

# Casein-Acrylamide Bioadhesive Polymeric Nano Micelles Enhance Dissolution, Penetration and *In Vivo* Absorption of Vortioxetine

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### CHALLENGE

**Overcoming Barriers in Brain Drug Delivery**  
Delivering therapeutics to the brain is extremely challenging due to multiple physiological barriers and inefficient delivery methods.

- GASTRIC PROTECTION**  
Acid-resistant coating prevents drug degradation
- ENZYME PROTECTION**  
Shielding from enzymatic degradation
- MUCOADHESION**  
Prolonged residence time at the absorption site
- EPITHELIAL PENETRATION**  
Facilitates transcellular or paracellular transport

**THE CHALLENGE**  
Conventional drug delivery methods face poor stability, low absorption, limited brain targeting, and systemic side effects.

### STRATEGY

**Oral Nano/micro-Delivery System: A Smart Strategy**  
A multi-functional nano/micro-vehicle is engineered to protect, transport, and deliver therapeutics efficiently across biological barriers to the brain.

**1. INTESTINAL ABSORPTION & TRANSPORT**

**2. BRAIN DELIVERY & THERAPEUTIC EFFECT**

**EFFICIENT BRAIN DELIVERY**

- Enhanced brain accumulation
- Targeted distribution
- Sustained therapeutic effect
- Reduced systemic side effects

