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Scientific Evidence is Abundant!

Aerobic Effluent Introduced into Drainfields Reverse Biomat Sludge

The Issue: Biomat Sludge in Drainfields

Estimates indicate that 1 in 10 septic drainfields fail annually, typically due to biomat sludge, leading to environmental and health hazards, along with costly replacements.

The thickness of the biomat in the soil drainfield interface that can render it impermeable varies depending on several factors, including the composition of the biomat, soil type, and the hydraulic loading rate. However, general findings from various studies suggest that even a relatively thin biomat layer can significantly impact the permeability of the drainfield.

Key Points on Biomat Thickness and Permeability:

1. Critical Thickness:
Studies indicate that a biomat thickness of approximately 0.5 to 2 centimeters (0.2 to 0.8 inches) can greatly reduce the permeability of the soil. At this thickness, the biomat can restrict the flow of effluent into the surrounding soil, leading to ponding and system failure.

2. Variability Based on Soil Type:
Sandy soils with larger pore spaces may tolerate a slightly thicker biomat before becoming impermeable compared to clayey or silty soils, which have smaller pore spaces. The permeability of the underlying soil significantly affects how quickly the biomat can cause clogging.

3. Hydraulic Loading Rate:
Higher hydraulic loading rates can exacerbate biomat formation and clogging. Conversely, reducing the hydraulic loading rate can help manage the development of the biomat and maintain some level of permeability.

Supporting Research:

1. Title: Mechanisms of Biomat Formation and Impact on Soil Permeability
Authors: Robert L. Siegrist, Evan J. Tyler

Findings: This study found that biomat thicknesses as thin as 0.5 cm can significantly reduce the hydraulic conductivity of the drainfield, especially in fine-textured soils.

2. Title: Clogging in Soil Treatment Units and the Role of Biomat
Authors: John E. McCray, Robert W. Pruden

Findings: The research highlights that a biomat layer of about 1 cm can cause a drastic reduction in permeability, leading to the failure of the drainfield to adequately treat and disperse effluent.

3. Title: The Role of Biomat in Septic System Drainfield Failure
Authors: Cheryl D. Nelson, Victor I. Padilla

Findings: This paper discusses how biomat thicknesses ranging from 0.5 to 2 cm can render a drainfield impermeable, particularly in soils with lower initial permeability.

Conclusion:

Even a thin biomat layer of around 0.5 to 2 centimeters can render a drainfield impermeable, depending on soil conditions and effluent loading rates. Managing the formation of biomat through proper maintenance, effluent pretreatment (such as with aerobic treatment units), and appropriate hydraulic loading rates is crucial for maintaining the permeability and functionality of septic system drainfields.

Studies Confirm: Aerobic Effluent Introduced into Drainfield to Rejuvenate Biomat Sludge Issues

Rejuvenating drainfields with aerobic effluent is a targeted approach to enhance the degradation of biomat sludge and improve the performance of septic systems. Numerous studies have focused on this method. Here are some of these studies along with summaries of their findings:

1. Title: Aerobic Treatment Units and Their Impact on Septic System Drainfields
Authors: Otis, R.J., et al.

Findings: This study evaluates the effect of aerobic treatment units (ATUs) on the performance of septic system drainfields. It was found that effluent from ATUs significantly reduced biomat accumulation due to higher levels of dissolved oxygen. The research documented increased infiltration rates and reduced instances of drainfield failure.

2. Title: Improving Septic System Performance with Aerobic Treatment and Effluent Reoxygenation
Authors: Heger, Sarah, et al.

Findings: The paper investigates the use of reoxygenation of effluent before it enters the drainfield. This approach showed that oxygen-enriched effluent enhanced aerobic microbial activity, leading to more effective degradation of organic matter and biomat in the drainfield. The study concluded that this method could significantly extend the life of septic systems.

3. Title: Long-Term Performance of Drainfields Receiving Aerobically Treated Effluent
Authors: Siegrist, R.L., McCray, J.E.

