



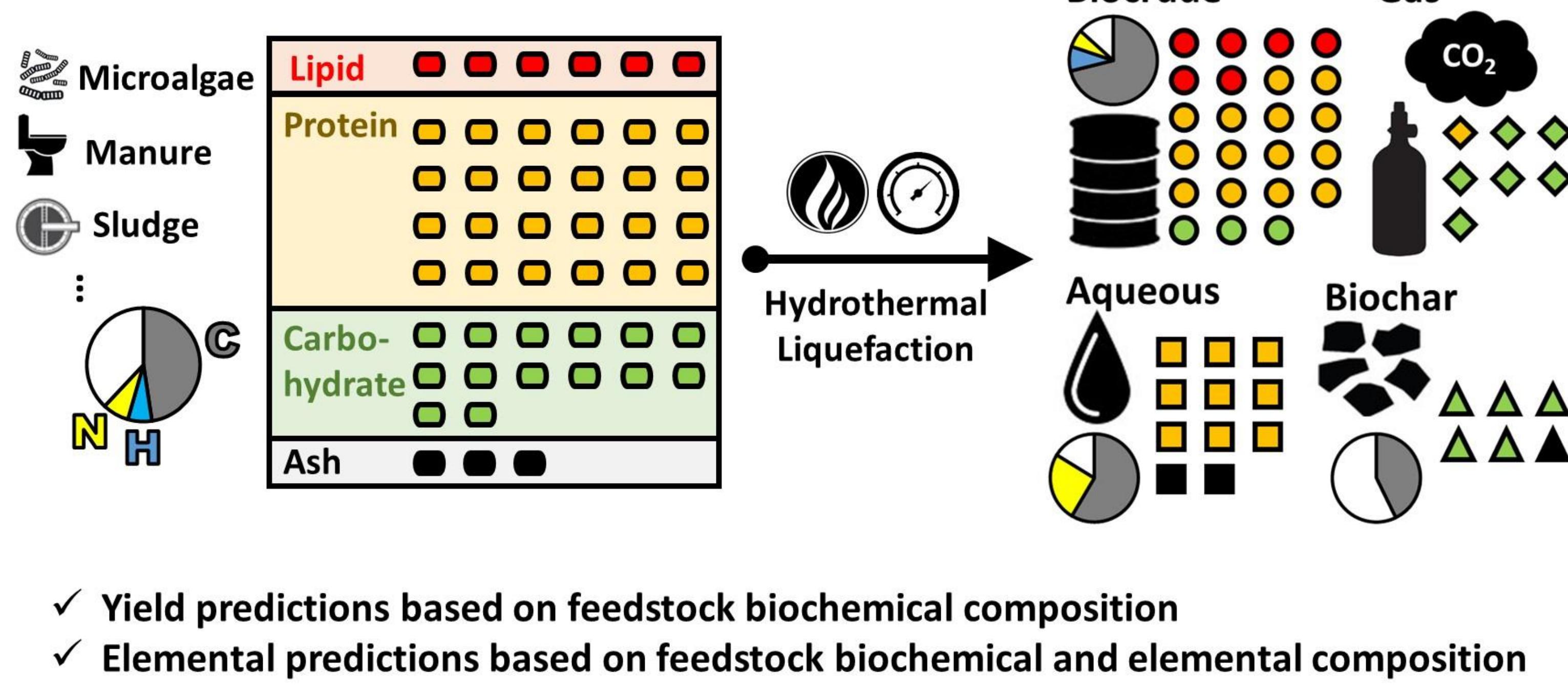
# Quantitative Multiphase Model for Hydrothermal Liquefaction (HTL) of Algal Biomass

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## At a Glance:

### Multiphase Component Additivity (MCA) Model



## Hydrothermal liquefaction (HTL) of microalgae is promising, but improvements are needed

**Critical Barrier:** Lack of understanding of connections between feedstocks properties and product yields/characteristics.

**Solution:** Establish quantitative relationships between HTL outputs and feedstock inputs with experimental data of various feedstocks.

