Algal Biofuel Production through Landfill Leachate Remediation

Scott J. Edmundson[1] and Ann C. Wilkie[2]
[1]School of Natural Resources and Environment
[2]Advisor, Soil and Water Science Department

Production of fuels from food commodities, while growing in magnitude, is inevitably a temporary transition to energy self-sufficiency. Photosynthetic algae are an emerging next-generation feedstock for biofuel production. While technically feasible, algal-based biofuels have not yet reached commercial viability. A significant expense in large-scale algal cultivation is the use of chemical fertilizers. Utilizing aqueous leachate from a landfills may provide low-cost sources of elemental nutrients for large-scale algal-fuel production, while simultaneously remediating the negative environmental impact of those liquid wastes. Native photosynthetic organisms growing on-site were investigated for lipid storage and landfill leachate tolerance. Algae were found to grow at all dilutions of landfill leachate, with the most significant growth occurring between 25 and 75% dilutions of leachate with groundwater. At these dilutions, organisms with an ability to synthesize and accumulate oils were observed, including most significantly *Chlorella ellipsoidea*, which had a lipid composition of 12.5% ash-free dry weight, without optimization. A mixed polyculture of native algae growing in a 60% landfill leachate dilution was found to yield 0.44±0.01 g/L ash-free dry weight at maximum cell density. With optimization, the system may yield substantial improvements in increased biological leachate tolerance and therefore biomass yield, biofuel production, and leachate remediation.