An overview of oil extraction from algae: A sustainable way of producing biodiesel

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Harvesting and Growing Algae

- Different techniques:
  - Open-pond growing – simplest method
  - Vertical growth/closed loop production – double the production rate because excess exposure to sunlight
  - Closed-tank bioreactor plants – indoor plants with drums containing algae
  - Fermentation – new method, algae is fed sugar, manufacturers can control all aspects of growth environment
Oil Extraction Methods

Mechanical
- Oil press: algae dried out, oil content forced out with expeller or press
- Ultrasonic: faster than pressing, ultrasonic waves create bubbles in a solvent, break open in algae to break down cell walls

Chemical
- Hexane solvent process = leftover algae mixed with hexane to produce oil and then oil is filtered
- Supercritical fluid method = CO₂ acts as SCF and converts algae to oil when combined
- Transesterification = how oil is refined once extracted

http://img.diytrade.com/cdimg/401138/3069081/0/1166001421/SCREW_OILPRESS.jpg
Sustainability of Algae Biofuel

• Algae biodiesel plants can be placed near fossil fuel based energy production plants

• Excess algae leftovers → fertilizer and feedstock

• More than 100,000 gallons of algae oil produced per acre of land

• Could surpass corn and palm oil (can produce more) and eventually petroleum if enough land was provided
### United States
- **Office of Fuels Development (part of Dept. of Energy)** started Aquatic Species Program
  - Investigate algae containing high levels of oil for mass production
  - Development of algae farms in desert regions → saltwater pools
  - High evaporation rates, salt build up

### Australia
- **South Australian Research and Development Institute (SARDI):** microalgae, bioreactor
- **Smorgon Falls (Victoria):** waste gas streams from power stations to convert algae
- **Solar Biofuels Consortium (Queensland):** high-efficiency biofuel systems