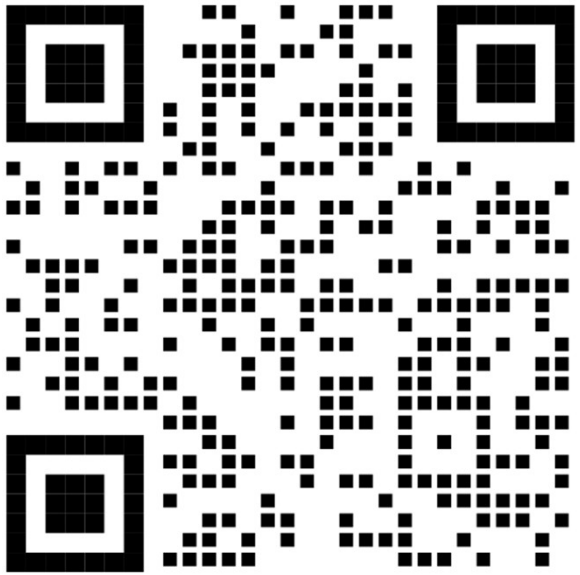
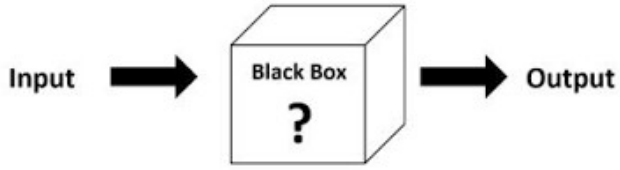
Lab Meeting

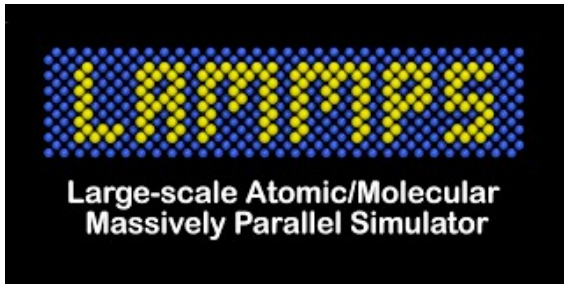


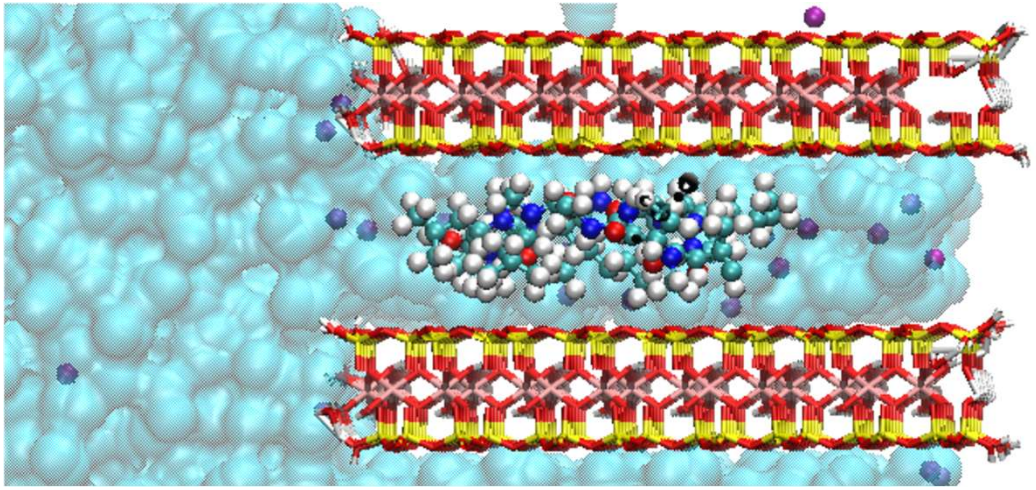
1. Why Create the Computational Model?



