HOW TO AVOID MICROPLASTICS IN WASTEWATER TREATMENT

The term “microplastic” was coined many years ago to describe tiny plastic particles smaller than 5 mm.

There are two types: those intentionally made for practical use (e.g. for products like cosmetics) and those formed from larger plastic items breaking down as waste.

Microplastics continue to be a concern in water treatment and wastewater facilities, leading to many discussions about their impact on aquatic environments and aquaculture water systems.

PROTECTING WATER TREATMENT INNOVATIONS

For decades, the moving bed biofilm reactor technology (MBBR) has played a crucial role in water and wastewater treatment, becoming indispensable in many applications. These MBBR reactors use various types of carrier media for the immobilization of microorganisms.

However, a concerning issue has come to light: the plastic elements used as biofilm carriers in MBBR reactors are contributing to microplastic pollution in water bodies. This is problematic because these plants are designed to purify water.

MICROPLASTIC RELEASE FROM PLASTIC CARRIERS

In MBBR systems, plastic carriers have always been used. However, because of their shape or material properties, there is a risk that they release tiny plastic particles through rubbing or degradation.

One type, soft foam cubes made of PU (polyurethane), has shown significant wear, leading to the need for replacement due to visible signs of deterioration.

Foam-type carrier: virgin material (left) and abraded material (right).

Abrasion of carrier media in operation.

UNDERSTANDING WEAR AND MICROPLASTICS IN MBBR SYSTEMS

Wear in MBBR systems happens due to rubbing, collisions between carriers, and interactions with tank walls and internal structures. Material properties and kinetic energy are key factors.

Lower carrier mass and slower movement in water reduce wear. Ideally, carriers would stay still, but water flow and aeration cause movement.

Carrier geometry, like hollow bodies, can trap inactive biofilms, increasing mass. This biomass does not contribute to substance exchange or metabolism and unnecessarily adds weight, leading to more wear, including microplastic release.

Carrier with signs of abrasion.

For comparison: clogged carrier (left) and unclogged carrier (right).

ECO-FRIENDLY MBBR CARRIERS: A CLEANER FUTURE

Unlike hollow bodies or foam cubes, thin chip-type carriers do not wear down. This has been demonstrated in many plants running for over a decade. The reasons are intricate but make sense. These carriers are lightweight thanks to their solid HDPE foam structure, and their outer protective ring acts like a cushion, preventing abrasion.

A thin chip, about 1.1 mm, allows active biomass to grow on both sides, getting substrate and oxygen for optimal diffusion. This chip stays free of dead biomass, keeping kinetic energy low.

Its shape and slow movement help minimize kinetic energy. The biofilm acts like a protective layer, preventing abrasion. These carriers do not release microplastics and works efficiently.

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