**THERAPEUTIC OUTCOMES**

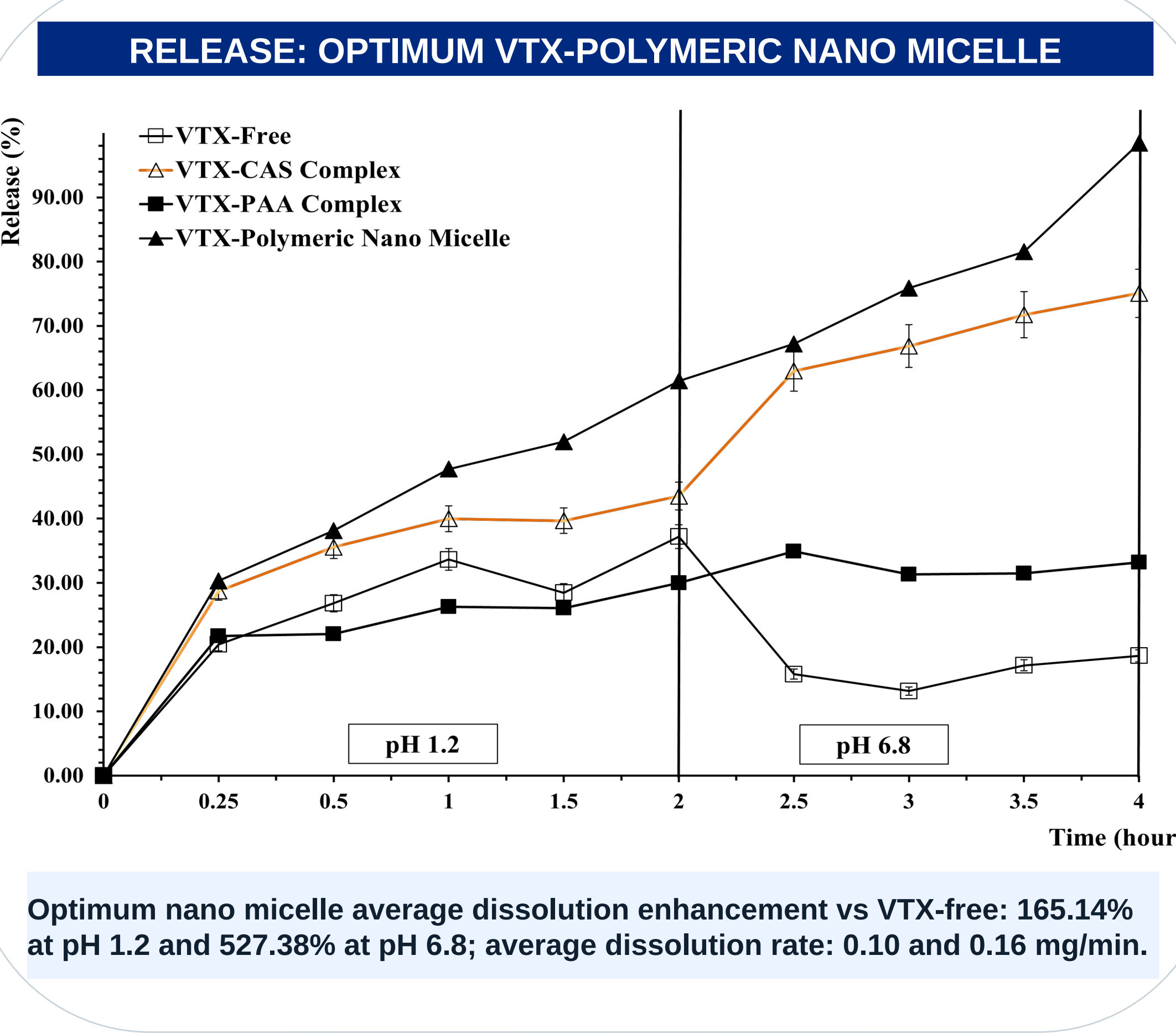
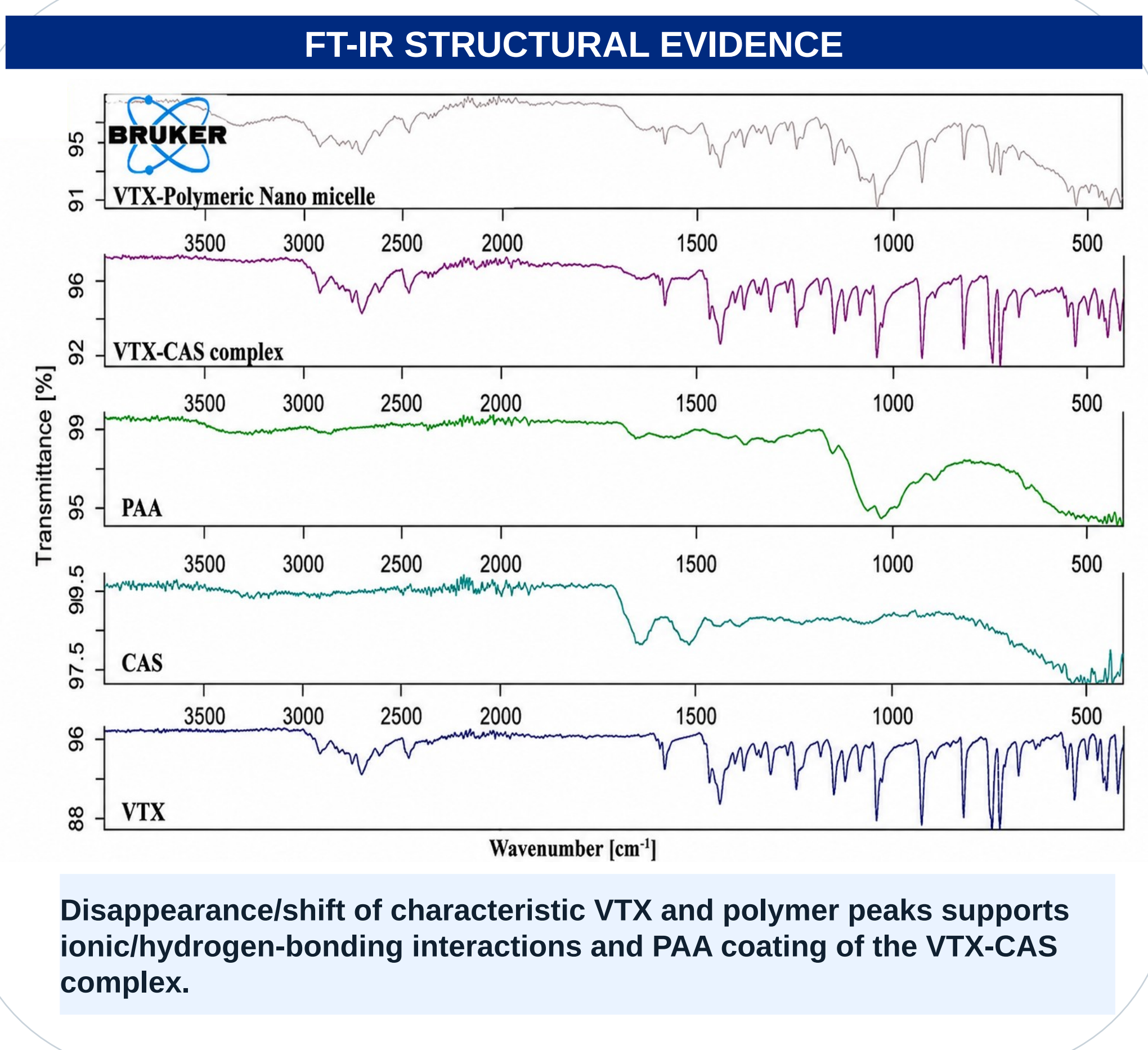