## A multiphase component additivity (MCA) model was developed for product yields and characteristics prediction

### ✓ Predicting product yields from feedstock biochemical composition

Yield of one product ( $Y_i$ ) equals to linear summation of yields from all biochemical components (Fig. 1, eq 1,  $k_{iL-A}$  are fixed coefficients)

$$Y_i = k_{iL} \times Lip + k_{iP} \times Pro + k_{iC} \times Carb + k_{iA} \times Ash \quad (\text{eq 1})$$

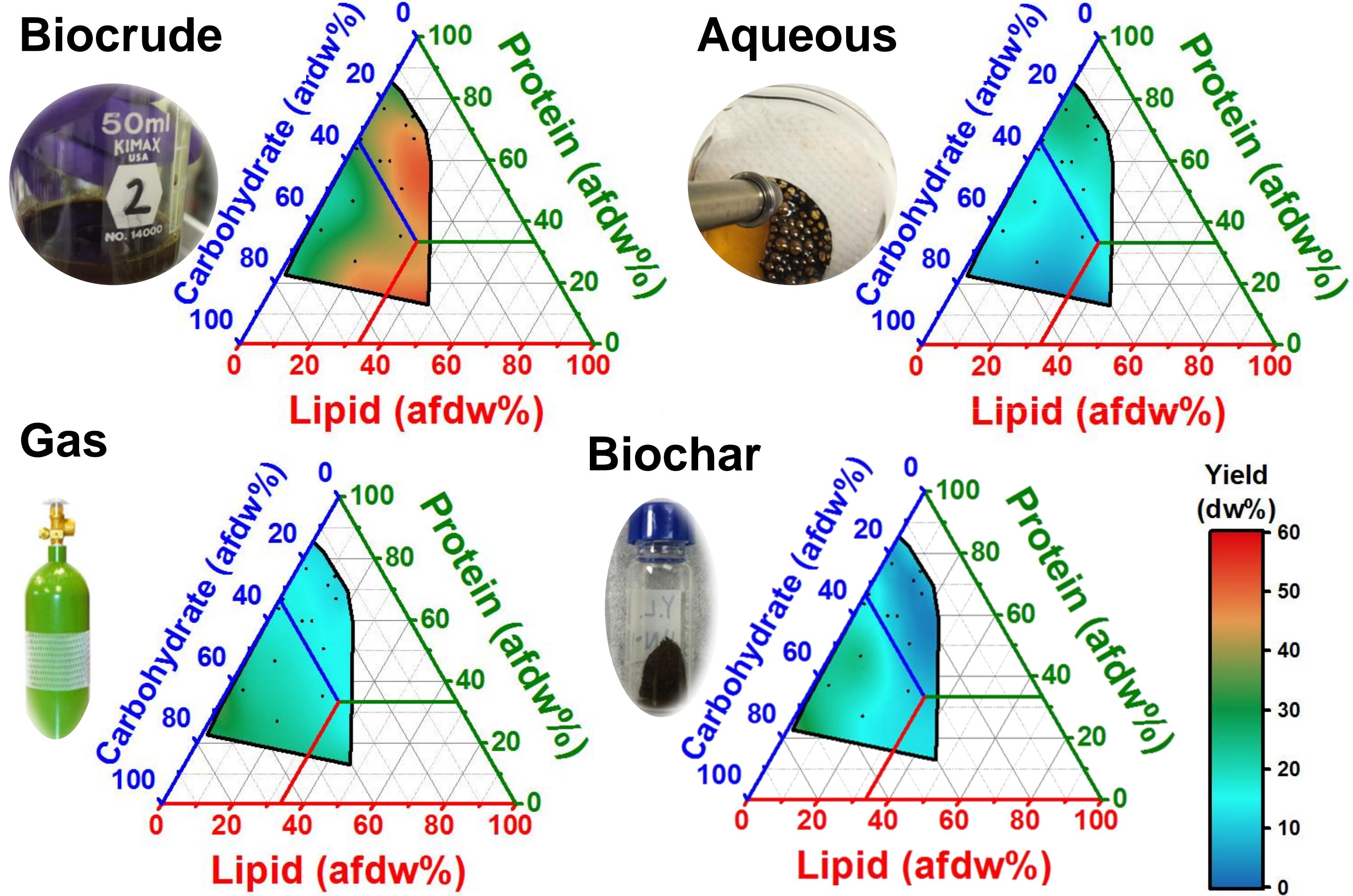


Fig. 1 Feedstock biochemical composition and HTL product yields. Contour plots generated by interpolation of experimental data.

