# Addressing Deficiencies in Wastewater Treatment: Engineering an Innovative Dielectrophoretic Apparatus Capable of Real-time Emerging Pollutant Remediation

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Over the last decade, more than 140 new emerging pollutants have been identified in wastewater treatment effluents, placing stress on existing infrastructure. These emerging pollutants inhibit microbial enzymes essential to the removal of conventional pollutants, yet existing solutions do little to mitigate infrastructure damage due to universal deficiencies in selectivity. This establishes a pressing need to develop a selective removal system that can be applied in early treatment stages, thereby preserving current infrastructure in the face of escalating threats. My project addresses this gap by developing and validating a cost-effective dielectrophoretic apparatus capable of working alongside existing infrastructure to selectively remove pollutants. First, I addressed deficiencies in conventional electrode passivation by optimizing a chitosan coating through electrophoretic deposition. I then validated the coating using industry-standard protocols to ensure industrial readiness. The optimized coating displayed a 92% coverage on the electrode with a 5B adhesion strength, the strongest adhesion according to ASTM D3359 protocols. The coated electrodes were then validated in a relevant wastewater environment aimed at accelerating degradation. The coated meshes demonstrated significant corrosion resistance compared to the control (<1mg ?W), confirming their operational viability. Following this, I developed a pilot system with an integrated physics-based optimization tool, which displayed ~15% removal in initial testing on a hydrophobic model graphite suspension. These novel findings offer a scalable and cost-effective approach to real-time emerging pollutant remediation efforts in early treatment stages with exciting potential applications in municipal treatment centers.

**Awards Won:**
Third Award of $1,200