Microalgae for Clean Water and Green Growth

In Argentina, approximately 40% of the population lacks access to sewer systems, a shortfall that is even more severe in vulnerable communities. Less than 30% of collected wastewater receives adequate treatment, leaving large volumes discharged untreated into the environment. The gap reflects deep territorial inequalities. Major urban centers are equipped with treatment facilities, while many medium and small localities struggle to finance and operate conventional infrastructure. These systems often demand high energy costs, specialized staff, and complex sludge management. The result is a persistent deficit that affects quality of life and drives environmental degradation.

This project optimizes microalgae-based wastewater treatment, a nature-based solution that recovers byproducts, requires low energy, and reduces carbon footprint. It aims to expand sanitation access while producing value-added products like biofertilizers and biostimulants, with strong potential for small communities.

RECOVER

REGENERATE

LA MATANZA, ARGENTINA

WASTEWATER

INDUSTRIAL

wef | CASE STUDY

CHALLENGES FACED

Microalgae reactors require shallow depth and longer hydraulic retention times to achieve adequate treatment, which increases the land area needed for installation. With open reactors, the technology is vulnerable to climate and influent fluctuations, requiring reliable controls.

No framework currently authorizes the use of wastewater-derived microalgal biomass in agriculture. Quality and safety trials are underway to enable its use as biofertilizer and biostimulant.

TECHNOLOGIES & SOLUTIONS USED

The project uses open raceway microalgae reactors, where paddlewheels circulate wastewater through shallow ponds. With sunlight and CO_2, microalgae capture nitrogen and phosphorus and release oxygen, enabling bacteria to degrade organic matter and purify water. The pilot plant has three 40 m^2 raceways with automated controls, testing low-cost treatment, optimized biomass production, and an innovative system that reduces land use and simplifies harvesting.

IMPACT & INSIGHTS

The pilot microalgae facility treated up to 12 m^3 of sewage per day, achieving high removal rates for biochemical oxygen demand (68%–98%), ammonium (57%–98%), total nitrogen (45%–88%), and phosphorus (26%–84%), while producing 2.1–7.7 g/m^2/day of biomass with >98% harvest efficiency. The project, a collaboration between a major utility and the national science and technology system, created a pilot that was first of its kind in Argentina and elevated the profile of microalgae technologies in the sanitation sector. The system offers an affordable, sustainable solution for small and decentralized communities, improving environmental quality while generating local economic opportunities.

LESSONS LEARNED

One of the key lessons learned at pilot scale is that these systems must operate continuously to assess performance under climatic variability and fluctuating influent quality. A robust plant is essential, equipped with reliable pumps, mixers, and sensors, plus backup systems and stable automation to control parameters such as water level, pH, dissolved oxygen, and CO_2. Equally important is engaging real-world operators early in project design so that innovation is grounded in practical expertise. This convergence of operational knowledge and scientific development offers the strongest pathway for successful application of the technology in the future.

> **The microalgae facility not only aims to improve environmental quality but also creates economic and productive opportunities in communities that are often left outside large conventional infrastructures.**

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