

## Processing of Biomass Using a Teledyne Isco Syringe Pump

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### Introduction

Bench-scale evaluations at high temperature and pressure involving biomass feed that requires precise control and delivery are a major technical challenge. This is due to the fact that the majority of available pumps capable of operating at low flow rates (<100 ml/min) are not suitable for high temperature operation. In our research, we require precise delivery of feed material to a separation device at temperatures up to 200 °C and pressures up to 600 psi depending on feed properties. A Teledyne Isco 1000D syringe pump was utilized to process a variety of biomass materials such as algal, cellulosic, and lignocellulosic at flow rates ranging from 10 to 300 ml/min.

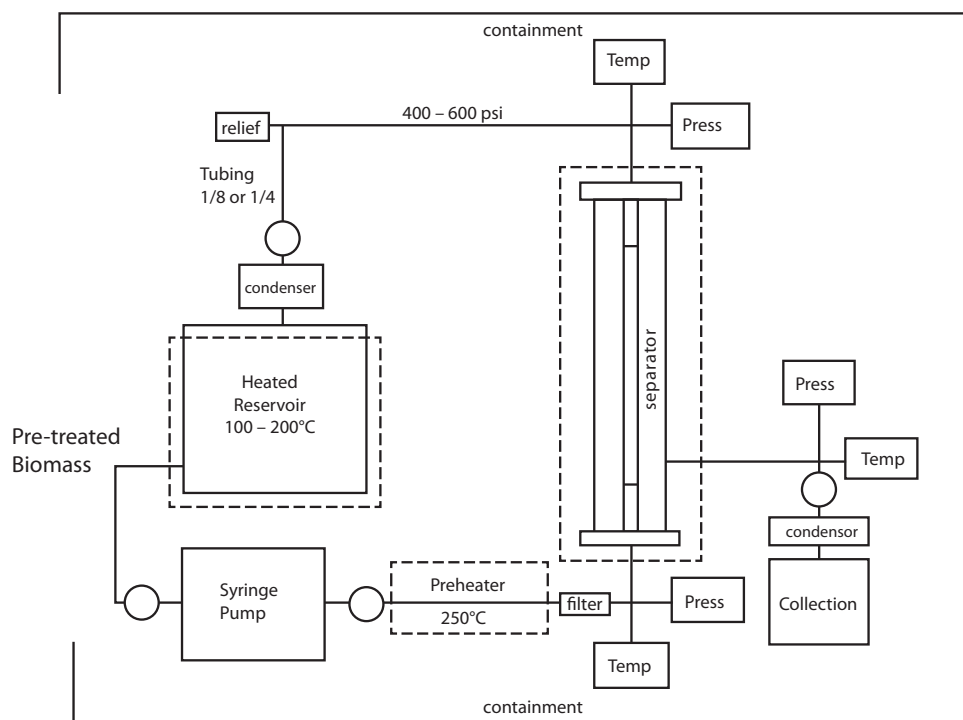
### Experimental Procedures

The processing of aqueous biomass at temperatures up to 200 °C requires pumping feed material at moderately elevated pressure with high precision and reliability. In this process, high temperature pretreated biomass containing small loading (up to 1%) of sus-

pending solids is fed to a separator for downstream processing.

The Teledyne Isco 1000D syringe pump, equipped with a high temperature package, delivers feed material at precise flow rates ranging from 10 to 300 ml/min, at pressures up to 600 psi, with operating temperatures up to 200 °C. The test setup incorporating the high pressure syringe pump is shown in the figure below.

Feed biomass samples contain both soluble and insoluble components. Operating the system at temperatures up to 200 °C with the high temperature upgrade ensures uniform concentrations and prevents precipitation of certain biomass components in the pump cylinder. Another useful feature of the Teledyne Isco pump is the ability to operate at constant pressure or constant flow. This allows the evaluation of system performance under two independent operating parameters, which is required to better understand the critical factors impacting biomass processing.



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