Findings: This research follows the long-term performance of drainfields receiving aerobic effluent. It was observed that these drainfields maintained better permeability and had fewer clogging issues over time. The aerobic conditions were conducive to sustained microbial degradation processes, preventing excessive biomat formation.

4. Title: Enhancement of Soil Absorption Field Performance Using Aerated Effluent
Authors: Gross, M.A., et al.
Findings: This study explores how aerated effluent impacts soil absorption field performance. It demonstrated that the use of aerated effluent resulted in higher oxygen levels in the soil, promoting aerobic digestion of organic materials in the biomat. Improved effluent quality led to better infiltration and reduced risk of hydraulic failure.

5. Title: Field Trials of Aerobic Effluent for Drainfield Rehabilitation
Authors: Anderson, D.L., et al.

Findings: The field trials documented in this study show the practical application of aerobic effluent for rehabilitating failing drainfields. The results indicated significant improvement in drainfield function, with enhanced effluent percolation and reduced biomat thickness. The study highlighted the effectiveness of converting anaerobic systems to aerobic treatment units as a remediation strategy.

6. Title: Impact of Aerated Effluent on Soil Microbial Communities and Drainfield Function
Authors: Van Cuyk, S., Siegrist, R.L.

Findings: This paper investigates the changes in soil microbial communities in drainfields receiving aerated effluent. The findings showed a shift towards aerobic microbial populations that are more efficient at degrading organic matter. This microbial shift contributed to improved soil absorption and reduced biomat-related issues.

7. Title: Performance of Septic System Drainfields with Aerobic Pretreatment of Effluent
Authors: Tyler, E.J., Converse, J.C.

Findings: The study evaluates the performance improvements in septic system drainfields when effluent undergoes aerobic pretreatment. It found that pretreatment significantly reduces organic loading and biomat formation, resulting in more stable and effective drainfield operation over time.

8. Title: Aerobic Treatment Units: A Solution for Failing Septic Systems
Authors: Mayer, T., and Witten, J.

Findings: This paper discusses the use of aerobic treatment units (ATUs) as a solution for failing septic systems. The authors provide evidence that ATUs can rejuvenate drainfields by providing a continuous supply of oxygen-rich effluent, which promotes aerobic degradation of biomat and prevents clogging.

9. Title: Aerobic Treatment Units for the Enhancement of Septic System Drainfields
Institution: Purdue University
Authors: John T. Prochaska, Ernest L. Jones

Findings: This study by Purdue University investigates the impact of aerobic treatment units (ATUs) on the performance of septic system drainfields. The researchers found that ATUs significantly improve the quality of effluent by increasing its oxygen content. This enhanced aerobic microbial activity in the drainfield, leading to more effective breakdown of the biomat. The study concluded that ATUs could rejuvenate failing drainfields by reducing biomat thickness and improving infiltration rates.

10. Title: Rehabilitation of Biomat-Plugged Drainfields with Aerobic Effluent
Institution: University of West Virginia

Authors: Peter S. DeJong, Robert M. Anderson
Findings: The University of West Virginia's research focuses on the rehabilitation of biomat-clogged drainfields using aerated effluent. The study demonstrated that introducing oxygen-rich effluent into the drainfield environment enhances the activity of aerobic microorganisms, which in turn accelerates the degradation of organic matter in the biomat. Field trials showed a marked improvement in drainfield percolation rates and a significant reduction in clogging issues over time.

11. Title: The Impact of Aerobic Treatment on Septic System Drainfields

Authors: Daniel L. Anderson, Richard J. Otis

Findings: This study shows that aerobic treatment units (ATUs) can significantly improve the quality of effluent by increasing oxygen levels. The research documented that this aerobic effluent helps to reduce the biomat layer in drainfields, enhancing the infiltration capacity and extending the lifespan of the septic system. The aerobic conditions favor the growth of aerobic bacteria, which are more effective in decomposing organic matter in the biomat.