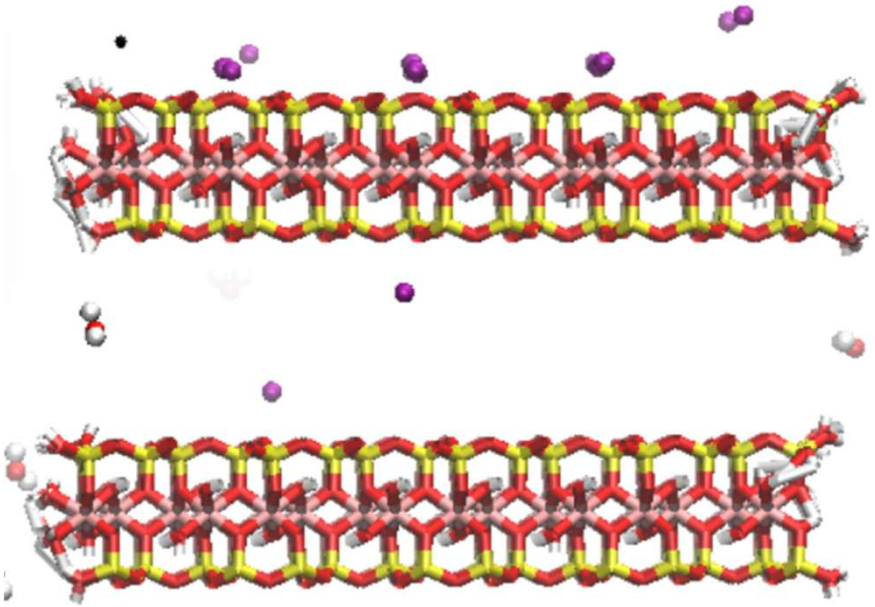
Traditional techniques

- Macroscopic release profiles
- Lack microscopic insights





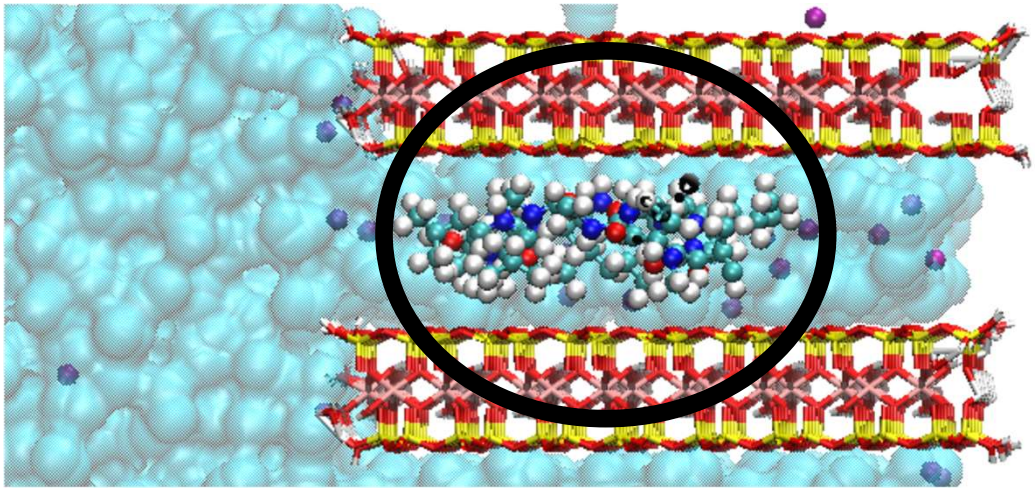
The Carrier: Montmorillonite (MMT)

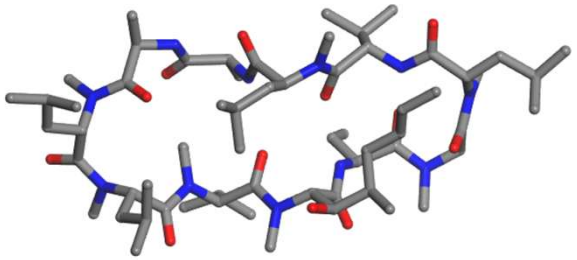


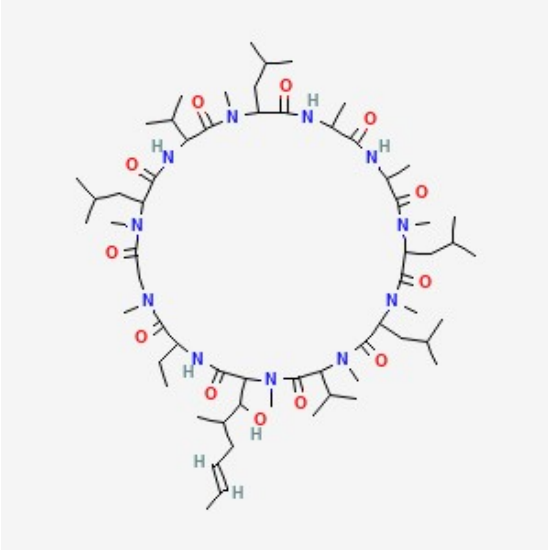
Act as a nano-sandwich

- a cost-effective, biocompatible excipient
- to improve the solubility of hydrophobic drugs.

Cyclosporine in Drug-Clay Complex

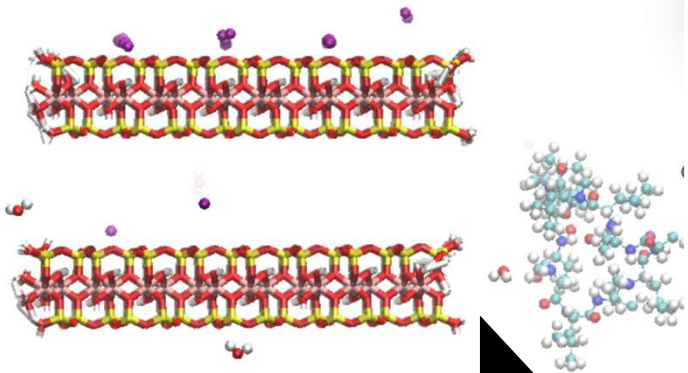




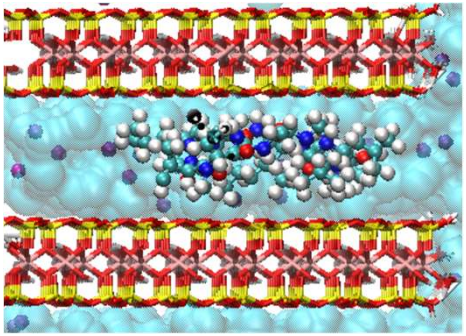


- An immunosuppressive agent
- Poor oral bioavailability(25%)
- Because of the absorption in the GI tract

