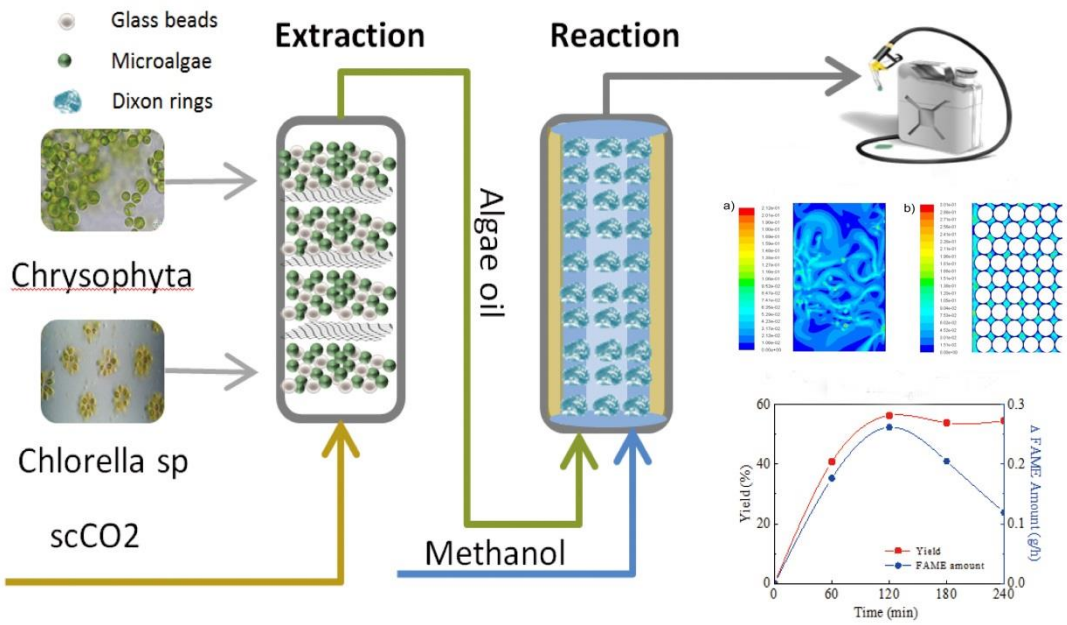
Continuous production of biodiesel from microalgae by extraction coupling with transesterification under supercritical conditions

Biodiesel is regarded as one of the most promising alternatives for petroleum diesel, and the continuous preparation via supercritical methanol transersterification is a competitive method, but its intensification is a key problem. Our group proposed an easy and novel method which utilized different structure packing filled in a tubular reactor to improve the treatment efficiency and yield. Fluent Numerical research showed that the flow filed and rate of the fixed bed reactor was much more uniform than that of tube reactor. Further decreased the packing size, the flow distribution was improved a lot and the wall effect was lightened. When the packing was 0.5 mm, the flow was nearly plug flow and the molar ratio and residence time was almost constant in all place. Finally without any catalyst, a yield of 90.84% was achieved with Dixon rings as packing on the condition of 350 ℃, 22 MPa, and molar ratio of methanol to oil 42:1.

The feedstock of biodiesel has been extended to the microalgae, which are non-edible plants. Most works are focusing the *in-situ* transesterification, although the *in-situ* process can utilize the wet microalgae directly, the residue after the reaction can't be used again as the raw material of high value-added products. Based on many years of supercritical carbon dioxide research and the successful use of Dixon rings packing reactor, a continuous production coupling with supercritical CO_2 extraction was brought in. Different from the in-situ transesterification of algae, supercritical extraction was progressed under a moderate temperature rather than the high reaction temperature above 200 ℃, so the residue after extraction can be recovered easily and completely through decompression according to the prominent performance of supercritical CO_2, and reuse as the raw material of medicine and health products. Results showed that under the optimal circumstances, a yield of 56.31% was obtained for Chlorella sp., and 63.78% for Chrysophyta due to the higher lipid content of it.



Continuous supercrtical methanol transesterification coupling with scCO2 extraction process.