

Cleaning and disinfection of the fresh water system on board the Windjammer Sea Cloud

Chemical cleaning and subsequent disinfection of pipes and storage containers on ships and offshore sites are essential in maintaining hygienic conditions. Piping and water storage container may develop biofilms and scaling within a short time and thereby compromising the quality of the fresh water supply on board. Example: Every three months the freshwater system on board the Sea Cloud is checked, cleaned and disinfected by trained personnel and once a year while staying at ports the whole system including pipes and container is cleaned by the professional multi-step flushing procedure.

May it be washing your hands or cleaning dishes and surfaces - sanitation is a part of everyday routines in virtually all areas of modern life. However, there are still areas that do not get the attention they deserve, despite the potential harmful consequences. On passenger and container ships, insufficient sanitation of the fresh water supply and low quality port water can be serious sources of infection [1]. It is therefore of paramount importance to ensure regular check-ups, cleaning and disinfection routines for fresh water tanks and the distribution system on board.

Contamination and poor maintenance lead to biofilm, sludge and scaling

If left unchecked internal surfaces of pipes and water tanks will relatively quickly be covered with microbial growth (biofilm) and, as a result of water hardness, scaling. If scaling is not removed in a timely manner, it is likely to enhance biofilm development further because it provides both nutrition and optimal attachment conditions for microbes. Biofilms may contain a variety of microbial life including bacteria, fungi, viruses and amoeba all of which may pose a health threat. Sludge may accumulate if fresh water tanks are contaminated with seawater or bilge water¹, which in most cases is a result of faulty design, e.g. when inspection covers of fresh water tanks are below bilge water level¹. Cross-contamination with bilge or seawater also increases the risk of microbial contamination in particular when sewage is involved. Water-borne infections on ships are commonly caused by enterotoxigenic *E. coli* or norovirus [1,2]. Depending on inspection stringency in some ports either the

1 bilge water refers to water that accumulates in the bottom of the ship and may contain sewage, seawater and other components from the ship's water system



Source: Korinexan

The Sea Cloud II: Modern cruise liner with historic charm

water itself or storage or distribution systems may already be of poor hygienic quality and will consequently also contaminate on-board systems. The World Health Organisation (WHO) identified the transfer from shore to ship as a third possible contamination route for fresh water if vessels, tanks or pipes for transfer are insufficiently maintained or protected from environmental input [3].

Water source and treatment affects quality and composition

Fresh water is usually boarded in different ports and often varies greatly in quality and composition. The quality in terms of how it is treated (e.g. filtering, disinfection, deionization) depends on local or national regulations, whereas the composition and parameters such as hardness, pH and content of organic compounds also greatly depends on soil properties and the actual source of the water. By seeping through different layers of rock, water takes on minerals including calcium and magnesium both of which are responsible for the degree of hardness. Especially in areas rich in limestone, gypsum or dolomite the water contains higher amounts of calcium and magnesium making it hard. Water that is won in areas rich in basalt, sandstone or granite and surface water from lakes, streams and rivers are generally soft. Especially high temperatures promote the formation of calcium carbonate in water, which leads to the familiar yet irritating scaling in water kettles or coffee makers but also in pipes and water heaters on ships.

Installing a softening plant or an ion exchanger to remove the minerals is generally regarded as the method of choice and has proven useful. The efficacy of limescale protection devices on the other hand remains to be fully demonstrated specifically for those using electric or magnetic fields. The mechanism proposed is to stabilize calcium and magnesium and thereby preventing scaling without removing the minerals from the water. An exception are devices working with nanocrystals or seed crystals for which an effect on limescale build up has been shown. However, even fresh water storage and distribution systems using this technology require regular cleaning since scaling cannot be prevented completely.

The pH of the water depends on various factors most of which the ship owner has only limited influence on. The interior material of new pipes (concrete, cement mortar, fibre cement, spun concrete) as part of the distribution system on shore, often exhibits a high alkalinity and thus raises the pH of the water during transfer. This can cause a significantly reduced efficiency of certain disinfectants, in particular the commonly used chlorine and hypochlorite.

