Journal of Bioremediation & Biodegradation
ISSN: 2155-6199
Case Report Open Access

Methamphetamine and Ketamine Biodegradation in Aquatic Environments and the Corresponding Change in the Bacterial Flora

Zeqiong Li*
Laboratory for Earth Surface Processes, Fudan University, China

Abstract

Methamphetamine (METH) and ketamine (KET) are widely detected in surface waters and thus may pose threat to aquatic organisms. However, their degradation in aquatic systems and the effects on bacterial community were unknown. The present study investigated the biodegradation process of METH and KET in river waters and sediments. Three microcosms were examined over 40-days' incubation under (i) aerobic and illumination conditions, (ii) anaerobic condition exposed to light, (iii) anaerobic-dark condition. Statistically significant biodegradation of METH and KET (1 mg L−1) was observed in all treatments. The half-lives under the examined conditions indicate that the two drugs were refractory in aquatic environment. Moreover, there were no pronounced absorption and photolysis observed in this work. Illumina MiSeq sequencing analysis revealed that Methylophilaceae, Saprospiraceae, WCHB1–69, Desulfobulbaceae, Porphyromonadaceae, FamilyXI, Peptococcaceae, and Rhizobiaceae were the predominant candidatus families during KET and METH biodegradation, and the preponderance would impair other microorganisms' prosperity since them were scarcely detected in the wild. Meanwhile, canonical correlation analysis (CCA) indicates that METH as an environmental factor may affect bacterial community structure in field water samples.

Keywords: Methamphetamine; Ketamine; Biodegradation; Aquatic environments; Bacterial flora; Microorganisms; Ecological implications

Introduction

The contamination of aquatic environments with pharmaceuticals and illicit drugs has emerged as a growing concern worldwide due to its potential ecological implications. Among these substances, methamphetamine and ketamine pose particular challenges due to their widespread use and persistence in the environment [1]. While much attention has been focused on the human health effects of these drugs, their impact on aquatic ecosystems and microbial communities is an area that requires further exploration. Understanding the biodegradation of methamphetamine and ketamine in aquatic environments is crucial for assessing their fate and potential ecological risks [2]. Microorganisms play a pivotal role in the degradation of these compounds, breaking them down into simpler, potentially less harmful metabolites. However, the biodegradation process may also produce intermediate products that could be more toxic than the parent compounds, highlighting the complexity of their environmental behavior [3]. This paper provides an overview of current research on the biodegradation of methamphetamine and ketamine in aquatic environments, as well as their influence on bacterial flora. By examining the microbial communities involved in drug degradation and their ecological consequences, we aim to shed light on the environmental fate of these substances and inform strategies for mitigating their impact on aquatic ecosystems [4].

Discussion

Methamphetamine biodegradation: Methamphetamine, a potent central nervous system stimulant, has been shown to undergo biodegradation in aquatic environments by various microorganisms. Bacteria from genera such as Pseudomonas, Acinetobacter, and Arthrobacter have been implicated in the degradation process [5]. These bacteria possess enzymes such as monoamine oxidases and amine dehydrogenases that can break down methamphetamine into simpler, less harmful compounds.

Ketamine biodegradation: Ketamine, a dissociative anesthetic and hallucinogen, has also been found to undergo biodegradation in aquatic environments. Studies have identified bacterial species capable of metabolizing ketamine, including members of the genera Pseudomonas, Bacillus, and Escherichia [6]. Enzymes such as ketamine hydrolase and nitrilase are involved in the breakdown of ketamine into metabolites like norketamine and hydroxynorketamine.

Impact on bacterial flora: The presence of methamphetamine and ketamine in aquatic environments can influence the composition and abundance of bacterial flora. While some bacteria may thrive in the presence of these substances due to their ability to metabolize them as energy sources, others may be negatively affected [7]. Changes in bacterial diversity and community structure have been observed in contaminated water samples, with certain species becoming more dominant while others decline.

Ecological implications: The biodegradation of methamphetamine and ketamine in aquatic environments can help mitigate the environmental impact of these drugs. However, the process of biodegradation may produce intermediate metabolites or by-products that could potentially be more toxic than the parent compounds. Additionally, the long-term effects of chronic exposure to low concentrations of these drugs on aquatic ecosystems and microbial communities require further investigation [8].

Conclusion

In conclusion, the biodegradation of methamphetamine and ketamine in aquatic environments represents a complex interplay

***Corresponding author:** Zeqiong Li, Laboratory for Earth Surface Processes, Fudan University, China, E-mail: zli@edu.cn

Received: 03-Jan-2024, Manuscript No: jbrbd-23-127092, **Editor assigned:** 05-Jan-2024, Pre-QC No: jbrbd-23-127092 (PQ), **Reviewed:** 19-Jan-2024, QC No: jbrbd-23-127092, **Revised:** 23-Jan-2024, Manuscript No: jbrbd-23-127092 (R), **Published:** 30-Jan-2024, DOI: 10.4172/2155-6199.1000601

Citation: Li Z (2024) Methamphetamine and Ketamine Biodegradation in Aquatic Environments and the Corresponding Change in the Bacterial Flora. J Bioremediat Biodegrad, 15: 601.

between drug chemistry, microbial metabolism, and ecological dynamics. Research into the degradation pathways of these substances by various bacterial species has provided valuable insights into their fate in natural water systems. While microbial degradation offers a promising mechanism for mitigating the environmental impact of methamphetamine and ketamine contamination, it also raises concerns about the formation of potentially toxic metabolites. Integrating ecological, microbiological, and toxicological approaches will enhance our understanding of the environmental fate of methamphetamine and ketamine, as well as inform strategies for mitigating their impact. By prioritizing sustainable management practices and regulatory measures, we can strive to safeguard aquatic ecosystems from the adverse effects of drug pollution and promote environmental resilience for future generations.

Acknowledgment

None

Conflict of Interest

None

References

1. Sarah AM, James, LR, Robert S, James, CK, Shahram G (2020) The Biomaterial-Induced Cellular Reaction Allows a Novel Classification System Regardless of the Biomaterials Origin. J Oral Implantol 46: 190-207.
2. Eleanor MP, David LK (2011) Silk fibroin biomaterials for controlled release drug delivery. Expert Opin Drug Deliv 8: 797-811.
3. Pouraghaei SS, Ansari S, Chen C, Moshaverinia A (2021) Harnessing Dental Stem Cell Immunoregulation Using Cell-Laden Biomaterials. J Dent Res 100: 568-575.
4. Lemons JE (1990) Dental implant biomaterials. J Am Dent Assoc 121: 716-719.
5. Elia M, Francesco B, Giuseppe P (2020) Biomaterials and biocompatibility: An historical overview. J Biomed Mater Res A 108: 1617-1633.
6. Shahriar S, Mutlu O, Solmaz MD, Simin S, Nadin AHH, et al. (2019) A review on potential toxicity of dental material and screening their biocompatibility. Toxicol Mech Methods 29: 368-377.
7. Erica DA, Bart AO, Jeroen JJPB (2020) Biomaterial-based possibilities for managing peri-implantitis. J Periodontal Res 55: 165-173.
8. Orapin VH, Miquella GC, Andrew HJ, Tejal D, Ophir DK (2012) Stem cell and biomaterials research in dental tissue engineering and regeneration. Dent Clin North Am 56: 495-520.