Preface

This book examines the production of algae culture and usage of algal biomass conversion products. In this book, the modern biomass-based transportation fuels biodiesel, bio-oil, biomethane, biohydrogen, and high-value-added products from algae are briefly reviewed. The most significant distinguishing characteristic of algal oil is its yield and, hence, its biodiesel yield. According to some estimates, the yield (per acre) of oil from algae is over 200 times the yield from the best-performing plant/vegetable oils. The lipid and fatty acid contents of microalgae vary in accordance with culture conditions. The availability of algae and the advantages of algal oil for biodiesel production have been investigated.

Billions of years ago the Earth's atmosphere was filled with CO_2. Thus there was no life on Earth. Life on Earth started with *Cyanobacteria* and algae. These humble photosynthetic organisms sucked out the atmospheric CO_2 and started releasing oxygen. As a result, the levels of CO_2 started decreasing to such an extent that life evolved on Earth. Once again these smallest of organisms are poised to save us from the threat of global warming.

In the context of climatic changes and soaring prices for a barrel of petroleum, biofuels are now being presented as a renewable energy alternative. Presently, research is being done on microscopic algae, or microalgae, which are particularly rich in oils and whose yield per hectare is considerably higher than that of sunflower or rapeseed. Algae will become the most important biofuel source in the near future. Microalgae appear to be the only source of renewable biodiesel that is capable of meeting the global demand for transport fuels. Microalgae are theoretically a very promising source of biodiesel.

Algae are the fastest-growing plants in the world. Industrial reactors for algal culture are open ponds, photobioreactors, and closed systems. Algae are very important as a biomass source and will some day be competitive as a source for biofuel. Different species of algae may be better suited for different types of fuel. Algae can be grown almost anywhere, even on sewage or salt water, and does not require fertile land or food crops, and processing requires less energy than the algae provides. Algae can be a replacement for oil-based fuels, one that is more effective

and has no disadvantages. Algae are among the fastest-growing plants in the world, and about 50% of their weight is oil. This lipid oil can be used to make biodiesel for cars, trucks, and airplanes. Microalgae have much faster growth rates than terrestrial crops. the per unit area yield of oil from algae is estimated to be between 20,000 and 80,000 L per acre per year; this is 7 to 31 times greater than the next best crop, palm oil. Most current research on oil extraction is focused on microalgae to produce biodiesel from algal oil. Algal oil is processed into biodiesel as easily as oil derived from land-based crops. Algae biomass can play an important role in solving the problem of food or biofuels in the near future.

Microalgae contain oils, or lipids, that can be converted into biodiesel. The idea of using microalgae to produce fuel is not new, but it has received renewed attention recently in the search for sustainable energy. Biodiesel is typically produced from plant oils, but there are widely voiced concerns about the sustainability of this practice. Biodiesel produced from microalgae is being investigated as an alternative to using conventional crops such as rapeseed; microalgae typically produce more oil, consume less space, and could be grown on land unsuitable for agriculture.

Using microalgae as a source of biofuels could mean that enormous cultures of algae are grown for commercial production, which would require large quantities of fertilizers. While microalgae are estimated to be capable of producing 10 to 20 times more biodiesel than rapeseed, they need 55 to 111 times more nitrogen fertilizer – 8 to 16 tons/ha/year.

This book on algae energy attempts to address the needs of energy researchers, chemical engineers, chemical engineering students, energy resource specialists, engineers, agriculturists, crop cultivators, and others interested in practical tools for pursuing their interests in relation to bioenergy. Each chapter in the book starts with basic explanations suitable for general readers and ends with in-depth scientific details suitable for expert readers. General readers include people interested in learning about solutions to current fuel and environmental crises. Expert readers include chemists, chemical engineers, fuel engineers, agricultural engineers, farming specialists, biologists, fuel processors, policymakers, environmentalists, environmental engineers, automobile engineers, college students, research faculty, etc. The book may even be adopted as a textbook for college courses that deal with renewable energy or sustainability.

Trabzon, TURKEY (September 2009)

Ayhan Demirbas
Muhammet Demirbas

http://www.springer.com/978-1-84996-049-6

Algae Energy
Algae as a New Source of Biodiesel
Demirbas, A.; Demirbas, M.F.
2010, X, 200 p. 45 illus., Hardcover
ISBN: 978-1-84996-049-6