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Coach	**Supervisor**	**Funding**
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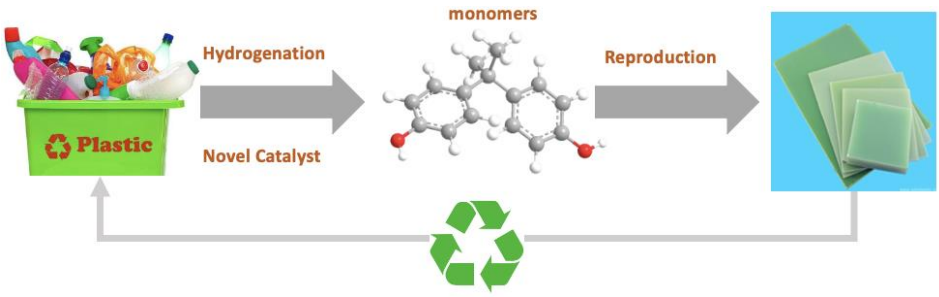
Mg-AlO Hydrotalcite-Based Catalysts: Synthesis and Performance Evaluation

Aim

Developing and testing Mg-AlO hydrotalcite-based catalysts for the efficient and selective hydrogenolysis of oxygen-containing plastics (e.g., PET/PC) under mild conditions, with a focus on establishing a UV-Vis based quantitative method that does not rely on standard compounds.

Justification

Plastics have significantly enhanced our quality of life due to their versatile properties, such as low cost, durability, and resistance to various environmental conditions. However, improper disposal of plastic waste poses severe environmental hazards, particularly through the generation of microplastics. Developing strategies for the catalytic depolymerization of plastics into valuable monomers and chemicals is a promising solution. Hydrogenolysis has gained attention for its efficiency in breaking polymer bonds, with heterogeneous catalysts playing a central role in these processes.



Mg-AlO hydrotalcite-based catalysts stand out due to their tunable properties, such as basicity, metal dispersion, and stability under reaction conditions. These catalysts can be further optimized for activity and selectivity in hydrogenolysis reactions. Advanced analytical tools such as HPLC-DAD (MS) will be employed to perform qualitative analysis, while a novel UV-Vis based method will be developed and validated for quantifying reaction products in cases where standard compounds are unavailable.

Program

1. **State-of-the-art report** on Mg-AlO hydrotalcite catalysts for hydrogenolysis.
2. **Synthesize novel Mg-AlO hydrotalcite-based catalysts** with optimized structural properties.
3. **Characterize the catalyst's microstructure** using advanced techniques:
    - TEM-EDX for elemental mapping.
    - H2-TPR for reduction behavior.
    - NH3-TPD for acidity measurements.
    - XRD for crystallographic properties.
4. **Performance testing** of the catalysts in hydrogenolysis reactions of oxygen-containing plastics under mild conditions.
5. *(Optional)* **Analytical method development:**
    - Use HPLC-DAD for qualitative identification of reaction products.
    - Propose and validate a UV-Vis spectroscopy-based quantification approach to address the lack of standard compounds.
6. **Evaluate structure-performance relationships** to optimize catalytic efficiency and selectivity under the guidence of characterization results.
7. *(Optional)* **Prepare and validate scalable reaction conditions** for potential industrial applications.