Abstract

I designed and optimized a sustainable bio-jet fuel production facility for converting *Salicornia bigelovii* seed oil into hydroprocessed renewable jet (HRJ) fuel and evaluated its sustainability. With 20 thousand hectares of farm as the basis, 76 thousand bbl/yr of biocrude oil could be produced, while 11.2 million kg/yr of salicornia seed oil and 386 thousand kg/yr of hydrogen would be consumed and 2,200 tonnes/yr of carbon dioxide would be sequestered and stored. The product would be produced in Abu Dhabi, UAE, sold to an existing refinery infrastructure, blended with conventional jet fuel in a 50:50 ratio, then used as a fuel for planes Abu Dhabi International Airport.

The process is not economically feasible at a crude price range of $20 to $75/bbl, though it is equitable. With a fixed capital investment of $26.0M and an annual manufacturing cost of $14.1M/yr, the rate of return on investment (ROROI) would be 10%, for a crude price of $269.34/bbl. Internal rate of return (IRR) is 10.7%. The design is most sensitive to crude price, tax rate, and the hydrogenation reactor cost. A well-to-wake life cycle assessment (LCA) on greenhouse gas (GHG) emissions was performed and the net carbon dioxide sequestered for my process would be 22.2 gCO_2-e per megajoule of energy in blended Jet-A. To make this process feasible at a moderate crude price, the HRJ process should be attached to the biomass-to-liquids (BTL) process to utilize the salicornia biomass to produce more biocrude oil.