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Microbe Edition: Introduction
How In-Pipe Technology Works

In-Pipe Technology (IPT) bacteria are heterotrophic bacteria commonly found in soil. They are part of a group of microorganisms termed "decomposers" and are "generalists" in regards to their broad capabilities of using many different carbon sources to fuel their metabolism. In the natural soil environment, similar bacteria feed on decaying material and by-products produced by the other organisms in the natural environment (food chain). These organisms produce a great diversity of enzymes that are both excreted and retained within the cells and are very active degrading complex organic matter. The IPT bacteria can be found in the human gastrointestinal tract but in very low numbers and usually in a low metabolic state. They are naturally occurring and are not pathogenic or genetically modified. IPT bacteria can operate using aerobic respiration, fermentation, and anaerobic respiration using nitrate, nitrite, fumarate, and other compounds as the final electron acceptor (Clements, 2002). They are vigorous growers and are very capable of degrading pollutants normally found in municipal wastewater.

The predominant bacteria in the human intestinal tract are strict anaerobes (Clark, 1977). A 2005 article published in Science (Eckburg, et. al.) found that 51% of the total bacteria detected within stool and pooled mucosa samples were *Firmicutes* (low Guanidine + Cytosine Gram-positive bacteria). Of the *Firmicutes*, 95% belonged to the *Clostridia* class, while 4.5% and 0.2% were members of the *Mollicutes* and *Bacilli* classes, respectively. The *Clostridia* class contains 274 phylotypes including *Eubacterium*, *Ruminococcus*, *Dorea*, *Lachnospira*, *Butyrivibrio*, and *Coprocuccus*. The *Bacilli* class representatives were identified as *Streptococcus*, *Gemella*, and *Lactococcus* genera. The other dominant phylum was that of *Bacteroidetes* (48% of total) containing *Bacteroides* and *Prevotellaceas* species. The *Proteobacteria* were found to be very minor constituents of the samples and those found included *Desulfomonas*, *Bilophila*, *Escherichia*, *Camphylobacter* and *Sutterella*.

Bacteria that have adapted to a defined and controlled environment (such as the intestinal tract) tend to become specialized in that ecosystem (Casjens, 1998). In order to compete effectively, the expressed genomes of bacteria that grow in controlled conditions tend tobecome smaller, and more specialized to that particular environment. When these bacteria are shed from this defined environment in feces, they are less capable than wild-type organisms of the same *Genus species* of adapting to the new external environment and will not be as efficient as wild-type generalist organisms.

Species of the intestinal tract bacteria do survive and proliferate in the new environment (Cho, 2000). In particular, the *Proteobacteria,* which are found in extremely low quantities in the intestinal tract, seem to thrive in the wastewater environment. These include various sulfate reducing bacteria and *Escherichia coli*. Under sewer conditions without IPT treatment, the bacteria present in the collection systems (and therefore the bacteria entering wastewater treatment plants) are primarily from the intestinal tract and their preferred environment has similar conditions as the intestinal tract. These bacteria are inefficient for metabolizing wastewater pollutants, and often present negative and undesirable effects (odors, corrosion, disease).

Please remember these general microbiology concepts as you read further on the particular application of interest. If your problems include Odor/Corrosion, FOG, or BNR, we have further In-Pipe

References

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Because Efficiency Counts

725 N. Central Avenue
Wood Dale Il. 60191
Office: 630.509.2488
Toll free: 888.325.5033
Fax: 630.509.2490
www.in-pipe.com