

**Full Fuel Cycle Analysis
of Biomass to Ethanol:
Wastewater Treatment
System Performance**

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Introduction

Background

The Department of Energy, through the National Renewable Energy Laboratory (NREL) has embarked upon a program to develop technologies for the production of fuel grade ethanol from renewable biomass resources. One of the current projects in the overall program is the Biomass-to-Ethanol Total Energy Cycle Analysis. The objective of this project is to characterize the economic and environmental consequences of some of the transportation fuel alternatives.

The project is evaluating ethanol production from six sources. Five of the sources are assumed to be crops grown specifically for ethanol production. The five crop sources have been selected based on the crops most likely to be grown in different regions of the country. The sixth source of biomass is the cellulytic fraction of municipal solid waste (MSW). It has been assumed for these evaluations that the process to produce ethanol from MSW will be ready by the year 2000, while the production from the other sources will begin in 2010.

An important part of the biomass-to-ethanol conversion process is the wastewater treatment system. The system must treat all wastewater streams from the process so that the effluent is suitable for discharge or reuse in the process. This report summarizes a study that evaluated wastewater treatment systems capable of treating the wastewater from biomass-to-ethanol production facilities. The selected treatment system, along with the sizing and cost of the system, is discussed first. A discussion of the potential inputs/outputs and environmental effects of the treatment system follows.

Objectives

The objectives of the Wastewater Treatment System Performance Study were as follows:

- To define treatment systems potentially applicable for the wastewater from biomass-to-ethanol production facilities
- To provide preliminary sizing of the treatment systems
- To provide preliminary equipment lists and order-of-magnitude cost estimates for the proposed systems
- To estimate the inputs, outputs, and emissions resulting from system operation
- To provide qualitative and quantitative estimates of the environmental emissions and effects resulting from system operation