## REFERENCES

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### ✓ Predicting product characteristics from feedstock biochemical/elemental composition

Elemental contents of one product ( $M_i$ ) linearly correlates to feedstock components that contain this element, and are also major contributors to this product (J, i.e., protein for N content in biocrude, Fig. 2, eq 2, a and b are fixed coefficients).

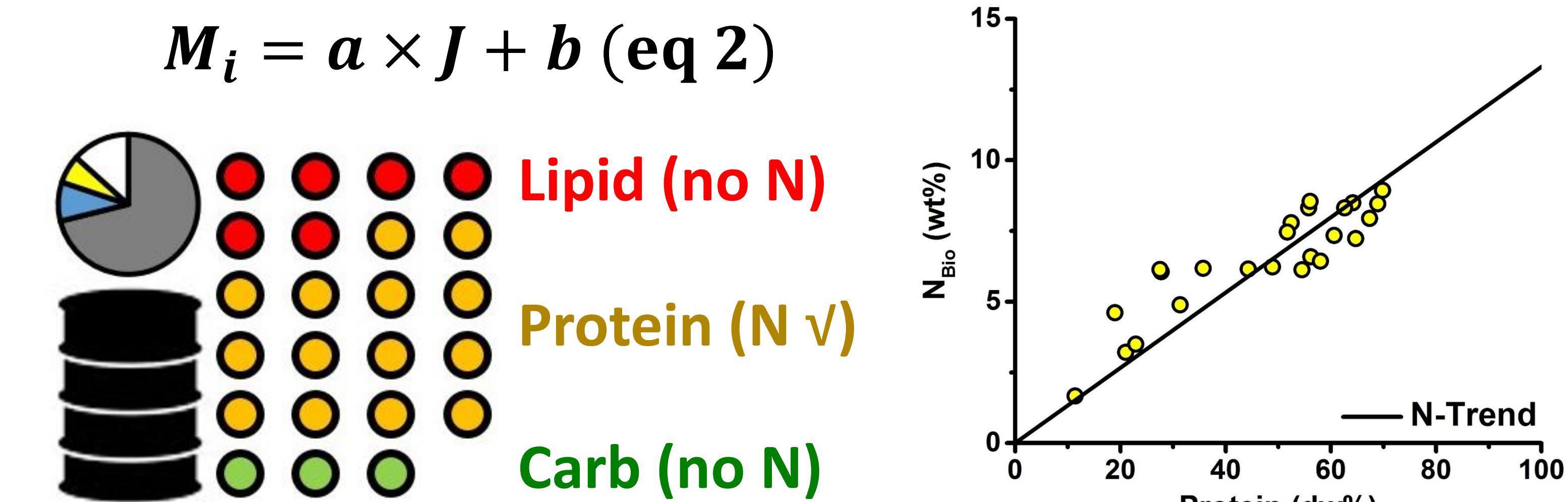


Fig. 2 Biocrude mainly comes from feedstock lipid, protein, and carbohydrate components, and only protein contains N, therefore biocrude N content ( $N_{\text{Bio}}$ ) linearly correlates to feedstock protein contents.

