Bishop Water Technologies Inc.

Biofilm for Wastewater Treatment

What If You Could….

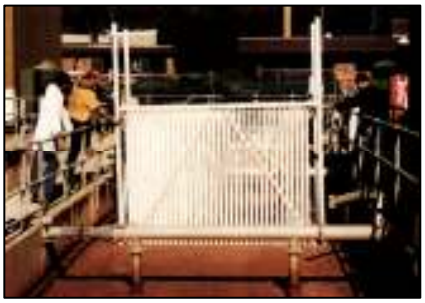
- **Increase the capacity of your Wastewater Treatment Plant (WWTP)?**
- **Substantially reduce capital spending?**
- **Lower your operation costs?**
- **Have a complete treatment system?**
- **Meet or exceed new regulations and discharge limits requirements?**

Retrofit Existing Plants

- Additional treatment capacity using existing infrastructure
- Meet new CCME guidelines with substantially less cost than traditional plant expansion
- Biocord Reactors are easy to adapt and add to any facility
- Requires no additional tank volume
- Provides a stable growth platform for slow-growing nitrification bacteria
- Offers more advanced treatment, effectively increasing Mixed Liquor Suspended Solids (MLSS) and Sludge Retention Time (SRT) by increasing biomass in system
- Rapid, efficient installation

Lagoon Efficiency Upgrade

- Enhances biological treatment capacity
- Allows optimization of lagoon(s) to meet new CCME Guidelines
- Adds fixed biomass to the lagoon(s) to increase biological treatment
- Provides nitrification, reducing ammonia effluent levels and denitrification if required
- Fits in existing lagoon(s)
- Lower capital costs
- BioCord material is Easily maintained
- Installation of BioCord is simple



New Purpose Built Plants

- BioCord systems have a smaller footprint and greater treatment capacity compared to traditional plants
- Easily meets new CCME Guidelines
- Simple and efficient to operate as compared to traditional plants
- Sludge control and nutrient conversion systems using Geotube® technology
- Ability to take high volatile BOD waste streams (septage) in conjunction with low BOD waste water
- Provides both nitrification and denitrification
- Reduced aeration requirements compared to activated sludge plants

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Effective, Affordable Solutions For Wastewater Treatment

www.bishopwater.ca

What is Biofilm

- Biofilm results when an aggregate of microorganisms adhere to each other on a surface.
- By contrast activated sludge microorganisms are suspended in sludge and mixed by stirring or aeration.
- Multiple layers of cellular mass formed on a surface provide a treatment system very resilient to toxic shock.
- Biofilm will not wash out when subjected to hydraulic surge.

History of Biofilm

- Initially developed in Japan in the 1970's.
- Led to the development of a specialty substrate for wastewater treatment.
- In North America, Biofilm began to be used for wastewater treatment in the 1990's.

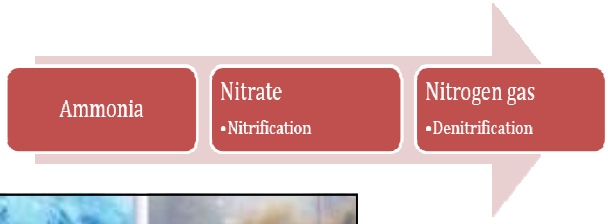
Nitrogen Removal from Wastewater

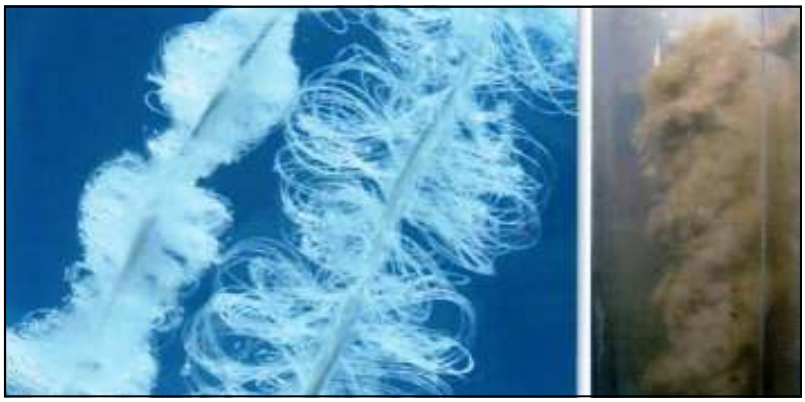
- Ammonia, the primary component of nitrogen based nutrients in wastewater, is converted to nitrate, in a process call nitrification. This only occurs in an aerobic environment
- **Ammonia + Oxygen -> Nitrate**
- Nitrates are then converted to nitrogen gas in a process call denitrification. This only happens in an anaerobic environment
- **Nitrate + Carbon Source -> Nitrogen Gas**
- Nitrogen gas is then released into the atmosphere. The air you breath is 80% nitrogen gas.

Biofilm Formation Process

1. Attachment of bacteria to surface
2. Growth of bacteria in multiple layers
3. Detachment and collection as sludge

Natural Biofilm Growth on concrete drain





Clean BioCord material shown on the left. Biocord with accumulated Biofilm shown on the right

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Change and Adaptation of Biofilm Wastewater Treatment Plant Technology

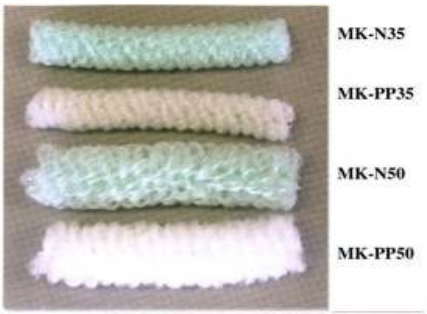
Biofilm is a natural process that has been around well before the development of traditional wastewater treatment systems. The challenge was that it was not completely understood until the Japanese started research in the late 1960's. With the focus of the industry on the waste activated sludge process it was all but ignored outside of Japan until the early 1990's.

