| SPEECH INFORMATION (For Conference Program Book) | |
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| **Topic** | **Carbon Capture/Utilization and Carbon Circularity – A Microalgae Platform** |
| **Abstract** | Microalgae absorb $CO_2$ through photosynthesis and fix carbon at rates 20-100 times higher than terrestrial plants. They can capture $CO_2$ directly from the atmosphere as well as from industrial emissions such as flue gas, biogas, and fermentation off-gas, making them a highly promising platform for carbon capture and utilization (CCU) and an important contributor to achieving net-zero targets by 2050. Microalgal biomass contains diverse functional compounds that can be converted into biofuels, bio-based chemicals, nutraceuticals, feed, fertilizers, and pharmaceuticals. From 2009 to 2012, our team established the world's first ton-scale demonstration plant using blast furnace gas from China Steel Corporation to cultivate microalgae for biodiesel production. Microalgae can also remove nitrogen and phosphorus from wastewater; our group has developed microalgae-bacteria symbiotic systems for treating wastewater from livestock, petrochemical, and electroplating industries, thereby advancing circular bioeconomy applications. Despite their potential, the commercialization of microalgal technologies faces challenges, including high cultivation and harvesting costs, slower $CO_2$ uptake compared with physicochemical capture methods, and substantial land and infrastructure requirements. This presentation will discuss the use of diverse $CO_2$ sources and sustainable nutrient inputs, strategies for overcoming technical and economic constraints, and innovative approaches, such as integrating chemical absorption with biological fixation, to enhance CCU efficiency and increase the value of microalgae-derived products. |