Here's some of the common wastewater parameters – and why we need to treat them

1 July 2024

The awareness to water contamination has urged the world to formulate advances in the wastewater treatment techniques to alleviate this alarming concern. However, to deal with this matter, it is very crucial to enumerate these wastewater constituents to further look into their possible detrimental effects to the public health and environment – if not disposed properly.

In the last **published blog** [insert link of previous blog in the words *published blog*], different wastewater treatment technologies were explored and discussed; but in this paper, we will look into five (5) of the common wastewater parameters as listed by regulatory bodies and see the need for those to be treated.

1. **Ammonia (NH_3)**

   Commonly described as urine-smelling, ammonia is a colorless yet particularly dangerous to human life as described by the American Chemical Society (2021). However, many literatures have already noted that this compound is infamous for the inhabitation of aquatic life, when discharged to healthy water bodies (Liu et al., 2019). In addition, as early as 1996, U.S. Geological Survey has already confirmed that ammonia helps eutrophication to prosper, and it declines possibility for lake restoration (Ding et al., 2022).

2. **Fecal coliform**

   Nobody wants any fecal matter near their face, what more to potable and drinking water! According to US EPA (2012), fecal coliforms are merely a type of bacteria that live in the intestines of warm-blooded animals – hence, their presence in water can be a clear indication of fecal contamination. *Escherichia coli,* or simply *E. coli,* is one best example of a fecal coliform bacteria, to which for centuries, has brought the world to anguish for its "diarrheagenic" effect (Nataro and Kaper, 1998).

3. **Nitrate (NO_3)**

   Nitrate is a naturally occurring compound that is essential in the life of animals and plants (EPA, 2023). But when found in excess in the water bodies, just like ammonia, can lead to massive algal bloom (Smith et al., 1999). Aside from this, nitrate can also reach the groundwater reserve that can lead to nitrate contamination, resulting to degraded water quality and public health concerns (Shen et al., 2011).

4. **Phosphate (PO_4)**

   Phosphorus, in the form of phosphate, is essential for life on Earth. However, like nitrate and ammonia, phosphate can contribute to eutrophication by promoting algal growth (Smoulders et al., 2009). Eutrophication is a phenomenon strongly avoided by experts due to its potential to harm aquatic animals and increase the risk of harmful algal blooms (HABs) (CDC, 2024). Moreover,

phosphate-induced eutrophication can lead to depleted dissolved oxygen (DO) levels in water bodies, impacting aquaculture and aquatic ecosystems reliant on adequate oxygen levels (US EPA, 2024).

5. **Sulfate (SO_4)**

   This compound is among the most common parameters that every wastewater treatment industry encounters. Despite generally regarded as "harmless" or without significant effect on human body (Zhou et al., 2018), if not regulated, sulfate can result to the formation of hydrogen sulfide (H_2S) which is known for its foul "rotten egg-like" odor (Llavador Colomer et al., 2012). More so, hydrogen sulfide is also the culprit to sewer lines corrosion as detailed by Park et al. (2014).

These five common parameters discussed are just a fraction of wastewater constituents that needed to be regulated – depending to the industry-type. However, defining each and being familiar to their characteristics and probable impact, not just to human health but also to the environment, is one leap of advancement for wastewater engineering.

References

American Chemical Society. (2021). Ammonia. ACS. https://www.acs.org/molecule-of-the-week/archive/a/ammonia.html

Centers for Disease Control and Protection. (2024). Harmful Algal Blooms and Your Health. US CDC. https://www.cdc.gov/harmful-algal-blooms/about/index.html

Ding, S., Dan, S. F., Liu, Y., He, J., Zhu, D., & Jiao, L. (2022). Importance of ammonia nitrogen potentially released from sediments to the development of eutrophication in a Plateau Lake. *Environmental Pollution*, *305*, 119275. https://doi.org/10.1016/j.envpol.2022.119275

Liu, Y., Ngo, H. H., Guo, W., Peng, L., Wang, D., & Ni, B. (2019). The roles of Free Ammonia (FA) in Biological Wastewater Treatment Processes: A Review. *Environment International*, *123*, 10–19. https://doi.org/10.1016/j.envint.2018.11.039

Llavador Colomer, F., Espinós Morató, H., & Mantilla Iglesias, E. (2012). Estimation of hydrogen sulfide emission rates at several wastewater treatment plants through experimental concentration measurements and dispersion modeling. *Journal of the Air & Waste Management Association*, *62*(7), 758–766. https://doi.org/10.1080/10962247.2012.674008

Nataro, J. P., & Kaper, J. B. (1998). Diarrheagenic *escherichia coli*. *Clinical Microbiology Reviews*, *11*(1), 142–201. https://doi.org/10.1128/cmr.11.1.142

Park, K., Lee, H., Phelan, S., Liyanaarachchi, S., Marleni, N., Navaratna, D., Jegatheesan, V., & Shu, L. (2014). Mitigation strategies of hydrogen sulphide emission in Sewer Networks – A Review. *International Biodeterioration & Biodegradation*, *95*, 251–261. https://doi.org/10.1016/j.ibiod.2014.02.013

Shen, Yanjun & Lei, Huimin & Yang, Dawen & Kanae, Sawase. (2011). Effects of agricultural activities on nitrate contamination of groundwater in a Yellow River irrigated region. IAHS-AISH Publication. 348. 73-80.

Smith, V. H., Tilman, G. D., & Nekola, J. C. (1999). Eutrophication: Impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems. *Environmental Pollution*, *100*(1–3), 179–196. https://doi.org/10.1016/s0269-7491(99)00091-3

Smolders, A. J., Lucassen, E. C., Bobbink, R., Roelofs, J. G., & Lamers, L. P. (2009). How nitrate leaching from agricultural lands provokes phosphate eutrophication in groundwater fed wetlands: The Sulphur Bridge. *Biogeochemistry*, *98*(1–3), 1–7. https://doi.org/10.1007/s10533-009-9387-8

US Environmental Protection Agency. (2012) Fecal Bacteria. US EPA. https://archive.epa.gov/water/archive/web/html/vms511.html

US Environmental Protection Agency. (2024). Nutrient Pollution. US EPA. https://www.epa.gov/nutrientpollution/problem

US Geological Survey. (1996). Nutrients in the Nation's Waters: Identifying Problems and Progress. USGS. https://pubs.usgs.gov/fs/fs218-

96/#:~:text=Ammonia%2C%20a%20form%20of%20nitrogen,human%20health%20and%20promote%20eutrophication.

Zhou, H., Sheng, Y., Zhao, X., Gross, M., & Wen, Z. (2018). Treatment of acidic sulfate-containing wastewater using revolving algae biofilm reactors: Sulfur Removal Performance and microbial community characterization. *Bioresource Technology*, *264*, 24–34. https://doi.org/10.1016/j.biortech.2018.05.051