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Short communication

Development of a hybrid environmental purification unit by using of excimer VUV lamps with TiO_2 coated titanium mesh filter

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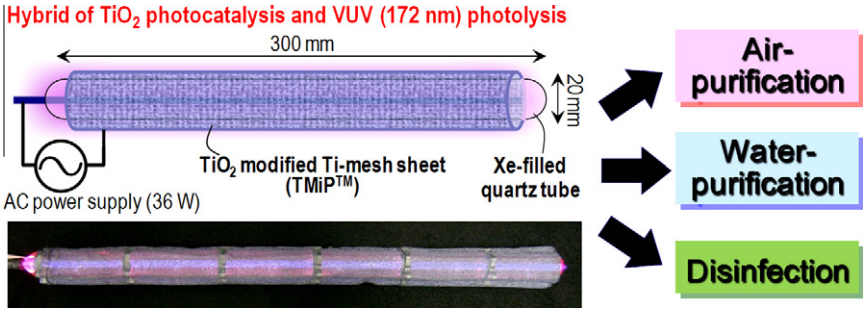
HIGHLIGHTS

- An environmental purification unit consisted of excimer-lamp with TiO_2 was developed.
- A synergy of photocatalysis and VUV photolysis was achieved by effective design.
- The unit was able to decompose acetaldehyde gas efficiently in practical scale.
- The unit was able to decompose phenol by generation of reactive species in water.
- Disinfection activity of the unit for waterborne pathogens was also evaluated.

GRAPHICAL ABSTRACT



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ABSTRACT

A versatile photocatalyst-excimer-lamp hybrid unit for both air- and water-purification at practical scale was investigated. The unit consisted of a xenon filled quartz tube (20 mm i.d. × 300 mm length) and TiO_2 nanoparticles-modified Ti-mesh sheet (TMiP™). Emission at 172 nm from a xenon excimer (Xe_2^*) was able to produce reactive species by direct photolysis of water or air. At the same time, the emission was able to excite TiO_2 on TMiP surface. Therefore, the unit decomposes organic contaminants by synergy of photocatalysis and photolysis. Air- and water-purification efficiency of the unit was examined by high concentration of acetaldehyde and phenol decomposition test, respectively. The disinfection activity of the units for waterborne pathogens was also investigated. For comparison, the purification units using excimer-lamp alone or UV lamps with TMiP and/or ozone treatment were evaluated in the same methods. The photocatalyst-excimer-lamp hybrid unit was able to decompose acetaldehyde and phenol effectively, compared with the other units. On the other hand, disinfection activity of the unit for waterborne pathogens was strongly affected by the kind of the waterborne pathogens. The difference of efficiency

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