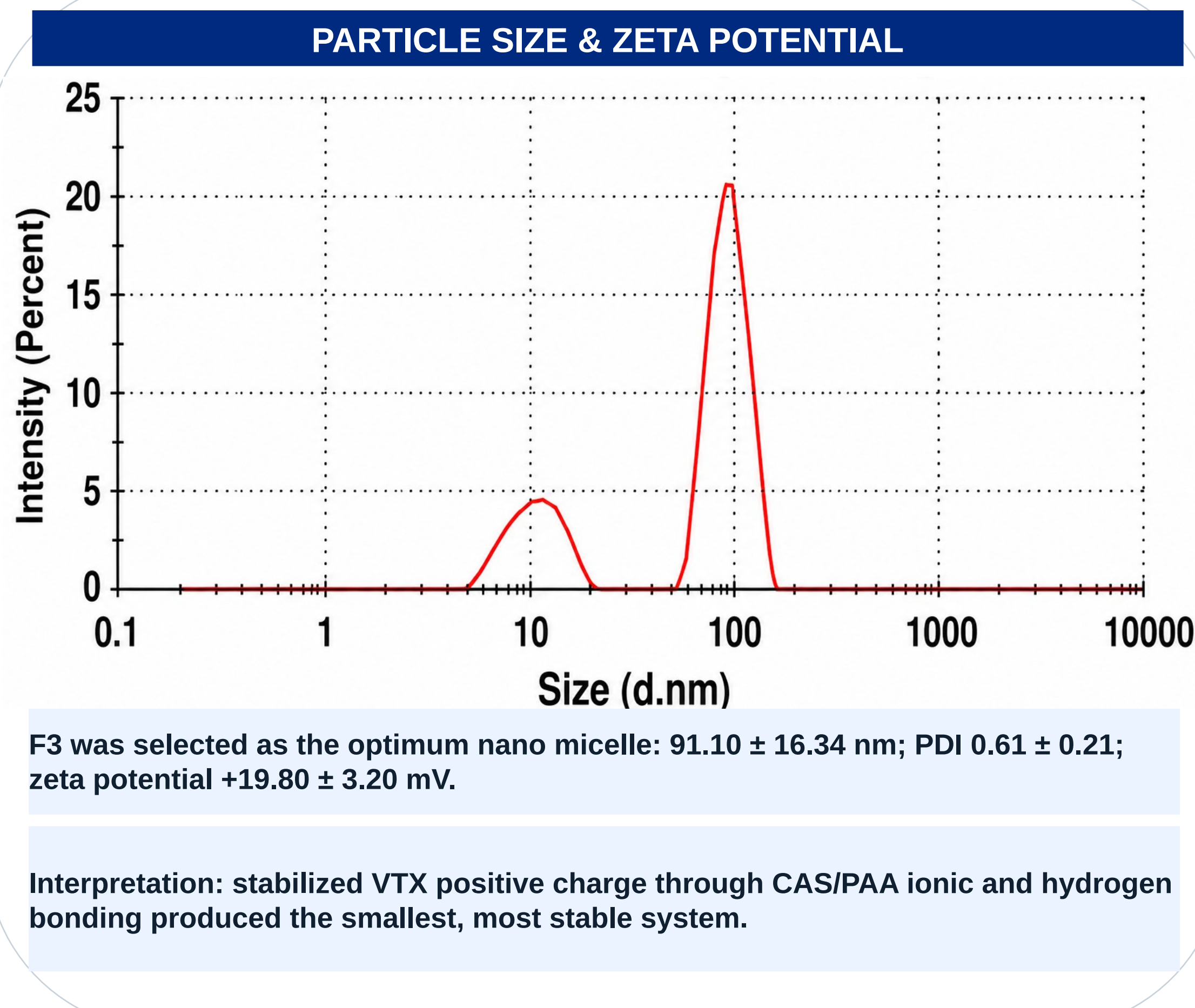
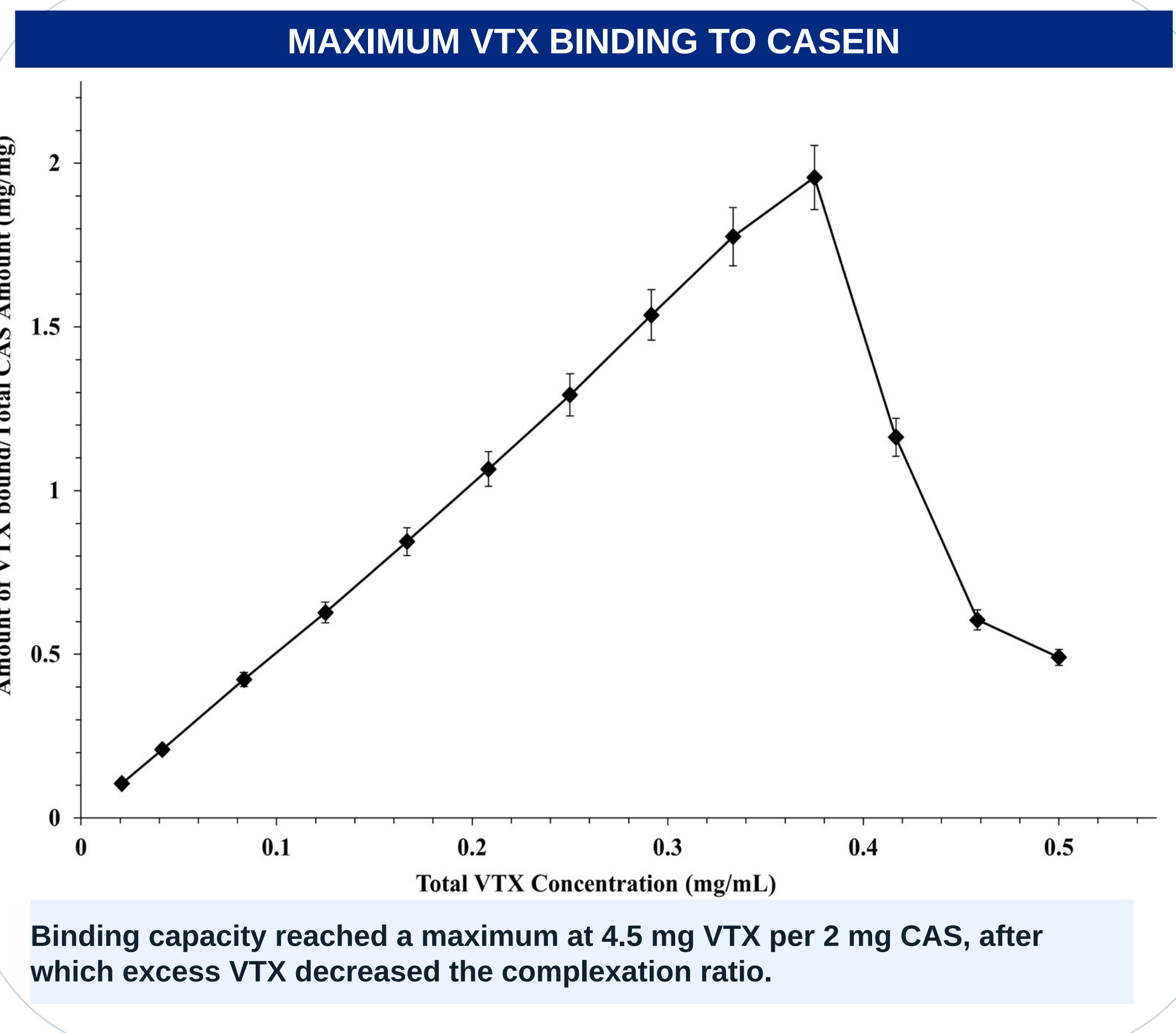
- Neuroprotection
- Neuroregeneration
- Anti-inflammatory effect
- Cognitive improvement

