PREDICTION OF BIOCRUDE YIELD IN HYDROTHERMAL CO-LIQUEFACTION OF DIFERENT BIOMASS FEEDSTOCKS

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Hydrothermal co-liquefaction (co-HTL) of biomass is strategically important to reduce transportation costs, optimize feedstock combination and improve biocrude yield. The potential synergetic effects might be attributed to the optimized biochemical composition of mixed feedstocks and associated suitable reaction conditions. In this study, single model components of biomass such as protein, saccharides, lignin, and lipid were liquefied individually and in binary mixtures under different conditions. An advanced model for predicting biocrude yield was developed as follows:

Biocrude yield (wt.%) = $17.16*X_1 + 8.57*X_2 + 0.4*X_3 + 97.66*X_4 – 32.1*X_1X_4 + 27.4*X_2X_3$
$+ 59.8*X_2X_4 – 65.6*X_3X_4 – 36.2*X_3X_4*Temp – 23.2*X_1X_4*Time – 28.3*X_1X_4*ratio$
Where X_1, X_2, X_3, X_4, Temp, Time and Ratio represent mass fractions of protein, saccharides, lignin and lipid, reaction temperature, time and mass ratio of water to feedstock respectively.

The biocrude yield in co-liquefaction of various actual biomass feedstocks was also predicted using three machine learning models (*Adaboost, Gradient boosting regression and Random Forest*). Fig 1 showed that machine learning methods exhibited good performance for predicting biocrude yield, which was more accurate than the models developed by us, and other studies as presented in Fig.2.

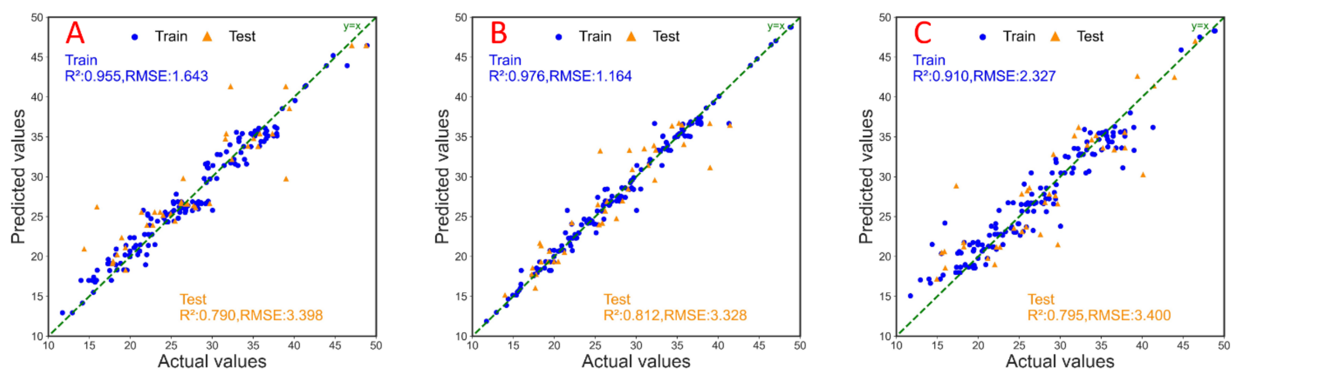

Figure 1 – Single-target prediction plots (training and testing) for co-liquefaction biocrude yield (wt.%, daf) based on (A) Adaboost, (B) Gradient Boosting Regression, (C) Random Forest. RMSE denotes root mean square error

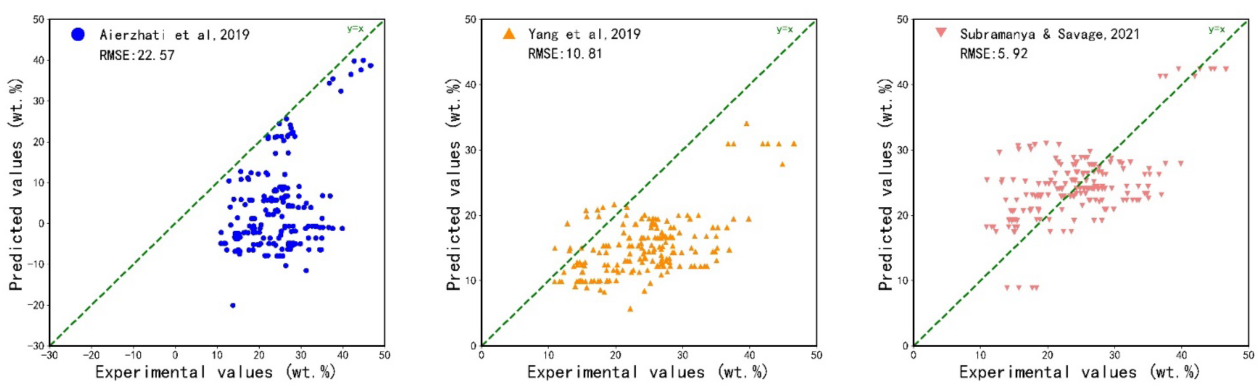

Figure 2- The prediction accuracy of hydrothermal co-liquefaction biocrude yield using published mathematical equations from Aierzhati et al., Yang et al., and Subramanya & Savage.