MBBR (Moving Bed Bio Reactors), FBBR (Fixed Bed Bio Reactors/Trickling Filters), BAF (Biological Aerated Filters), RBC (Rotating Biological Contactors), IFAS (Integrated Fixed Film/ Activated Sludge Systems) and several other technologies are all based on the Biofilm process in one way or another.

With the initial research and development of the Biofilm process happening in Japan — a specialty purpose substrate called Bio-Cord was invented. This substrate allows symbiotic layering of different bacteria to develop, mirroring the process that occurs in nature.

This intimate understanding of the process enabled by BioCord design, is the reason Bishop Water Technologies is at the forefront of making the Biofilm process work in an automated, simple, natural and cost effective way. It is believed that BioCord holds the key to advancing wastewater treatment more in the next decade than it has since the early 1900's.

SP-100



The Advantage of BioCord Reactors as Substrate

- Biocord is a man-made biofilm substrate, developed and manufactured in Japan and has been used there for 30 years
- Purposefully made for biofilm growth, other types of biofilm carrier are adaptations of product used for other purposes.
- Made of a cord covered with rings of thread, both made of polymers
- Provides a culture bed for a wide spectrum of microbes, both aerobic and anaerobic
- Multilevel cell growth: Outer layer of microorganisms protects inter layer from toxic shock
- Available in different styles and construction to suit specific waste streams
- Simplicity and ease of installation

Product Number	Specific Surface Area	BOD Range	Phosphorus Range	TKN Range (Nitrogen)	Primary Application
SP-100	2.4m2/m	<1,000mg/l	<2mg/l	<100mg/l	· Biological treatment of high concentration wastewater from abattoirs, food factories and fish farms. · Retrofit of activated sludge plant, improving biological treatment including nitrification and denitrifi-cation · Ideal for wastewater with high suspended solids
PV-45	1.2m^2/m	<300mg/l	<2mg/l	<30mg/l	· Biological treatment for low and medium concentration wastewater from abatoirs, food factories and fish famrs · Treatment of municipal wastewater
PP-45	2.8m^2/m	<500mg/l	<2mg/l	<50mg/l	
K-45	0.5m^2/m	<300mg/l	<2mg/l	<50mg/l	
PP + K-45	1.6m^2/m	<500mg/l	<2mg/l	<100mg/l	
MK-N35	0.8m^2/m	<300mg/l	<2mg/l	<30mg/l	· Purification of Rivers and Lakes · Removal of solids and polishing of low concentration effluent · Retrofit of settling tanks for additional rmoval of suspended solids and polishing effect.
MK-N50	1.6m^2/m	<300mg/l	<2mg/l	<30mg/l	
MK-PP35	0.8m^2/m	<300mg/l	<2mg/l	<30mg/l	
MK-PP50	1.6m^2/m	<300mg/l	<2mg/l	<30mg/l	

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Who We Are

Bishop Water Technologies Inc. is a registered engineering company in the Province of Ontario, Canada. When required we partner with select engineering companies from other provinces and countries when required to deliver regional solutions.

What makes us different is that we specialize and focus on waste water / sludge management and shore line protection / restoration solutions using advanced and proven technical solutions that are efficient, uncomplicated and cost effective.

We are the Agents/Distributors for Tencate Geotube® in Eastern Canada and TBR BioCord Reactors for Canada and the USA. We also have associations and agreements with specialized polymer mixing and pumping equipment service companies which has allowed us to have selected the best interface equipment to provide a process solution that works for our clients.

We provide a full suite of sludge management products including chemical conditioning, non –pathogenic bacteria and enzymes, BioCord reactors for advanced biofilm process and our cornerstone technology, Geotube® dewatering units.

Our Engineers and principles have over 40 years combined experience in the industry and we are proud members of the Association of Professional Engineers of Ontario.

Why We Do What We Do

Change is constant and with today's technology change is happening more rapidly than ever, however this has not been the case with the wastewater industry. We are a group of individuals that challenge conformity. We are not afraid to ask the questions why and how do we make change? We are not afraid to think outside the box and outside the comfort zone of many. We are motivated to find and deliver solutions when we hear the words NO or CAN'T, as such we are very good at what we do for our clients.

"Good Science, Good Business, Engineered for Industries Working with Water" is our motto, our goal is to provide Unique Solutions to Environmental Challenges.

How We Do Business

At Bishop Water Technologies we pride our selves on the development of innovative, cutting edge technology, geared towards simple, cost effective environmental solutions. Through creating partnerships with other like minded companies and environmental enthusiasts, we work everyday to provide safer, cleaner water for future generations.

Services Offered

- Process Design and Site Assessment
- Pre-Project Budgeting
- Civil Structural Engineering
- Mechanical/Piping Engineering
- Electrical and Controls
- Design Reports, Contact Documents
- Applications for approvals. MOE C of A's, where applicable
- Filed inspection and QA/QC during construction
- Process guidelines and design assistance to the customers consulting engineering firm
- Complete facility designs with certified drawings and specifications, ready for construction by others
- Complete facility design and project management (turn-key facilities)

Award Winning Bonnechere Valley Township Geotube® Sludge Management Facility

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