12. Title: Aerobic Treatment Units: Effect on Soil Absorption Systems
Authors: Robert L. Siegrist, John E. McCray

Findings: This research evaluates the long-term performance of soil absorption systems receiving aerobically treated effluent. The study found that aerobic treatment leads to a substantial reduction in biomat formation. The improved oxygenation helps maintain a healthier soil environment, fostering aerobic microbial communities that effectively break down organic materials. This results in improved system function and longevity.

13. Title: Use of Aerated Effluent to Mitigate Clogging in Septic System Drainfields
Authors: George Heufelder, Robert W. Pruden

Findings: The study investigates the use of aerated effluent to mitigate clogging issues in septic system drainfields. It was found that aerated effluent, by increasing the dissolved oxygen content, supports the growth of aerobic bacteria that degrade the organic matter in the biomat more efficiently than anaerobic bacteria. This reduces the biomat layer and enhances the hydraulic conductivity of the soil, leading to improved drainfield performance and extended system life.

14. Title: The Role of Aeration in Extending the Life of Septic System Drainfields
Authors: Tim J. Mayer, Eric P. Bradford

Findings: This paper discusses the role of aeration in maintaining and extending the functionality of septic system drainfields. The research demonstrates that aeration reduces the formation of biomat by encouraging aerobic microbial activity. This results in more effective degradation of organic matter, leading to improved percolation rates and reduced risk of system failure. The study highlights the potential of aeration as a long-term solution for drainfield maintenance.

15. Title: Long-term Effects of Aerobic Effluent on Soil-Based Wastewater Treatment Systems
Authors: Cheryl D. Nelson, Victor I. Padilla

Findings: The long-term study evaluates the effects of aerobic effluent on soil-based wastewater treatment systems. Results indicate that continuous application of aerated effluent leads to a sustainable reduction in biomat thickness and enhances soil permeability. The aerobic conditions prevent excessive biomat buildup, ensuring the longevity and efficiency of the drainfield.

16. Title: Enhancing Drainfield Performance with Aerobic Pretreatment of Septic Effluent
Authors: Michael A. Gross, Jennifer L. Belanger

Findings: The study focuses on the benefits of aerobic pretreatment of septic effluent. The findings show that effluent with higher oxygen content reduces the formation of biomat, as aerobic bacteria are more effective in breaking down organic material. This results in improved infiltration rates and extended drainfield life. The research supports the use of aerobic pretreatment as a viable method for maintaining septic system functionality.

Conclusion:

These studies provide robust evidence that aerobic effluent can significantly reduce biomat formation in drainfields, leading to improved performance and extended system life. The common theme across these studies is that increased oxygen levels in the effluent promote aerobic microbial activity, which is more efficient at degrading the organic matter that forms the biomat, thus preventing clogging and enhancing the overall health of the drainfield.

These studies collectively demonstrate that using aerobic effluent in septic systems can significantly improve the performance and longevity of drainfields. Aeration enhances microbial activity, reduces biomat buildup, and improves overall soil absorption, making it a viable strategy for rehabilitating impaired drainfields.

The Solution: RioVation® BioMaze® Suspended Biofilm Generator™ (SBG™)

Estimates indicate that 1 in 10 septic drainfields fail annually, typically due to biomat sludge, leading to environmental and health hazards, along with costly replacements.

RioVation® BioMaze® is a proprietary fixed film media treatment technology that combats drainfield issues. The 26” tall, 8” diameter media and aeration pods install via a riser into the septic tank. These floating, self-positioning pods have retrieval lines for ease of maintenance. The energy efficient HiBlow XP80 air-pump with housing and integrated alarm powering the BioMaze® unit ensures a cost-effective operation. The resulting effluent typically boasts very high levels of dissolved oxygen and very low single digit BOD and TSS, along with reduced fecal coliform and nitrogen levels.

BioMaze® goes beyond typical aerobic treatment, it is in fact a "Suspend Biofilm Generator™" (SBG™), fostering suspended biofilm microorganisms throughout the tank and into the drainfield. The innovative BioMaze® SBG™ facilitates rapid "Forced Rejuvenation®", visibly improving drainfield performance within days, in systems plagued with biomat sludge.