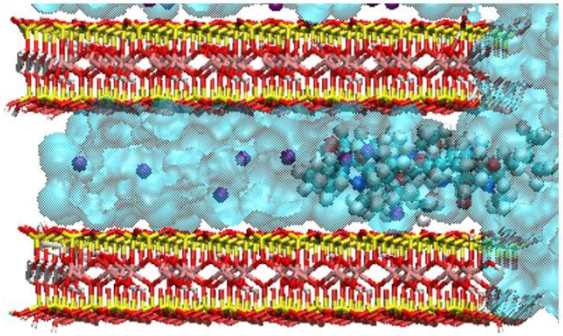
Timeline of Drug Release



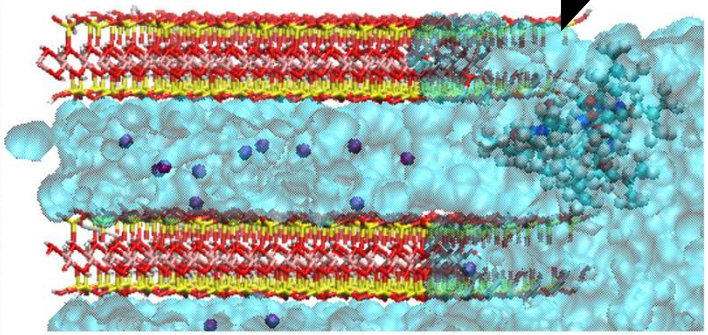
Phase 1 → Phase 2 → Phase 3



Adsorbed at the center of the interlayer space

