RECAT Technologies

PhotoCREC Reactors for Air/Water Treatment

The PhotoCREC Reactors are novel photocatalytic water and air treatment units, commercialized under exclusive license by Recat Technologies. Because of their unique design, PhotoCREC Reactors achieve high energy utilization efficiencies with complete mineralization of organic pollutants and inactivation of micro-organisms and viruses.

PhotoCREC Reactors use a Titanium Oxide (TiO_2) photocatalyst and are manufactured in two configurations,

Suspended PhotoCREC Reactors

These laboratory scale slurry reactors, ideal for testing and development of new photocatalysts, are manufactured with capacities up to 60 L and use small amounts 0.2 g/L of suspended catalyst. They allow precise control over the amount of catalyst loaded into the reactor and provide a reliable measure of,
photocatalytic reaction rates, photon energy utilization efficiencies and an accurate estimation of the irradiated energy absorbed in the unit. These units are recommended for water treatment research and development and for cases where the separation of the suspended innocuous TiO_2 photocatalyst particles is not at issue.

Immobilized PhotoCREC Reactors

Immobilized PhotoCREC reactors can be used for water and air treatment. Water treatment semi-commercial units are manufactured with capacities exceeding 300 L. Air treatment units are designed for a minimum capacity of 20L. These units hold small amounts of immobilized and uniformly irradiated TiO_2 and employ a design ensuring proper fluid flow and fluid/catalyst interaction. Produced drinking water is free of suspended TiO_2 particles.

Competing Technologies

Most competing photo conversion technologies for water treatment are based on the use of UV radiation. PhotoCREC reactors use photocatalytic processes and a design optimizing fluid flow, catalysts loading and irradiation, producing energy savings over 45% [1]. In fact, PhotoCREC units perform with the highest reported photocatalytic energy efficiencies. This results in the lowest reported irradiated energy consumption per unit of mineralized pollutant and of inactivated microorganism.

Technical Benefits

PhotoCREC reactors are ideally suited for,

Photocatalyst Development

There is a growing effort to develop highly efficient photocatalysts, with solar energy utilization well above 5%. PhotoCREC slurry reactors allow rapid testing and accurate measurement of irradiated absorbed energy, in the visible light range, for new semiconductor samples with various amounts of dopants.

Kinetic Modeling and Catalyst Characterization

The lack of applicable reaction rate models has made application and scaling up of photocatalytic reactor units for both air and water treatment highly unreliable. PhotoCREC reactors address this problem by allowing variation of operational parameters such as catalyst loading, model pollutant concentration, and absorbed irradiation. This provides an accurate determination of photocatalytic organic pollutants conversion rates. Total Organic Carbon (TOC) measurements show that this approach accounts for over 95% of all organic species.

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Kinetic rate models based on using PhotoCREC units and a novel "series-parallel" approximation, accurately reflect performance of scaled up units.

Evaluation of Energy Efficiency

PhotoCREC reactors can be used to develop kinetic rate models and measure absorbed irradiation energy. This permits a rapid evaluation of Quantum Yields (QY) and Photocatalytic Thermodynamic Efficiency Factors (PTEF), allowing photocatalytic energy efficiency of semiconductors to be assessed.

Financial and Social Benefits

Lack of clean drinking water is a major factor in the spread of disease around the world. Existing water treatment technologies are either costly or do not adequately remove contaminants. In addition to reducing organic, inorganic, and biological pollutant levels, PhotoCREC reactors require little capital investment to set up and operate.

PhotoCREC reactors are engineered with rural communities in mind, where there is urgent need for a steady supply of drinking water free of both organic and microbiological contaminants. Unit operation is simple and can be handled by a member of the community being served.

User Support

Recat Technologies Inc. PhotoCREC users by,

- Providing training following delivery
- Developing reaction kinetic models
- Consulting on industrial scale photocatalyst use
- Implementing upgrades and improvements
- Communicating advances to users

Impact

PhotoCREC reactors have been successfully used in the photo-conversion of many organic and inorganic pollutants, as well as the inactivation of water contained microorganisms. These reactors are adaptable to being powered by solar energy.

Semi-Commercialization Version of PhotoCREC

Current bench scale versions of the PhotoCREC unit (see image) have a water treatment capacity of 300 L, addressing the basic daily needs of a community of 500 people (around 1200 L/day). Recat Technologies is currently pursuing research to increase the PhotoCREC reactor's capacity, with the goal of supplying drinking water to communities of 3000 people.

About Recat Technologies

Founded in 2003, RECAT Technologies Inc., is a University of Western Ontario (UWO) affiliated spin-off specializing in the development and commercialization of innovative Reactor Engineering and Catalytic Technologies (RECAT). RECAT's founder and President Dr. Hugo de Lasa, is a distinguished researcher and engineer whose contributions to the field of chemical engineering have gained him international recognition. The PhotoCREC reactors were invented and developed by Dr. de Lasa at the UWO 's Chemical Reactor Engineering Centre.

References

[1] de Lasa H., Serrano B., Salaices M., "Photocatalytic Reaction Engineering", Springer (2005).

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