neoprene gloves and avoid inhaling or contact with skin), as is true with any strong oxidizer. It should be fed into the pool water with an automatic chemical feeder, tied to a pH/ORP controller, in order to maintain recommended levels necessary to maintain a minimum 750 mV ORP.

In high concentrations of 50% or so, hydrogen peroxide can be used to bleach mineral stained pool plaster. It’s used to bleach mineral stained hair of blonde/gray haired bathers, and the fur of zoo polar bears who have been swimming in improperly maintained pools with high dissolved metal concentrations. And, (here’s some real trivia) when mixed with chopped horseradish, it can remove phenols or carbolic acid from polluted water.