



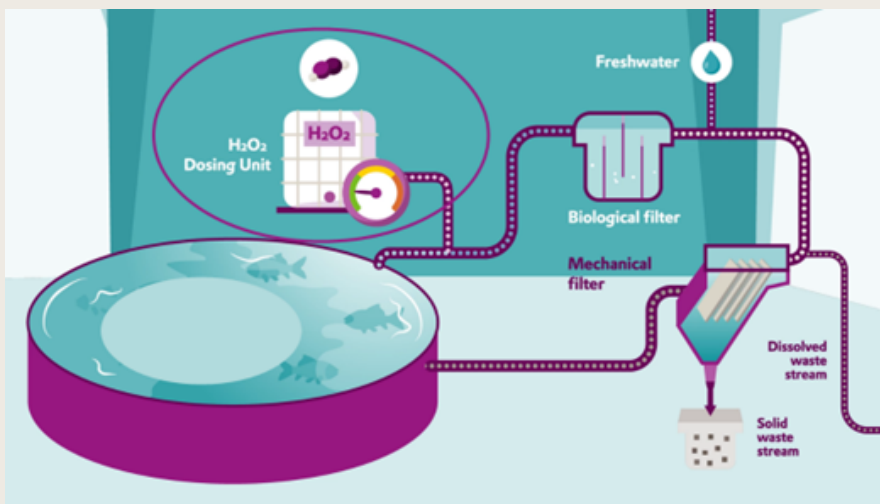
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Use of hydrogen peroxide solutions for oxidative water treatment in recirculating aquaculture systems (RAS)

The scenario describes the use of aqueous solution containing up to 50.0% w/w hydrogen peroxide for oxidative water treatment in recirculating aquaculture systems.

Description of processes and activities

To ensure the well-being of the animals in a land based aquaculture facility, important water parameters such as pH, salinity, temperature and oxygen saturation must be controlled and adjusted according to the requirements of the fish. Especially in recirculating aquaculture systems high effort is needed to maintain the water quality at an acceptable level (e.g. biological and physical filters). Nevertheless, in most systems an increase of chemical pollutants indicated by an increasing chemical oxygen demand (COD = the sum of all substances present in the water available for oxidation) can be observed over time. These pollutants originate in undigested feed, fish faeces, or other fish residues like skin or mucus, which remain and accumulate in the water despite extensive mechanical and biological filtration. Hydrogen peroxide helps to decrease the level of pollutants by oxidation to a stable minimum in the presence of the animals. The decrease of pollutants leads to healthier fish and higher yields in fish production.



For this purpose, aqueous solution containing up to 50.0% w/w hydrogen peroxide is delivered to the aquaculture farms in closed containers or packaging, which are unloaded and stored at appropriate facilities. For the treatment itself the hydrogen peroxide is dosed manually or automatically via pipes and pumps into the water loop of the aquaculture system, most preferably at locations where no fish are present, e.g. in a side stream, before the filtration systems or the protein skimmer.

In water the hydrogen peroxide oxidates the pollutants yielding in smaller organic oxidation products (aldehydes, carboxylic acids, etc.), which can be more easily digested by the biological filters of the RAS, and eventually to CO₂. Hydrogen peroxide also catalytically decomposes into oxygen and water only.

Operational conditions related to frequency, duration and amount of use

Oxidative treatment of the water in aquaculture systems can be carried out continuously 24 hours a day in order to keep the pollutants at a low level or as shock dosage to reduce the concentration of pollutants for a certain time. Due to the sensitiveness of cultured animals the hydrogen peroxide in use concentration needs to be far below the lethal doses and as low, that the animals have a higher benefit of the cleaner water than the remaining concentration bothers them in any way. Under normal conditions that means below 20 ppm.

Operational conditions and risk management measures related to product characteristics

The 50.0% w/w hydrogen peroxide solutions are shipped and stored in closed containers or packaging. Transfer of the solutions into the aquaculture system occurs manually or automatically with pumps and pipes. In the aquaculture system the hydrogen peroxide is strongly diluted to the in-use concentration (<20 ppm). To ensure that the desired concentration is not exceeded in automatic mode, a control loop with a hydrogen peroxide probe is applied.

▪ Environmental conditions

Under normal conditions, the hydrogen peroxide is fully consumed during the oxidative treatment process. In case of continuous dosage, a certain concentration level of hydrogen peroxide can be observed in the water. Typically, a certain amount of water of the aquaculture system is used as purge. That means that fresh water is added to the system and another part is disposed. Before return to environment this purge water stream is be polished in different water treatment steps. During these steps the remaining hydrogen peroxide is almost completely degraded to oxygen and water.

▪ Human characteristics

It is assumed that workers have an inhalation volume of 10 m³/8-hour working shift and a body weight of 70 kg in the present exposure scenario.

Risk management measures

Workers handling concentrated solutions of hydrogen peroxide are equipped with chemical resistant gloves, clothes and boots and safety glasses. Respiratory protection may be used by workers transferring concentrated hydrogen peroxide solutions at dedicated outdoor facilities.

Waste related measures

Any spillage of hydrogen peroxide that may occur during transfer of the aqueous solutions is washed away with plenty of water. Emptied transportation containers are properly sealed and returned. Emptied packaging is disposed by dedicated companies. Purge streams of the aquaculture systems contain only very low amounts of hydrogen peroxide due to utilisation and degradation.

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