

Bioassays: New Tools Engineers Need in their Toolset

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Over the last two decades, there has been a growing interest in developing technologies to tackle the problems associated with the presence of contaminants of emerging concern in various environmental matrices. Given the vast array of chemicals present in environmental samples, monitoring the performance of treatment processes using compound-specific chemical analyses may not be practical. The use of in vitro bioassays is increasingly considered a complementary method enabling the assessment of the potential risks posed by known and unknown contaminants, including transformation products formed during treatment. Our most recent research fully integrated the use of bioassays in the investigation and development of technologies to treat wastewater and stabilize biosolids. We used different in vitro bioassays (ER α CALUX®, LuminoTox®, YES and YAS) to monitor changes in biological effects following sludge stabilization by lagoons, aerobic and anaerobic digestion as well as during ozonation of wastewater containing several contaminants of emerging concern. The bioassays were shown to provide information not available using common performance evaluation tools such as chemical analyses. For example, while concentrations of estrogens were < LODs, measurable changes in estrogenic activity during sludge treatments using bioassays allowed the identification of the most performant processes to mitigate the risk of endocrine disruption in the receiving environment. Appearance of androgenic activity during ozonation of water containing pesticides and differences in toxicity removal for different modes of application of ozone also indicated that results from bioassays can influence the optimization of operating conditions. These findings suggest that bioassays currently envisioned as tools in a regulatory framework, must also be considered as valuable tools for engineers developing and optimizing technologies.