Title : Development of Anode Materials for Lithium-Ion Batteries Derived from Spent MIL-53(Al) Adsorbents Used in Wastewater Treatment

Author(s) : **1.** Tanawut Gonnakon **Student ID :** 650510161

Major : Industrial Chemistry

Advisor(s) : **1.** Assistant Professor Dr. Yothin Chimupala

Type of presentation* ***(choose 1)*** **:**

- ☑ **Oral Presentation** (เฉพาะ ตัวแทนนศ.ที่สาขาเลือกให้นำเสนอแบบบรรยาย)
- ☐ **Poster** (กรณี นำเสนอผลงานปัญหาพิเศษ/การค้นคว้าอิสระ)
- ☐ **Cooperative Education** (กรณี นำเสนอผลงานสหกิจศึกษา)

ABSTRACT

The accumulation of plastic waste, heavy metals, and synthetic dyes in the environment has become a global crisis. At the same time, the demand for high-performance energy storage systems continues to increase, particularly for lithium-ion batteries (LIBs), which still require the development of anode materials with improved electrochemical performance and enhanced safety. This study proposes a value-added approach for converting waste or discarded materials into high-value products by utilizing polyethylene terephthalate (PET) plastic waste to synthesize a three-dimensional metal–organic framework material, MIL-53(Al). This framework consists of aluminum as the metal center and terephthalic acid, derived from plastic waste, as the organic ligand. Furthermore, MIL-53(Al) was employed as an adsorbent for the removal of heavy metals (Co, Ni, Zn) and methylene blue (MB) dye from wastewater. After reaching adsorption saturation, the spent MIL-53(Al) was reutilized as an anode material in lithium-ion batteries.

Cycling stability tests at a current density of 100 mA/g for 100 cycles revealed that MIL-53(Al) saturated with cobalt and nickel exhibited specific capacities of 26.8 and 29.4 mAh/g, respectively, which are comparable to pristine MIL-53(Al) (32.9 mAh/g). In contrast, samples saturated with zinc and methylene blue showed significantly

**Type of presentation must be matched with an option you choosing on student upload system.*

***The abstract can be more than one page and must be approved by project advisor before upload.*

lower capacities of 7.89 and 13.5 mAh/g, respectively. Rate capability tests performed at varying current densities ranging from 50 to 2000 mA/g, with 10 cycles at each rate, demonstrated that the cobalt-adsorbed sample delivered the most prominent electrochemical performance, achieving a specific capacity of 47.5 mAh/g at the highest current density of 2000 mA/g. Notably, this capacity exceeded that obtained at lower current densities, indicating enhanced rate performance. Electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV) analyses of cobalt-adsorbed MIL-53(Al) confirmed effective charge transfer processes and the occurrence of electrochemical reactions within the framework structure.

**Type of presentation must be matched with an option you choosing on student upload system.*

***The abstract can be more than one page and must be approved by project advisor before upload.*