# Lab on a Chip

# Supplementary Information

## Biomass-to-biocrude on a chip via hydrothermal liquefaction of algae

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The experimental apparatus contains a number of components and the flow path among them is indicated in the Figure S1. The manufacturing numbers and the application purposes are provided in Table S1. All critical components in the apparatus have pressure rating higher than 20 MPa and are mainly connected using Yor-Lok fittings. During the experiment, the switching valve was in collection position to ensure fluids exiting the microfluidic reactor quickly entered the fixed-volume sample isolator. Once the sample isolator is filled with representative samples collected at steady state, the switching valve is quickly turned to the eluting position. Then a large amount of DI water is pumped in from the syringe to eject the sample into the sample vial. This procedure ensures sample quality while maintaining high pressure in the chip during collection.

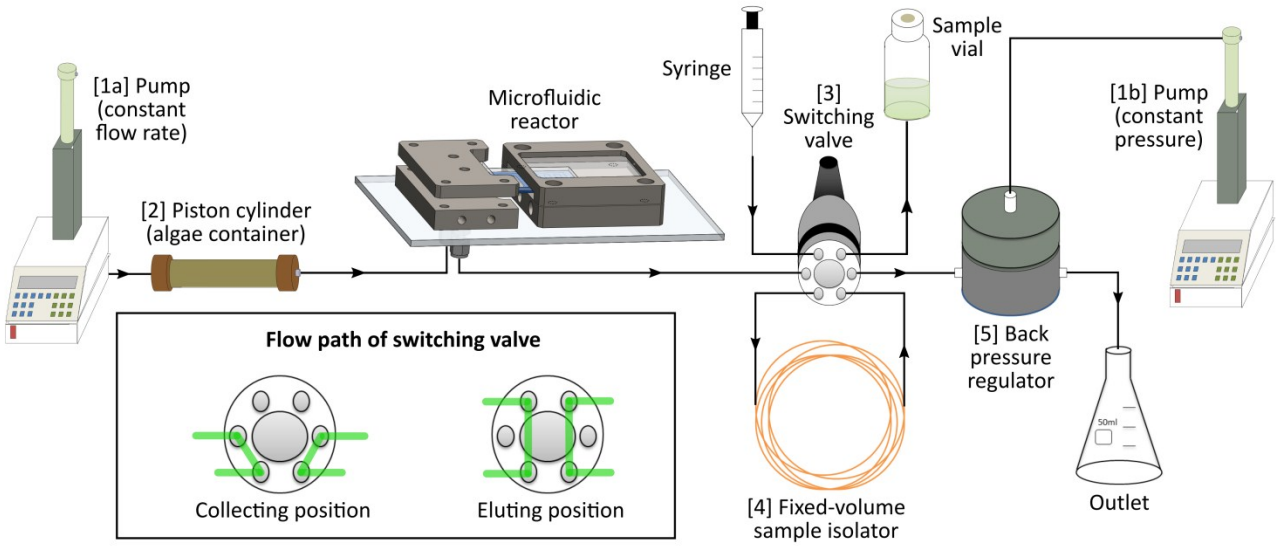


**Figure S1:** Schematic diagram of experimental setup with flow direction indicated by arrows along the processing path. The flow path of the switching valve at two positions is shown in green lines.

**Table S1:** List of components in the apparatus and their purpose.

| Number | Part Name | Mfg Number | Purpose |
|---|---|---|---|
| **1** | High Pressure Pump | *ISCO 260D* | 1a. Pumping algae slurry at constant flow rate<br>1b. Maintaining constant pressure for BPR |
| **2** | Piston cylinder | *HIP TOC3-10* | Algae slurry container |
| **3** | Switching valve | *Rheodyne®7030* | Switching flow paths without depressurizing the whole system |
| **4** | Fixed-volume sample isolator | *Radel® R Tubing 1220* | Temporarily storing fixed-volume sample in the loop ensures sample quality |
| **5** | Back pressure regulator | *Equilibar EB1ULF1 - SS316* | Maintaining constant pressure for a continuous flow at ultra-low flow rate |

