



OsmoBCTM System

INTEGRATED FILTRATION
SYSTEMS FOR
INDUSTRIAL APPLICATIONS

OsmoBCTM Forward Osmosis Process For Landfill Leachate Effluent Treatment

Achieve 93% Volume Reduction and Produce High Quality Clean Water

COST EFFECTIVE TECHNOLOGY ACHIEVES
ENVIRONMENTAL DISCHARGE GUIDELINES

Application Background

Recent advancements in Forward Osmosis (FO) membrane technology have made it possible for the treatment of challenging wastewater separations applications. Currently, on-site treatment of collected leachate has been limited to conventional treatment technologies. Due to the high conductivity and variable quality of leachate streams, use of biological and chemical treatment may not be effective in achieving sufficient quality for release to the environment or transport to a local sewage treatment facility.

Conventional Treatment Technologies

Leachate streams contain high COD, pH, ammonia nitrogen, heavy metals and other components. Typically, the streams are dark in color and have a strong odor. Variations in composition and volume can make treatment complex. Common methods of treating landfill leachate include:

- Activated sludge
- Aerobic Biological
- Anaerobic Biological
- Carbon Adsorption
- Chemical Precipitation
- Multimedia or Micro Filtration
- Membrane technology such as UF, NF and RO

- Solids Concentration or Dewatering
- Crystallization of hazardous matter

The use of reverse osmosis (RO) technology is limited by the need for extensive pretreatment and membrane fouling resulting in low recovery. This is due to the leachate conductivity and presence of high levels of organic and inorganic scaling materials.

Use Of Forward Osmosis Technology Meets Discharge Control Limits

Dewatering of landfill leachate, concentration and solidification of contaminated retentate and discharge of purified permeate water meeting regulatory standards are achieved by Fluid Technology Solutions, (FTS) Inc. The proprietary process utilizes a unique Forward Osmosis membrane combined with a High Brine Concentration & Recovery process that produces permeate meeting US EPA Regulation 40 CFR Part 445 and state administered NPDES permits. The process enables compliance to RCRA Subtitle C for hazardous waste.

During commercial operation of the FTS process, even with seasonal and variable water quality and operation of the process near capacity, the removal efficiency remained 99% or higher for removal of ions, metals, BOD and COD.

Table 1

Contaminant	Untreated Leachate mg/l	Permeate mg/l	% Rejection
N- Ammonia	1110	1.6	99.86
Arsenic	0.039	ND	
Calcium	91.6	0.15	99.84
Sulfate	310	0.04	99.99
BOD – 5	472	2	99.58
COD	3190	ND	
TKN	780	ND	
TSS	100	ND	

Membrane technology, such as FO, is the most effective strategy for treating water for reuse or discharge. FTS recommends the OsmoBC™ treatment process for Landfill Leachate containing high concentration of non-biodegradable BOD, COD, TDS and TSS. The advanced forward osmosis membrane process is proven to generate clean water without excessive pretreatment and without significantly degrading flux rates for long term operation.

The OsmoBC™ Treatment Process

Figure 1 depicts how a Forward Osmosis (FO) system is combined with a High Brine Concentration and Recovery (HBCR™) system.

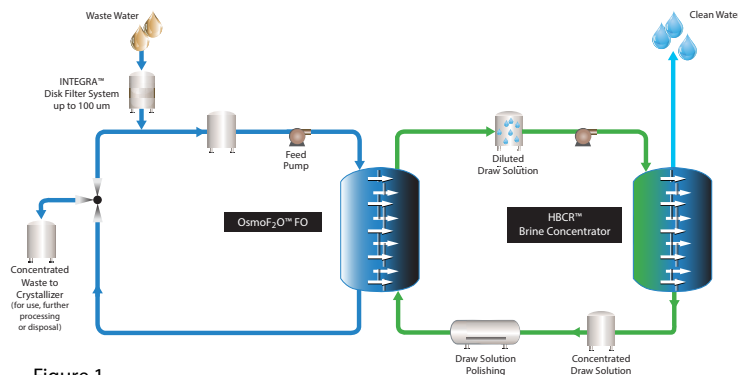


Figure 1

The pretreatment process consists of only coarse filtration (50µm) and pH adjustment to 6.5 prior to the FO concentration step.

The FO system concentrates the feed and a draw solution extracts the clean water. The draw solution is continuously re-concentrated and recycled to the system. The OsmoBC™ system can concentrate wastewater streams up to 95% with associated volume reduction. Permeate conductivities of less than 10 uS/cm are achieved.

Forward Osmosis for Landfill Leachate Wastewater

A schematic of the use of FTS's OsmoBC™ process for

the treatment of landfill leachate is shown in Figure 2.

Up to 93% clean water has been recovered from leachate streams. Leachate may be reduced to 5% or less of the original volume. An evaporative crystallizer can be added to achieve zero liquid discharge (ZLD), if necessary.

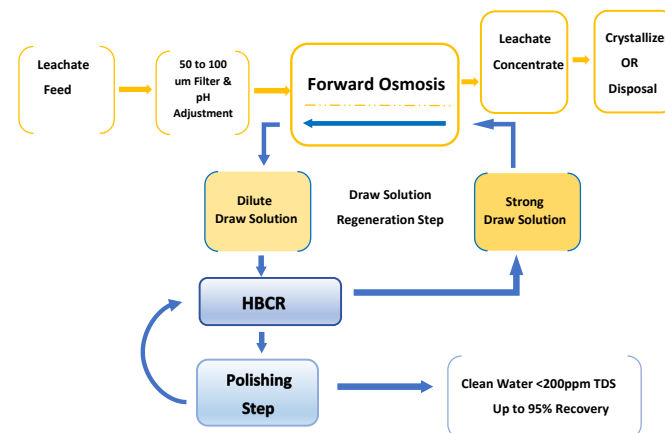


Figure 2

Simplified Process Flow Diagram for the Treatment of Landfill Leachate

Product Recommendations

For landfill leachate wastewater, we recommend the:

- OsmoF2O™ FO-CTA-8040-85 Industrial Elements
- HBCR™ HBR-TFC Brine Concentration Elements.

Benefits of OsmoBC™ System for Landfill Leachate

FTS provides proven, commercialized systems to provide landfill operations with the following benefits:

- Ensure safety & effluent requirements are met
- Low Capex and Opex reduces overall cost
- Anti-fouling and anti-scaling FO membrane
- Up to 93% recovery of clean water
- Lowest volume of concentrate to meet ZLD objectives

Legend

CFR – Code of Federal Regulations
 NPDES – National Pollutant Discharge Elimination System
 RCRA – Research Conservation and Recovery Act
 US EPA – United States Environmental Protection Agency