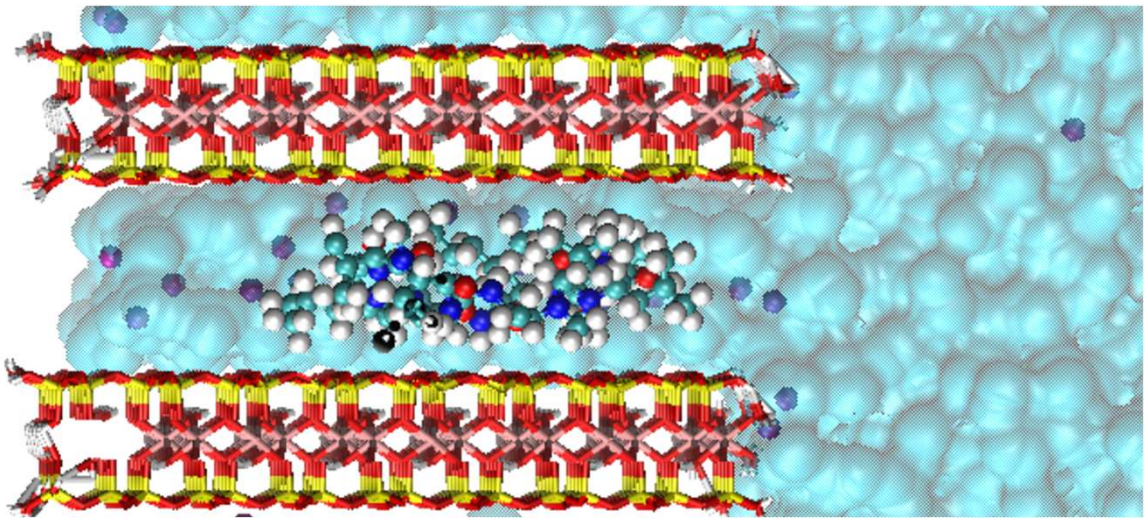


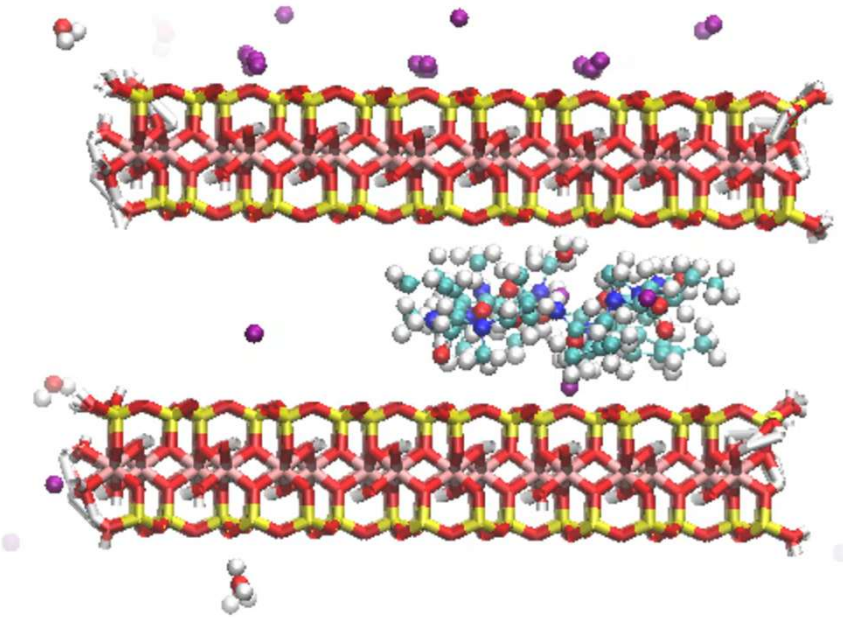
The drug slowly migrates towards the edge.



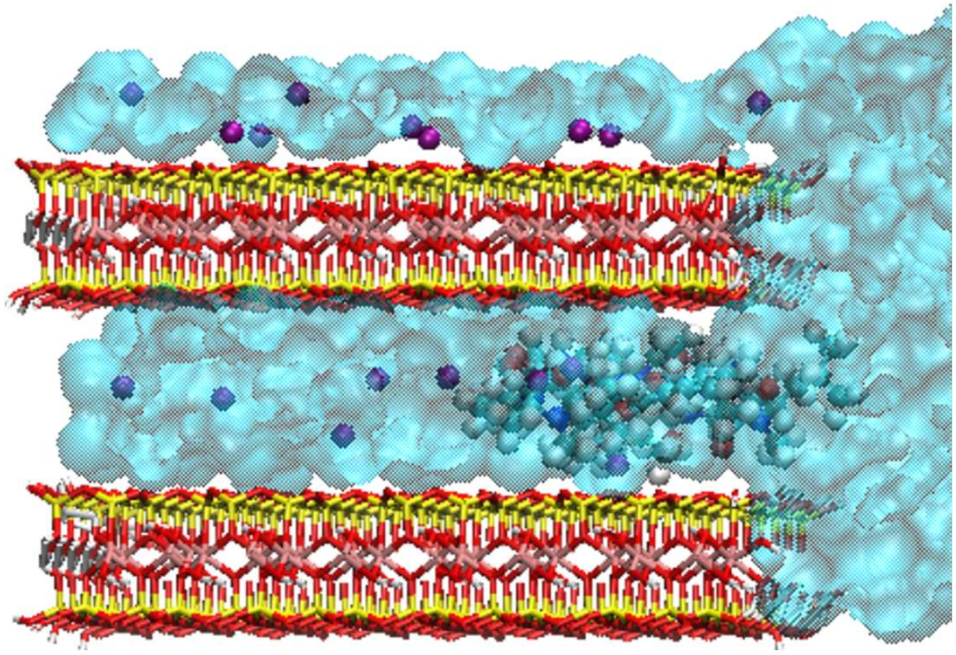
The drug releases from the clay.

