Making JP-10 superfuel affordable with a lignocellulosic platform compound

With the support of the National Natural Science Foundation of China, Prof. Zhang Tao (张涛) and Prof. Li Ning's (李宁) group at the CAS Key Laboratory of Science and Technology on Applied Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, recently developed a new strategy for the synthesis of bio-JP-10 fuel from furfuryl alcohol, which was published in *Angew Chem Int Ed* (2019, 10.1002/anie.201906744).

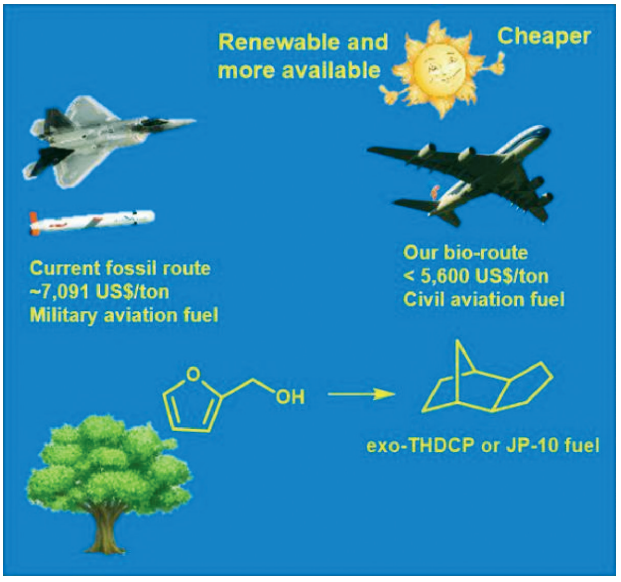

Figure The advantages of the bio-route over the fossil route for the production of JP-10 fuel.

JP-10 is an advanced jet fuel currently obtained from fossil energy. Compared with conventional jet fuels, JP-10 fuel has many attractive properties such as high energy density, good thermal stability, and low freezing point. For example, owing to the higher density of JP-10 fuel it has a higher volumetric heat (39.6 MJ/L) than conventional jet fuels (~34.8 MJ/L). In practical application, this means that the flight range and/or payload of aircraft can be increased about 14% without changing the volume of the oil tank. Currently, JP-10 fuel is produced from cyclopentadiene which is obtained in low yields from coal tar (10—20 g/ton) or by the steam cracking of naphtha (14 kg/ton). Moreover, the high price (~7 091 US$/ton) of JP-10 fuel also limits its application in civil aviation. Therefore, it is highly desirable to develop some technologies for the synthesis of bio-JP-10 fuel from more available feedstocks.

For the first time, the team developed a new strategy for the synthesis of bio-JP-10 fuel from furfuryl alcohol that is produced on an industrial scale from agriculture and forestry residues. Under the optimized conditions, bio-JP-10 fuel was produced with high overall carbon yields (~65%). A preliminary economic analysis indicates that the price of bio-JP-10 fuel can be greatly decreased from ~7 091 US$/ton (by fossil route) to less than 5 600 US$/ton using the new strategy. In the future, this price can be further decreased with the development of furfural production technology. For example, Huber et al. developed a cost-effective technology to produce furfural recently, which will greatly decrease the price of furfuryl alcohol unit price from ~1 500 US$/ton to ~400 US$/ton. Based on this price, the future unit production costs for bio-JP-10 fuel can be decreased to less than ~2 900 US$/ton. Therefore, it is believed that the future commercialization of bio-JP-10 fuel is very promising especially when one considers the growing support for green policies and the exemption of CO_2 emission tax.