# A Novel, Cost-Effective Water Filtration and Desalination Technique Based on Biodegradable Superabsorbent Polymers

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Desalination and purification of seawater could prevent droughts and give all humanity access to clean water. However, current desalination techniques like reverse osmosis (RO) are difficult to implement due to extremely high costs, energy consumption, and infrastructure requirements. To address this problem, a highly sustainable, energy and maintenance-free osmosis technique is designed for removal of dissolved salts, arsenic, lead, copper, and coliforms from seawater. The technique consists of two steps. First, contaminated seawater is treated with chitosan, ethylenediaminetetraacetic acid, and activated carbon for preliminary purification. Next, biodegradable superabsorbent polymers are utilized as a revolutionary osmosis medium to absorb clean water from the seawater. The clean water is recovered with acid-base chemistry. After optimization, the technique was tested for filtration of highly contaminated simulated seawater in liter size batches. On average, it eliminated coliforms, reduced arsenic to 6 ppb, lead to 4 ppb, copper to 0.5 ppm, and dissolved solids to 554 ppm. These results are statistically significant ($p<0.001$) and under EPA limits. Drinkable water is produced at a cost of 28 cents/liter, representing at least a 10000% reduction in cost compared to implementing RO in developing countries. The technique is about 280% more water-efficient and has 99% lower initial operating costs than RO. Output chemicals may be easily regenerated for reuse or used in agriculture. Thus, this technique represents a new paradigm in water filtration and finally makes desalination and purification of seawater a cost-effective reality for the world.

**Awards Won:**
University of Arizona: Tuition Scholarship Award
Arizona State University: Arizona State University Intel ISEF Scholarship
Third Award of $1,000