**High Pressure Manifold Design:**

A manifold module is used in this study to provide high pressure sealing between the microfluidic chip and the rest of the apparatus. This manifold uses a modular design (Figure S2) and can interface with any chip sharing the same port pattern and thickness. Compression between the o-ring (Double-Seal Viton® 004) and the chip is achieved through screw fasteners and care must be taken when tightening to avoid fracturing the chip. To assist with tightening, a spacer is placed between the clamp and the manifold to prevent fracture by overstressing. Also, a layer of polished glass is placed between the chip and the clamp to provide even clamping pressure. The manifold was fabricated out of stainless steel (SS316).

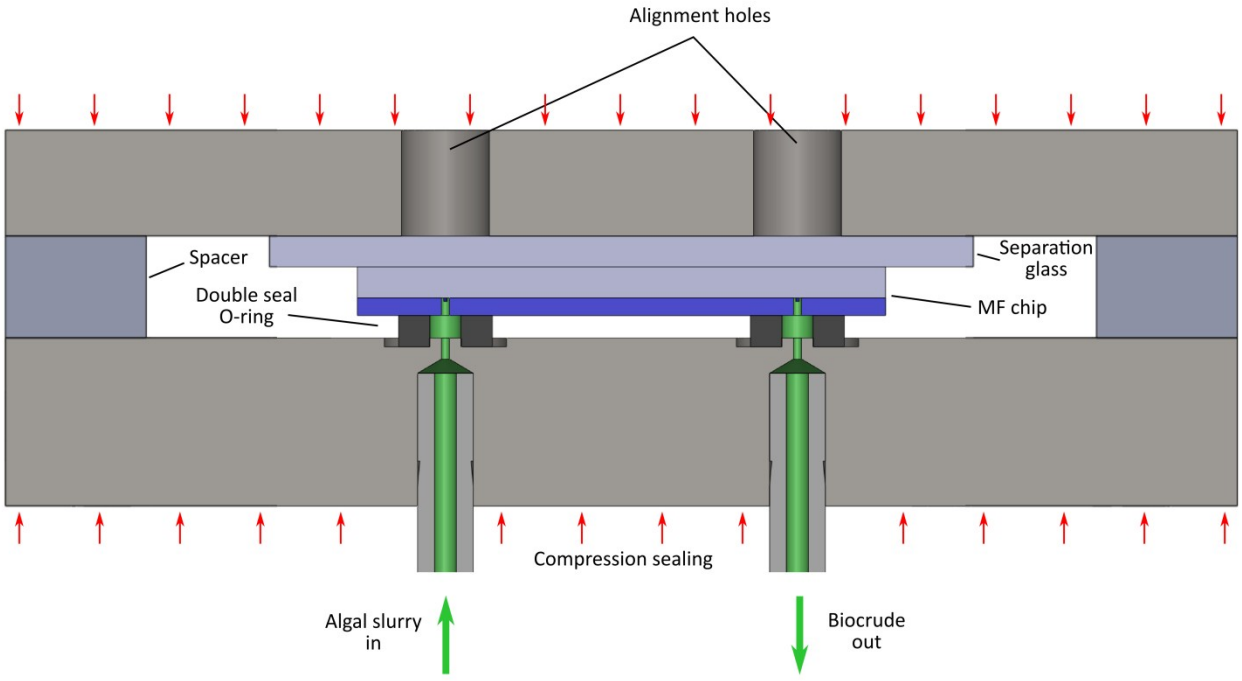


**Figure S2:** Detailed drawing of the compression sealing of the microfluidic chip (MF) with algae slurry fluid indicated in green. O-rings and spacers are used to ensure a quality seal between the manifold and the chip and to prevent overtightening and damage.