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# Yeast fermentation of carboxylic acids obtained from pyrolytic aqueous phases for lipid production

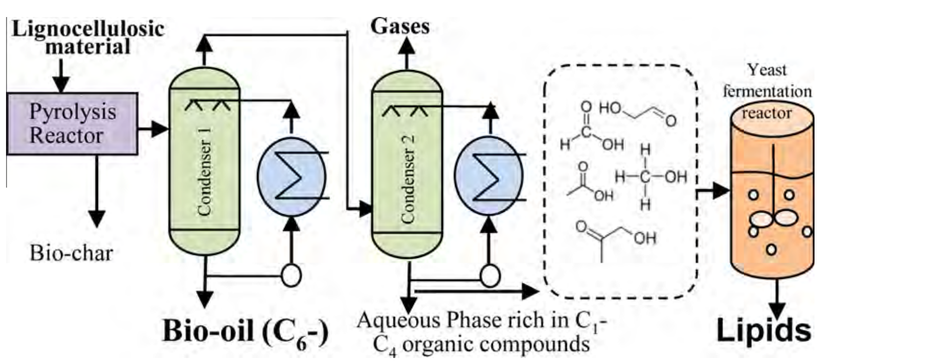
Jieni Lian [a], Manuel Garcia-Perez [a], Ralph Coates [b], Hongwei Wu [c], Shulin Chen [a,*]

[a] Biological Systems Engineering, Washington State University, WA 99164-6120, USA
[b] Amaron Energy, Salt Lake City, UT 84103, USA
[c] Fuels and Energy Tech. Institute, Curtin University, Box U1987, Perth WA 6845, Australia

## HIGHLIGHTS

- ▶ A fractional condenser was used to separate pyrolytic aqueous phase and bio-oil.
- ▶ Model compounds representing C1–C4 pyrolytic molecules were fermented.
- ▶ The optimal acetate concentration for fermentation with *C. curvatus* was determined.
- ▶ A technology to produce lipid from the pyrolytic aqueous phase was proposed.

## GRAPHICAL ABSTRACT

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## ABSTRACT

The presence of very reactive C1–C4 molecules adversely affects the quality bio-oils produced from the pyrolysis of lignocellulosic materials. In this paper a scheme to produce lipids with *Cryptococcus curvatus* from the carboxylic acids in the pyrolytic aqueous phase collected in fractional condensers is proposed. The capacities of three oleaginous yeasts *C. curvatus*, *Rhodotorula glutinis*, *Lipomyces starkeyi* to ferment acetate, formate, hydroxylacat-aldehyde, phenol and acetol were investigated. While acetate could be a good carbon source for lipid production, formate provides additional energy and contributes to yeast growth and lipid production as auxiliary energy resource. Acetol could slightly support yeast growth, but it inhibits lipid accumulation. Hydroxyacetaldehyde and phenols showed high yeast growth and lipid accumulation inhibition. A pyrolytic aqueous phase with 20 g/L acetate was fermented with *C. curvatus*, after neutralization and detoxification to produce 6.9 g/L dry biomass and 2.2 g/L lipid.


## 1. Introduction

The ever growing demand for goods and services and global warming require new approaches to produce higher quantities of fuels and chemicals which are currently produced mostly from non renewable sources (Doma, 2011). As a natural, abundant and renewable resource, biomass is being considered as the only option for the production of renewable C-based fuels and chemicals to mitigate the potential detrimental effects of a gradual depletion of petroleum resources. Pyrolysis oil, a product of biomass simultaneous depolymerization and fragmentation at temperatures between 300 and 600 °C is being studied as a promising platform for fuels and chemicals production (Jarboe et al., 2011; Garcia-Perez et al., 2007, 2008).

However, the complex composition of these oils, with more than 400 chemicals identified, makes their refining difficult. The presence of carboxylic acids is particularly troublesome (Garcia-Perez et al., 2010). These compounds cause phase separation, reduce

* Corresponding author. Address: Biological Systems Engineering Department, Washington State University, Pullman, WA 99164-6120, USA.
*E-mail address:* chens@wsu.edu (S. Chen).

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