



Green-Formula Surfactant for Cooking-Oil Fume Purification towards a Circular Economy

Dr Min-Hao YUAN

*Assistant Professor, Department of Occupational Safety and Health,
China Medical University, Taichung, Taiwan*

http://webap.cmu.edu.tw/TchEportfolio/index_1/mhyuan

ABSTRACT

In Taiwan, the number of public nuisance disputes have been significantly increased for unpleasant smells (Volatile Organic Compound, VOC) and fine particulate matter (PM_{2.5}) by Cooking-Oil Fumes (COF) since 2000. Hence, Taiwan EPA recently established new regulation for the Management of Air Pollution Control Device for Catering and Restaurant in 2018. This study developed a green-formula surfactant (H6) for increasing the scrubbing removal efficiency for COF purification by a small-scale high-gravity rotating packed bed (HiGee Scrubber). The HiGee Scrubber is designed by a covered area of 0.17m², gas capacity of 15 m³/min and scrubbing solution of 17 L. On-site experiment was conducted in a fried-food stall in night market of Taichung city. The H6 is sulfur-free without using pH adjustment, which could be a good candidate ingredient as emulsifier for industrial purpose. Therefore, the developed green-formula surfactant will play key role to reduce cost for COF scrubber and water-in-oil emulsification as boiler fuel and provide a pathway to a circular economy for air pollution control of COF and boiler combustion.

The results showed that the H6 improved the simultaneous removal efficiencies of PM_{2.5} ($\eta_{PM2.5}$) and VOC (η_{VOC}), which were all better than these of water and traditional detergent. The $\eta_{PM2.5}$ and η_{VOC} of H6 were 88.7% and 55.2% by DustTrak and GC-FID, respectively, while these of water and the traditional detergent were only 32.6% and 55.4% for $\eta_{PM2.5}$ and 26.8% and 35.0% for η_{VOC} . The effluent gas profiles of PM were similar among the three solutions, while PM₁, PM_{1-2.5} and PM_{2.5-10} (coarse) of H6 were 89.8%, 1% and 9.3% for by Sioutas cascade impactor, respectively. Moreover, water and the traditional detergent were difficult in removing the low-molecule compounds (e.g. formaldehyde, acetaldehyde and acetone) in COF. The $\eta_{VOC,C1-C16}$ of water and the traditional detergent were only 2.3% and 3.7%, respectively, while that of H6 was 31.1%. Further works will be examined for the emulsification of boiler fuel by the used H6 solution.

Date: 4 June 2019 (Tuesday)

Time: 11:00 am - 12:00 noon

Venue: Room ZN902a, 9/F, Block Z,
The Hong Kong Polytechnic
University,
181 Chatham Road South,
Hungghom, Kowloon, Hong Kong

SPEAKER'S BIOGRAPHY

Dr Min-Hao Yuan is an Assistant Professor in Department of Occupational Safety and Health, China Medical University (Taichung, Taiwan). His research is on air pollution control technology for PM_{2.5}, VOCs and odor pollutants and property optimization of biodiesel/emulsified fuel's safety. The vision is to build the resilience and critical thinking of a sustainable society and to facilitate a paradigm shift towards a green and circular economy. Dr Yuan received his Ph.D. in Environmental Engineering from National Taiwan University (Taipei, Taiwan) in 2011. Dr Yuan has also been trained by the leading universities in Japan (University of Tokyo and Tokyo Institute of Technology) and US (the University of Michigan-Ann Arbor) and awarded several merit-based PhD/Postdoc fellowships from Taiwan, Japan and US. Dr Yuan has been published 23 academic journal articles and received the Excellent Paper Award from Journal of *Journal of the Taiwan Institute of Chemical Engineers* and Outstanding Contribution in Reviewing in *Chemical Engineering Journal* in 2015 and 2017, respectively.

*** All Interested Are Welcome ***

For further information, please contact Dr Ben LEU at Tel. 3400-8322 or syleu@polyu.edu.hk.
Certificates of attendance will be provided to participants if they attend the whole lecture.