

Application Guide

Media selection for three difficult effluents · mining, food and beverage, landfill leachate · Nuowaisen Environmental

Municipal wastewater is the easy case. These three effluents are not, and each punishes a different mistake. This guide sets out what changes the media selection in each case, and where the honest limits of a media supplier's responsibility sit.

1. Mining and mineral processing effluent

Three things change the media choice, and none of them is about the media's nominal quality.

Solids load is high and variable. A clarifier handling a storm surge into an open pit, or a thickener overflow during an ore-type change, can carry several times its design solids for hours. Settling media does not stop working at high load - it fills. The question is how fast it recovers, and that is decided by cell size, not by surface area.

The solids are abrasive. Silica and ore fines polish polypropylene and will wear the leading edges of a plate pack over years. This is a service-life question rather than a design question, and it is why stainless steel and FRP appear in mining specifications where they would be unnecessary in municipal work.

pH moves. Polypropylene handles the range a mine presents, but the reagent regime matters far more for the ancillaries - frames, anchors, fixings - than for the sheet itself.

Selection point	What to do
Cell size	Size for the bad hour, not the average. A small cell chosen for removal efficiency will blind during the first high-solids event and lose more throughput than it ever gained
Hydraulic loading	Published band 3-5 t/m ² ·h. At 4 t/m ² ·h a 150 m ³ /h flow needs 37.5 m ² of settling area
Channel velocity	Must stay in the 2.5-3.0 mm/s band. Above it the flow re-entrains what has settled and more media will not help
Material	PP standard (published 3-4 years, co-polymer 8-10 years); FRP or stainless where abrasion or specification demands it

Worked example: 3,600 m³/day is 150 m³/h. At 4 t/m²·h the settling area is 37.5 m². At a 4.5 m stack the net volume is 169 m³, which is 338 modules of 1000 x 500 x 1000 mm before any cutting allowance.

2. Food and beverage wastewater

These plants share a pattern: high organic load, a flow that follows the production shift rather than the clock, and a discharge consent that does not.

The load arrives in slugs. A washdown shift can put several hours of load into the plant in twenty minutes. In an activated sludge plant that slug passes through the biology and the biology takes days to recover. In a moving bed reactor the biomass sits on carriers that stay in the basin, so the inventory that meets the slug is the whole inventory.

The biology you need grows slowly. Nitrifiers divide far more slowly than the heterotrophs that consume BOD. Attached growth holds them against washout, which is why plants that pass a carbon consent and fail an ammonia consent are often running a short sludge age.

You usually cannot build. Most upgrades happen inside an existing aeration tank during a shutdown measured in days.

Parameter	Published value
Carrier series	K1-K5 in HDPE, Φ 10-25 mm, specific surface above 800-1000 m ² /m ³
Fill fraction	15-67 % of reactor working volume - a design band, not a preference
Biofilm formation	3-15 days depending on temperature and load
Nitrification rate	400-1200 gN/m ³ ·day, published per series

Worked example: 800 m³/day with BOD falling from 900 to 40 mg/L is 688 kg/day. At 4,000 g/m³·day that is 172 m³ of carrier - a 43 % fill in a 400 m³ reactor. Run the same arithmetic for ammonia and take the larger answer. If the calculation lands above 67 %, the reactor is too small for the load; pushing the fill higher does not add capacity.

What breaks a carrier bed: fat, oil and grease coating the carriers (a pre-treatment problem, not a media problem); pH swings from CIP chemicals and caustic washdown; and the two things that decide whether an MBBR works at all - retention screens and enough air to move the full bed. Both sit outside the media supplier's scope, and both are where retrofits fail.

3. Landfill leachate

Ammonia in the thousands of mg/L, COD that biodegrades poorly, salinity that climbs as the fill ages, and a composition that changes with rainfall.

The argument for attached growth is narrow and specific: leachate nitrification is limited by the growth rate of nitrifiers, not by ammonia concentration. In suspended growth a plant must hold a sludge age long enough to keep those organisms while the hydraulic load changes with every storm. Attached growth removes that coupling.

Selection point	What to do
Sizing basis	Mass of ammonia removed per day ÷ published rate = carrier volume; then check the 15-67 % band
Temperature	5-60 °C service range, but the rate is not constant across it - size on the coldest sustained period
Season	Size for winter and for the wet season. Both inputs move the wrong way at the same time
Downstream	Aeration is oxygen-hungry and membrane fouling silently removes the capacity a larger carrier volume was meant to add

Where the rest of the range fits. Settling media after chemical precipitation or in the clarifier ahead of the biological stage, on the same published loading band. Disc aerators because the oxygen transfer rate is set by the aerator, not the carrier. ABS pipework because leachate attacks metals.

What we do not claim. We manufacture media and aeration equipment. We do not design leachate treatment trains, and we do not quote a single removal percentage for leachate as a medium. Anyone who does has not seen your analysis.

4. The questions that sort suppliers

- What is the basis of your specific surface figure - geometric or adsorption?
- Your removal rate: at what temperature and dissolved oxygen was it established?
- If my fill fraction calculation lands outside your published band, what do you tell me?

The third one is the real test. A supplier who answers "then the reactor volume is wrong for the load" is telling you the truth and losing the order. A supplier who answers "we can go higher" is selling you a bed that will bridge.

Nuowaisen Environmental · Gongyi, Zhengzhou, Henan, China
+86 157 3675 9204 · 164532173@qq.com · <https://www.nuowaisengroup.com/>
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