Water treatment using low temperature plasma with packed bed reactor at atmospheric pressure

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Plasma based water treatment is one of the emerging technologies that could be potentially modularized and scaled-up for in-situ water resource utilization or point of use applications in regions lacking water treatment infrastructure as well as integrated with conventional water treatment systems. A packed bed reactor which employs dielectric barrier discharge (DBD) plasma as the source of advanced oxidation species is designed and manufactured. The DBD is consisted of a quartz tube as dielectric material, stainless steel rod as inner electrode, alumina beads as packed material, and copper tape wrapping around the quartz tube as outer electrode. Air is introduced from the bottom of the reactor and get activated when passing through the plasma region before feeding into a water container for bubbling via a membrane. Methylene blue solution is used to quantify the oxidative capability of the reactor with degradation efficiency by measuring its absorption intensity. Different parameters such as gap size, bead diameter, flow rate, treatment time, and plasma power are explored to search for better reactor performance. Electrical characterization is also conducted to estimate the plasma power and identify the trends in the experimental parameter space. In the final paper, the detailed experimental results will be presented.