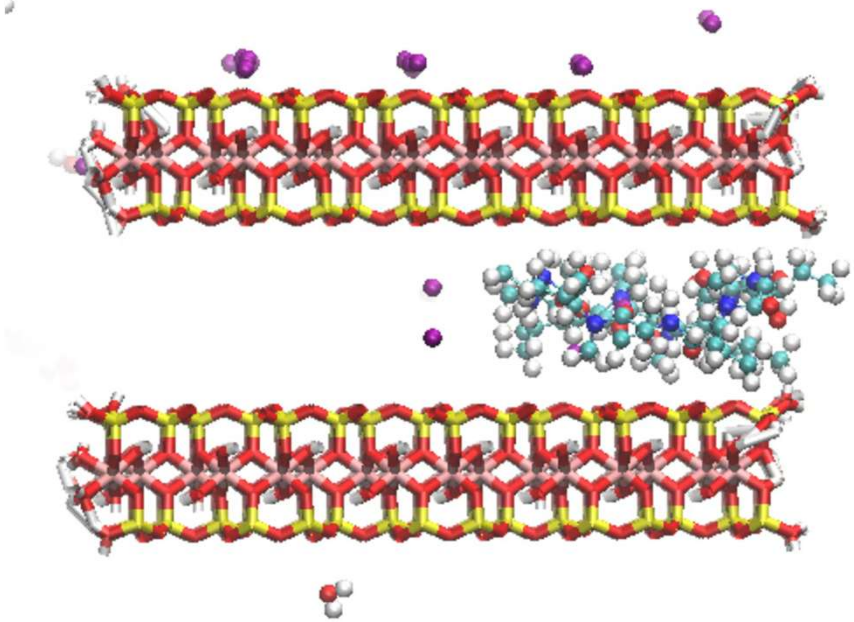
A. Deep Trapping





B. Edge Trapping





2. Preparation of Bioproduct

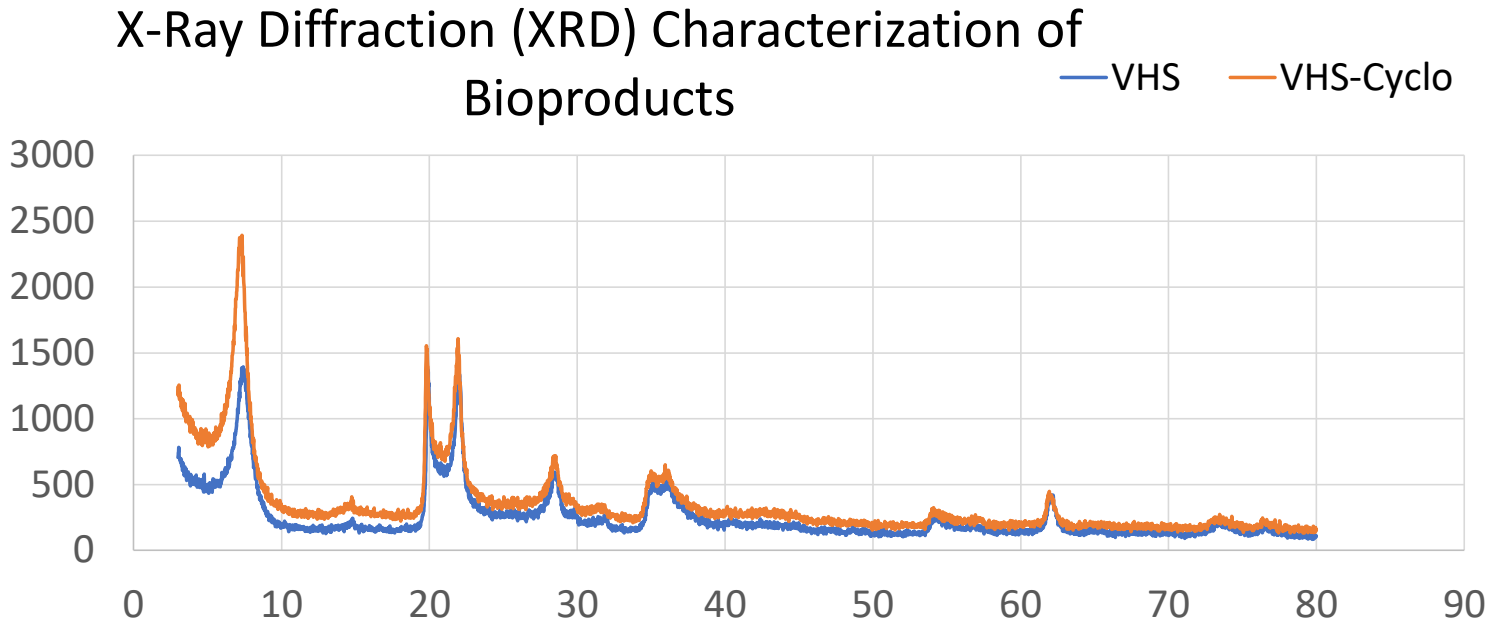
•**Materials:**
Cyclosporine A (CsA): **0.25 g**
Montmorillonite (MMT): **1.25 g**
•**Ratio:** 1:5 (w/w)
•**Solvent:** 100 ml Ethanol (EtOH)

Using magnetic stirrer for 24 hours

•**Equipment:** Rotary Evaporator
•**Condition:** Water bath at **45°C**
•**Process:** Evaporation under reduced pressure(**150 mbar**)

