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Trichloramine in the air of indoor pools in Bavaria

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Abstract

Swimming and bathing are very popular activities. Without doubt they have a lot of positive effects and one would wish that they were practised more often. The health benefit has been stated in numerous cases over the time, but the adverse effects should be considered, too. Public swimming pools control the quality of their swimming pool water to ensure a microbiologically and chemically safe environment for the swimming pool user. In Germany, but also in other countries there exist technical rules, which help to achieve this goal.

We always have to keep in mind that the normal bather is not sterile. A human being sheds a lot of bacteria, which can be the source of infections in other bathers. Fecal accidents can cause the swimming pool manager a lot of trouble, because high bacterial densities are released into the water and may be difficult to remove. If parasites are involved, it is even more challenging, because they are highly resistant against chlorine and on the other hand the minimal infective dose is low. Above that, in swimming pools biofilms can develop and can also be the source of infections. The surveillance of waterborne infections in the US states clearly that this is not a minor problem. However, the etiologic agents suggest that there may be often deficencies in the water treatment. The surveillance of our own routine samples showed that the adherenece to microbiological standards (in this case German standards) is fairly good, but improvements would be welcome.

In some countries the sole or main objective in swimming pool water treatment is the application of a disinfectant, usually chlorine. A disinfectant should ideally meet following requirements: it should inactivate microorganisms effectively and rapidly; it should have an oxidizing capacity for contaminants; be effective, but not toxic to humans; be easily measured on-site, on-line and dosed automatically and it should be handled safely. The commonly used disinfectant is chlorine in all its forms. Some countries also use bromine. Ozone and UV radiation do not have a disinfection capacity in the pool itself and have to be combined with another disinfectant. In Australia silver and copper ionisation has been used as an alternative disinfectant. The bad experience with this water treatment method gave rise to an Australian guideline in which the efficacy of disinfectants is tested. This guideline is the basis of a draft OECD guideline on the same subject. We in Germany do not agree with all points, but the discussion is still ongoing.

The concentration of disinfection byproducts should be minimized in swimming pool water and air due to the possible adverse health effects. Besides the well-known DBP like THM quite a bunch of other DBPs has been detected by the chemists. The health effect of these “new” DBPs has jet to be ascertained. Chlorate and bromate are other well-known contaminants of swimming pool water. To this day they are not regulated in the German technical rules, but the discussion has focused on them during the last months.

In order to reduce DBPs effectively or to avoid their production it is necessary to improve the water treatment. Filtration is a major water treatment step and is well known to remove organic material. The addition of coagulant enhances the filtration efficacy. In addition to a conventional coagulant it is advisable to include the use of activated carbon in the treatment process. Especially the precursors of DBPs can be reduced by this treatment step so that it is included in all technical rules concerning swimming pool water treatment in Germany. The filter material used conventionally is sand, but other technologies are up-coming. In quite a few swimming pools membrane filtration has been installed. The manufacturers argue often that a treatment of the whole volume stream will not be economically feasible. They favoured in discussions a split stream treatment, where the rest of the water is merely disinfected. There have been experimental set-ups to test the result of this variation in water treatment. It could be shown that activated carbon is a necessary addition to improve the water quality. However, depending on the percentage of the split stream considering the total volume stream an increase in the concentration of particles could be seen in the pool water and after the water treatment step. The nature of these particles and their significance concerning the bather’s health is the subject

of discussions. Clear is, when modelling is applied to swimming pool water treatment that it can take a very long time to remove point source contaminants. Therefore good hydraulics are essential in swimming pool water treatment.