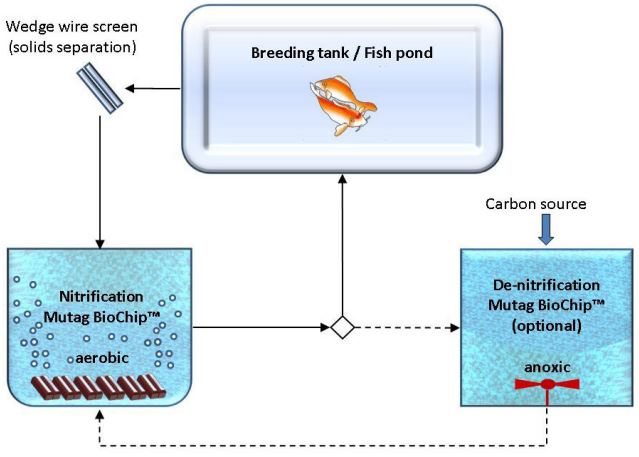
ADVANCING AQUACULTURE: THE MUTAG BIOCHIP™ SOLUTION

Aquaculture, the controlled breeding and raising of aquatic creatures such as fish, crustaceans, and shellfish, plays a crucial role in addressing the looming crisis of overfishing. This industry employs specialized techniques and cutting-edge technology to enhance productivity compared to natural conditions.

AQUACULTURE: A CRUCIAL SOLUTION FOR OVERFISHING CHALLENGES

As our oceans grapple with the challenges of overfishing, aquaculture emerges as a vital solution. There are several types of aquaculture set-ups, ranging from outdoor fish farming to sea farming in net enclosures and indoor fish farms. Regardless of the approach, all these systems demand advanced water treatment technologies to ensure the well-being of aquatic life and the sustainability of the industry.

To meet this need, MUTAG introduced the Mutag BioChip™, a ground breaking innovation designed to meet the stringent standards of water treatment in aquaculture. This advancement promised to bolster the industry's effort in conserving our marine ecosystems and securing a sustainable future for aquatic resources.



MAXIMIZING WATER EFFICIENCY: THE ROLE OF RAS

The RAS is a vital tool in maintaining water quality within fish farming operations. Unlike open systems that rely on freshwater replacement, RAS offers a sustainable alternative by treating and reusing water, effectively reducing water usage. This is particularly significant considering increasing water scarcity and stricter environmental regulations.

MEETING QUALITY STANDARDS WITH MUTAG BIOCHIP™

In the quest for impeccable water quality in aquaculture, the Mutag BioChip™ emerges as a game-changing solution. It plays a crucial role in recirculating aquaculture systems by efficiently removing organic contaminants and harmful nitrogen compounds from water.

An example of a fishfarm.

EXCEPTIONAL REMOVAL RATES: MUTAG BIOCHIP™ IN ACTION

The Mutag BioChip™ achieves removal rates that outshine similar set-ups more than six times. The process involves transferring water from the breeding tank to the treatment tank through the Mutag BioChip™. In the treatment tank, the MBBR principle comes into play, as microorganisms attach themselves to the carrier media's surface, forming a highly effective thin biofilm layer.

In the aerated MBBR tank, individual carriers freely float in the water, kept in motion by tube aerators or mixers at the tank's bottom. Within this tank, nitrifying microorganisms attached to the carriers convert ammonium nitrogen (NH4-N) into nitrite (NO2) and then into nitrate (NO3).

EFFICIENT NITRATE REMOVAL WITH MUTAG BIOCHIP™

In the typical process, water that has undergone biological treatment as described is returned to the breeding tank. Optionally, if there are high nitrate levels, a portion of water can be directed from the nitrification stage to a second tank equipped with Mutag BioChip™ and mixers. In this tank, specific conditions promote anoxic de-nitrification, converting nitrate (NO3) into harmless elemental nitrogen (N2) released into the atmosphere as gas. Afterwards, the de-nitrified portion can be sent back from the de-nitrification tank to the nitrification stage.

INNOVATIVE APPLICATION AT FISCHZUCHT LANGWALD

In the German aquaculture company Fischzucht Langwald, the Mutag BioChip™ has played a crucial role in nitrification since 2010, specifically in a sturgeon farm operating under RAS.

Mutag BioChip™ carrier media.

COMPARING CARRIER MEDIA EFFICIENCY

An experimental trial was conducted to assess carrier media efficiency. In this trial, a conventional carrier media with a defined active surface area of 900 m^2/m^3 was compared to an older version of the Mutag BioChip™. Both media types were subjected to similar conditions, including identical tank volumes and flow rates. The breeding tanks had a capacity of 6 m^3, while the MBBR tanks for water treatment were 600 liters each.

EXAMINING CARRIER MEDIA BEHAVIOR

The experimental phase commenced in February 2010, marked by limited fish food supply due to a low water temperature of 10°. As the temperature gradually increased over several weeks, nitrifying bacteria on the carrier surface became more active, responding to an augmented food supply.

Nitrification by means of Mutag BioChip™ RAS process in a fish farm.

EFFICIENT NITRIFICATION WITH MUTAG BIOCHIP™

In the MBBR employing the Mutag BioChip™, NH4 concentrations consistently remained within the range of 0.1 to 0.2 mg/L. These observations were recorded at average water temperatures of 21° and a peak of 25°, with a daily food supply of 500 g. Given that this trial focused solely on nitrification and lacked a second MBBR for de-nitrification, water exchange rates ranged from 5 % to 15 % of the system per day. This was necessary to maintain low NO3 levels and safeguard the well-being of the fish.

The Mutag BioChip™ showcased remarkable specific NH4 removal rates, achieving up to 0.24kg NH4-N/m^3 of media per day. This achievement was notable, considering that the biomass on the carriers in both MBBR tanks remained consistent, despite the lower filling level in the tank utilizing our chip.

STABILITY AND EFFICIENCY IN AQUACULTURE WATER TREATMENT

Unlike the conventional carrier media, which exhibited varying levels of biomass and resultant NH4 increases, the Mutag BioChip™ maintained its efficiency and stability. Even with reduced carrier volume, the Mutag BioChip™ proved itself as a highly efficient and reliable choice for aquaculture water treatment, consistently delivering optimal removal performance.

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