Cleaning and disinfection – but right

Efficient and professional cleaning and disinfection of pipes and other parts of the fresh water system are essential requirements for hygienic operation. Unfortunately, the idea seems to persist that disinfection (of the water or the pipes) alone is sufficient to ensure proper sanitation. However, there is mounting evidence showing that a professional cleaning



Equipment for cleaning on board

prior to disinfection is required and should not be omitted for the sake of time saving to remove biofilm and solid particles such as scaling from internal surfaces. This holds true for newly installed as well as continuously or only intermittently used fresh water systems.

Internal surfaces of pipes are cleaned to create normal flow rate, which in comparison to installing new pipes is less cost intensive and takes less time. Using the right method – for instance, multi-step flushing combining specialized and complementing products – this can be achieved within a day or even a few hours.

Given the aforementioned range of and often alkaline pH, it is more advisable to use chlorine dioxide as a disinfectant rather than chlorine or hypochlorite (also known as bleach). Unlike hypochlorite, chlorine dioxide is still efficient at high pH-values, while at the same time it does not leave the typical taste and odour of chlorine, thus making the consumption of fresh water more agreeable.

In addition, the CARELA group designed a dosing system for water conditioning (CAREbox, patent pending) that allows long distance monitoring based on machine-to-machine (M2M) technology and can therefore be used worldwide. The system can also be used to disinfect hygienically unacceptable water immediately after transferring it from port onto the ship. If required the korinexan® service team is able to provide support from the distance without travel expenditure.

Source: korinexan



Fresh water tank during professional cleaning

Routine check-ups and cleaning of pipes and tanks prevent costly restoration or re-installation

As a crucial component of fresh water hygiene in maritime and inland navigation, the fresh water distribution system should be checked and cleaned at regular intervals – at least once a year, or better two to four times a year. This will help prevent health risks for consumers caused by hygienic problems and avoid high follow-up costs.

Ship owners should, whenever possible, during installation or maintenance works visually check the interior of pipes to make sure they are aware of the pipes' condition at all times. This will allow them to react in a timely manner should it be required. It will always be more economic to clean when scaling and biofilm are still relatively scarce and recent as compared to having to remove firm impurities or fouling that is already causing hygienic problems or may even require installing new pipes.

Years of experience in the field have shown that consequently performed regular hygienic cleaning and subsequent disinfection (multi-step flushing) of fresh water storage tanks and distributing pipes can help reducing or even avoiding continuous disinfection of the fresh water. This promotes the wellbeing and hygienic experience of passengers and crew members by raising the actual and perceived fresh water quality. Notable shipyard and shipping companies have long since acknowledged these requirements. They rely on the CARELA group based in Germany that specializes in the development

and production of professional cleaning agents and disinfectants for waterworks and the water industry. Its subsidiary korinexan®, with its division ships & marine & offshore, supports shipyard operators and ship owners with a professional cleaning service to meet their hygienic demands for fresh water storage and distribution systems.

Cleaning and service assignments in the seaports of Singapore, Hamburg, Kiel, Rostock, Rotterdam, Copenhagen, Genoa, Shanghai and Dubai are regularly and routinely completed for major shipping companies. In addition, the fresh water systems of inland navigation ships cruising and crossing the Rhine, Danube, Neckar, and Lake Constance and Lake Geneva, to name just a few, are regularly cleaned to high hygienic standards with korinexan® multi-step flushing.

Aboard the windjammer Sea Cloud II

The Sea Cloud sailing ships offer high-end cruises for a selective number of passengers who expect high standards and quality in all aspects on board the ship. To adequately fulfill these expectations with regard to the quality of fresh water, the system is routinely cleaned and disinfected every three months. The korinexan® multi-step flushing was specifically designed to comply with the time-limited demands of ships and offshore sites. There is a two-layered approach to efficient and successful sanitation: crew members of the Sea Cloud were trained and instructed by korinexan® to independently and within a short time inspect, clean and disinfect emptied fresh water storage tanks while the ship is on cruise. Once a year during unloading or maintenance work a korinexan® team of qualified personnel uses professional multi-step flushing to conduct a comprehensive cleaning of the whole fresh water system including all piping from the beginning to the final outlet in the passengers' cabins. Subsequent sampling through independent national or local authorities confirm a consecutively high fresh water quality. Passengers unaccustomed to this quality of fresh water, e.g. from the US, are genuinely impressed and do not seem to miss the taste of chlorine that is so common in some regions. "Highly recommended", says Capt. Adam Pazdzioch of Sea Cloud Cruises in Hamburg.

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