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Coupling Photobiocatalysis to Biodegradation in a Circulating-Bed Biofilm Reactor

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Inventors

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Intellectual Property Status:

Patent pending

Invention Description

The proper treatment of wastewater is becoming more and more important as the number of toxic and biologically recalcitrant organic compounds continues to increase. Current treatment systems are sequentially coupled, in that they involve a two-step process of advanced oxidation followed by biodegradation. In the ideal case of sequential coupling, advanced oxidation is controlled so that the recalcitrant organic compounds are only transformed to the point that they are rapidly biodegradable, at which point they would be passed to the biodegradation stage. Chemical transformation beyond this point generally wastes oxidant and increases operation costs with no further benefit. AOP are inefficient for simple organics and bacteria are not suitable for biodegrading recalcitrant compounds. Coupling the processes effectively utilizes the strengths of both.

Researchers at the Biodesign Institute of Arizona State University have recently devised a wastewater treatment scheme that intimately couples the advanced oxidation processes (AOP) with the biodegradation processes. They have shown it to be useful and effective on large scale activated sludge systems and in systems with toxic concentrations of contaminants. This is accomplished by the use of a photo-catalytic circulating-bed biofilm reactor (PCBBR). The PCBBR employs macro-porous carriers that accumulate biofilm in their interior. The AOP takes place in bulk solution with UV light photolysis or TiO_2 photocatalysis. In this unique design, the bacteria are well protected from UV light, toxic substrates, and free radicals, but are close enough to the AOP reactions so they can immediately biodegrade the photo-catalytic products.

Potential Applications

- Examples of manufacturing processes that would benefit from this technology include:
  - Municipal/industrial wastewater treatment
  - Food processing
  - Elastomer processing
  - Textile dye removal/leather tanning

Benefits and Advantages

- Faster processing times
- Efficient – offers complete mineralization of toxic and recalcitrant organic contaminants
- Cost effective – less waste of added oxidants
- Simple/Robust – a single tank reactor is easier to manage than multiple tanks

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