## The model can be used to assess the feasibility and improve the performance of various valorization pathways

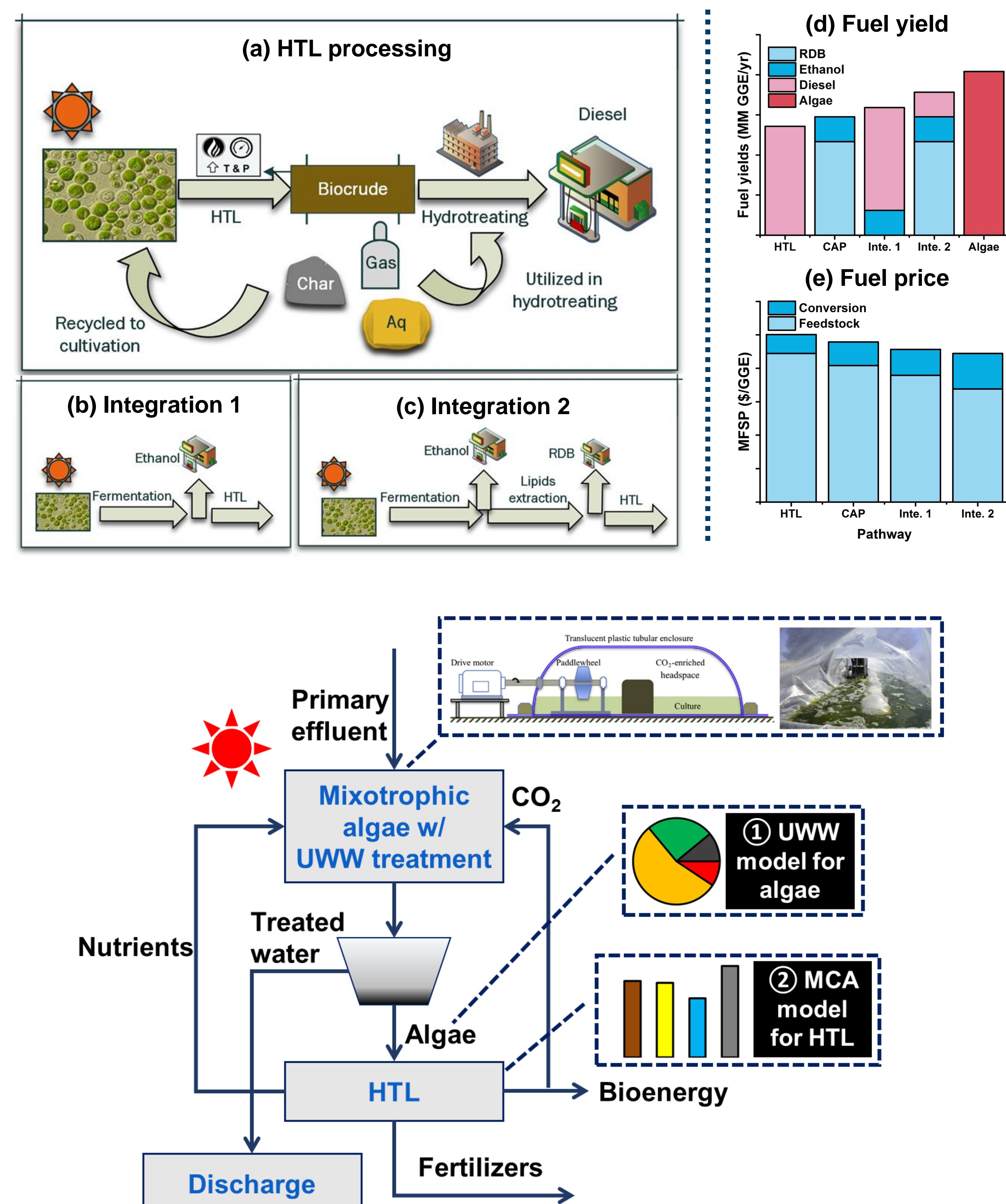


Fig. 3 Top: comparison of yield and price of fuel from HTL, combined algal processing (CAP)<sup>1</sup> and their integration pathways. Bottom: illustration of an urban wastewater (UWW) treatment system coupled with algal cultivation.<sup>2,3</sup>

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