Step 1: Mixing → Step 2: Stirring → Step 3: Solvent Removal

XRD Analysis Results

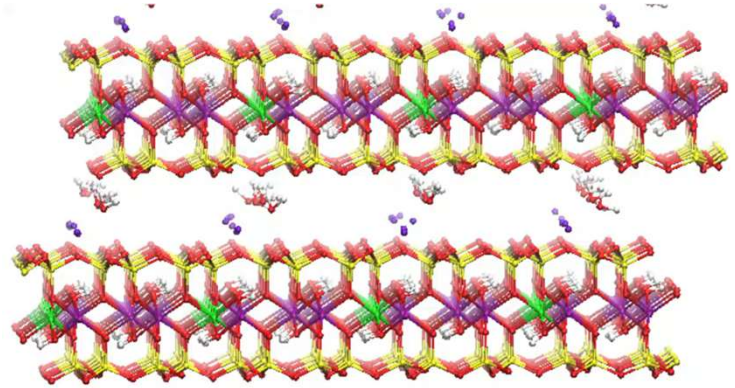


Cyclosporine + Clay

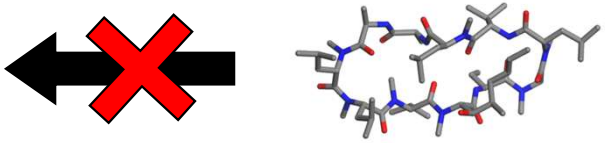
d(001)= 12.04Å

Montmorillonite

d(001)=11.90Å

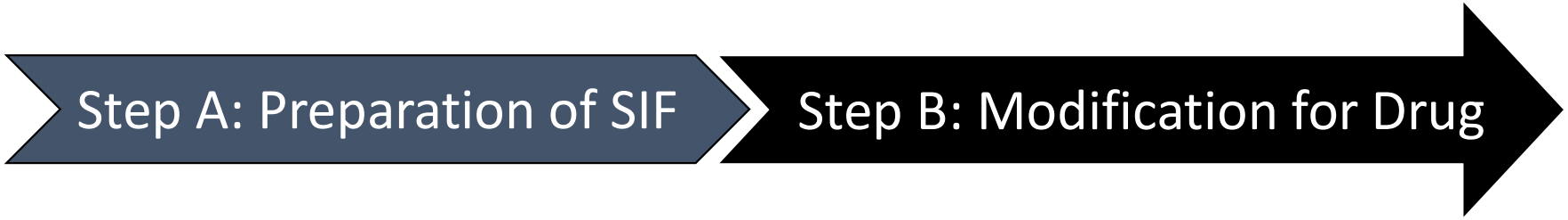


did not fully enter the interlayer space



Dissolution Test & HPLC Analysis

1. Dissolution Medium Preparation



Step A: Preparation of SIF (pH 6.8)

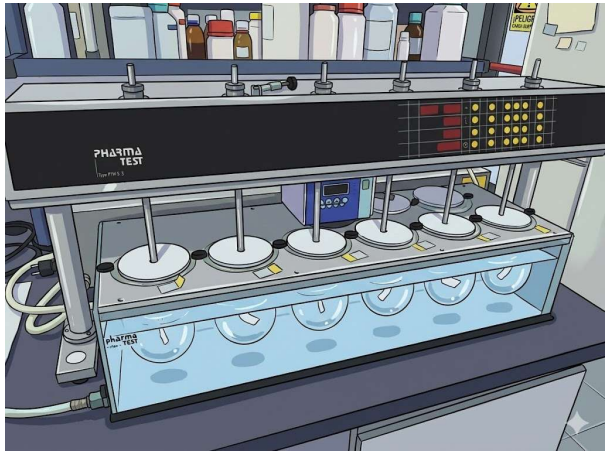
- **Composition:**
  - KH_2PO_4: **3.402 g**
  - NaOH: **0.448 g**
  - Distilled Water: **0.5 L**
- **Adjustment:** pH adjusted to **6.8** (Simulated Intestinal Fluid).

Step B: Modification for Hydrophobic Drug

- Due to the low aqueous solubility of Cyclosporine, organic solvent was added to maintain **sink conditions**.

- **Medium: 60% SIF + 40% Ethanol (v/v)**.

Dissolution Test & HPLC Analysis

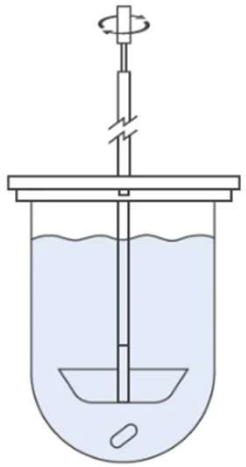


•**Conditions:**
•Temperature: **37 degrees**
•Stirring Speed: **100 rpm**

•**Reference (Vessels 1-3): 25 mg** Pure Cyclosporine Capsules.
•**Test (Vessels 4-6): 0.15 g** Bioproduct (Equivalent to 25 mg drug)*.

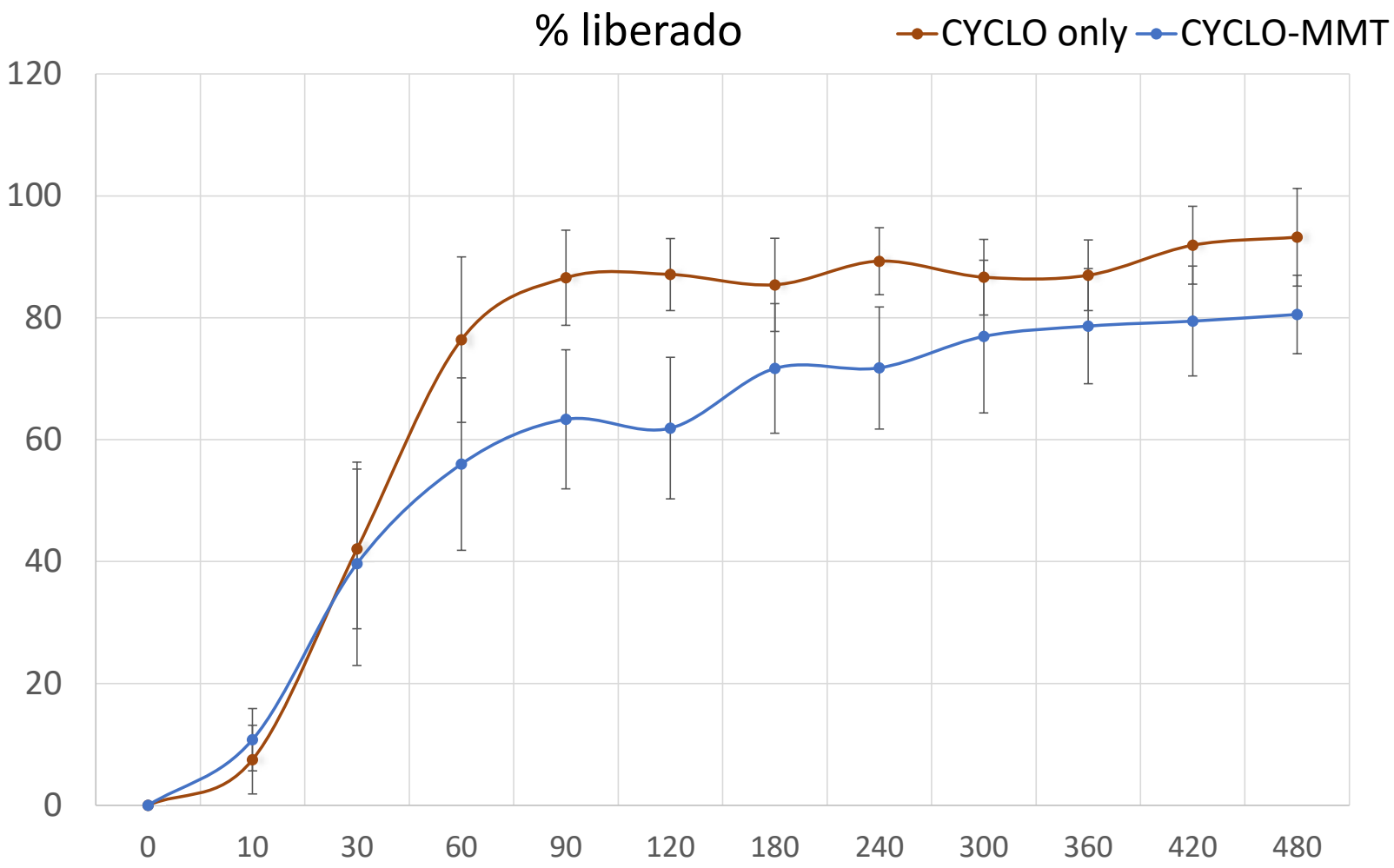
1. Medium Preparation
2. Experimental Setup
3. Sampling Protocol

Volume: 1000 mL
Medium per vessel.



•**Sampling Points:** 10, 30, 60, 90, 120, 180, 240, 300, 360, 420, 480 min.
•**Aliquot Volume: 5 mL** withdrawn at each time point (replaced with fresh medium).
•**Quantification:** Samples filtered and analyzed via **HPLC**.

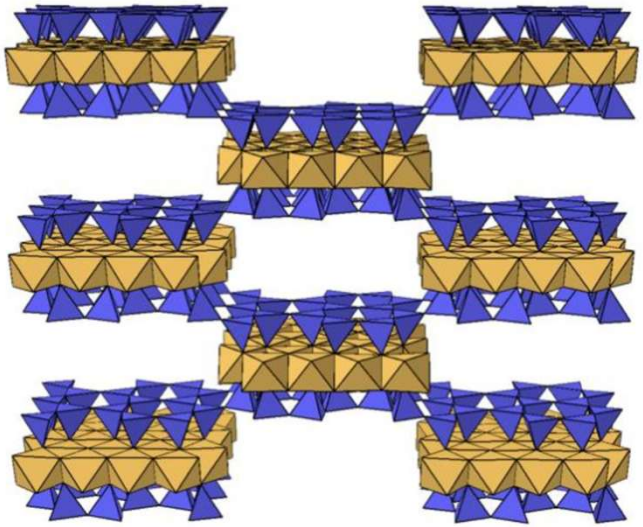
Dissolution Test- Result



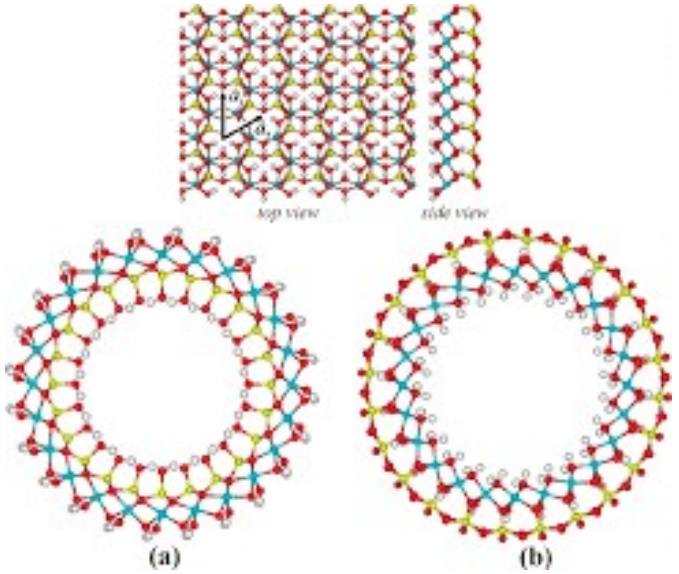
Lower Release
-the lack of intercalation (from XRD)

Large SD
-Heterogeneity in the physical mixture
- More replicas are required

The other Clay options



The structure of Sepiolite

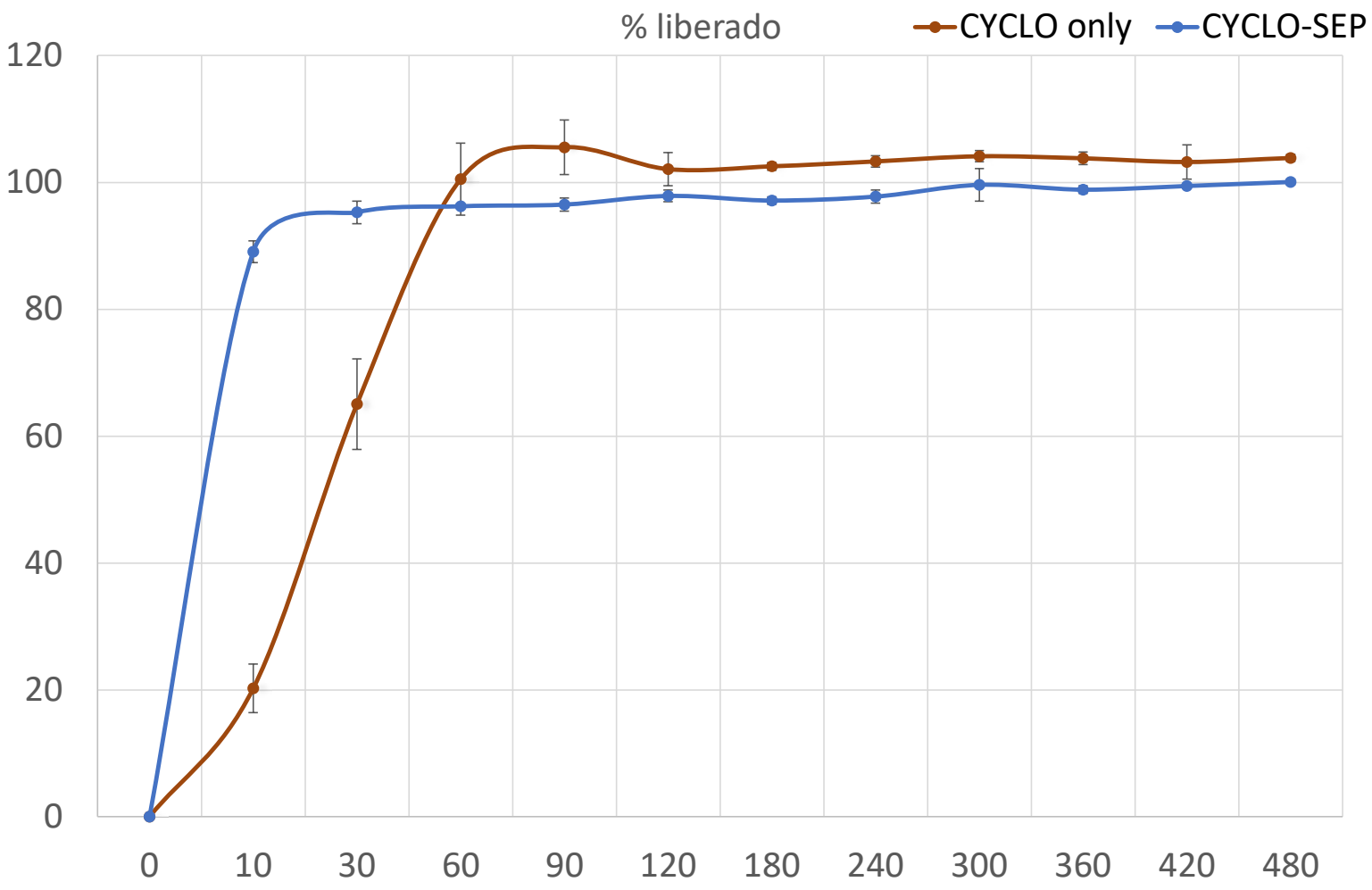


The structure of Halloysite

Step 1: Mixing → Step 2: Stirring → Step 3: Solvent Removal

1. Medium Preparation → 2. Experimental Setup → 3. Sampling Protocol

The other Clay Sepiolite option- Dissolution Test



-immediate release, reaching **~90%** within the first **10 minutes**.

-Reaches nearly **100%** equilibrium quickly (within 30 mins)