### OUTCOME

**Transforming Brain Therapy**  
This oral nano/micro-delivery system achieves safe, effective, and targeted brain delivery, leading to improved therapeutic outcomes and better quality of life.

- ENHANCED BRAIN ACCUMULATION**  
Increased delivery of therapeutics to the brain.
- TARGETED DISTRIBUTION**  
Precise delivery to affected brain regions.
- SUSTAINED THERAPEUTIC EFFECT**  
Prolonged action for long-term benefits.
- REDUCED SYSTEMIC SIDE EFFECTS**  
Minimized off-target effects and toxicity.
- IMPROVED THERAPEUTIC OUTCOMES**  
Neuroprotection, regeneration, anti-inflammatory effects, and cognitive improvement.

**A STEP FORWARD IN NON-INVASIVE, EFFECTIVE, AND SMART BRAIN THERAPY.**

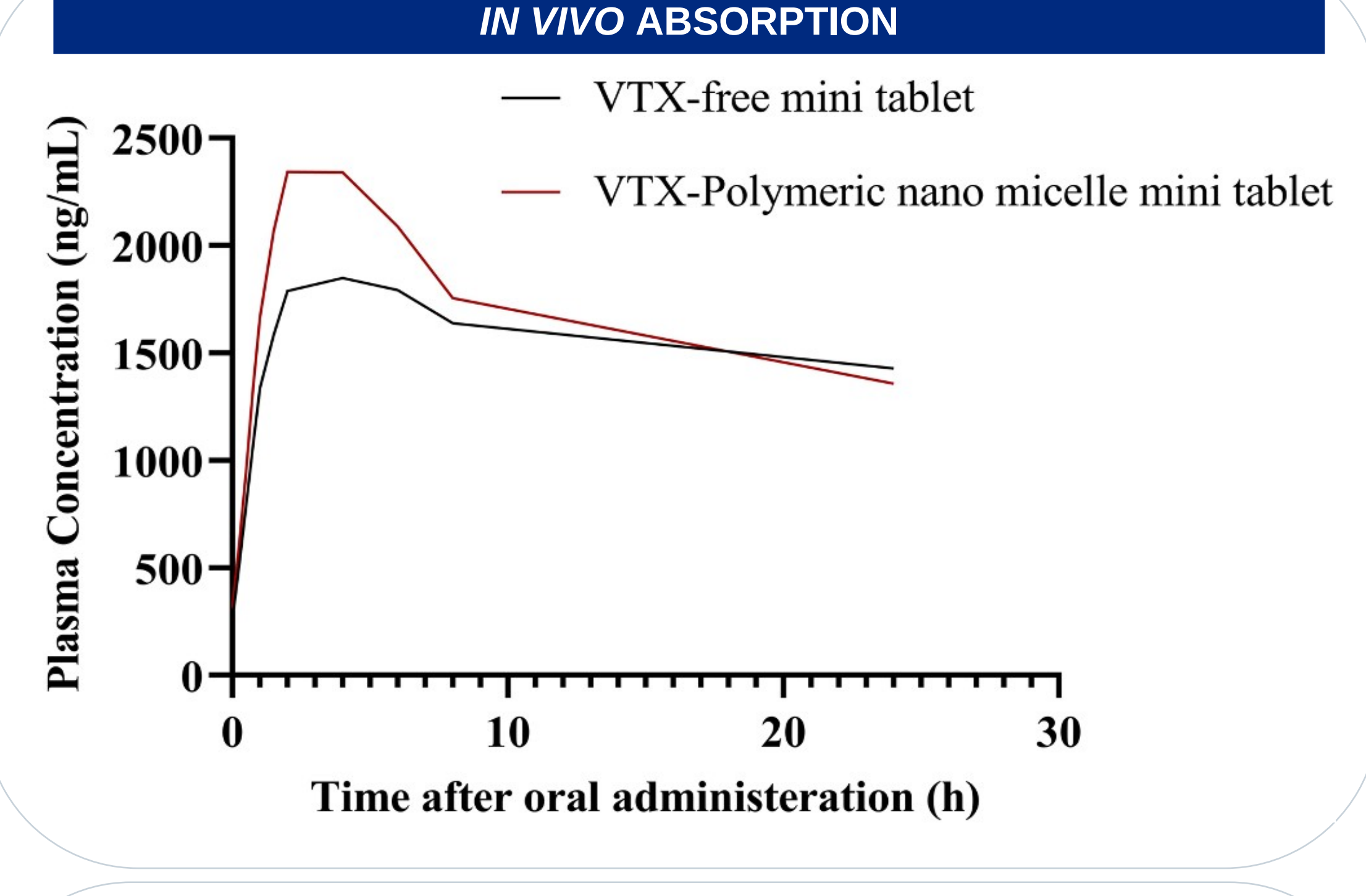
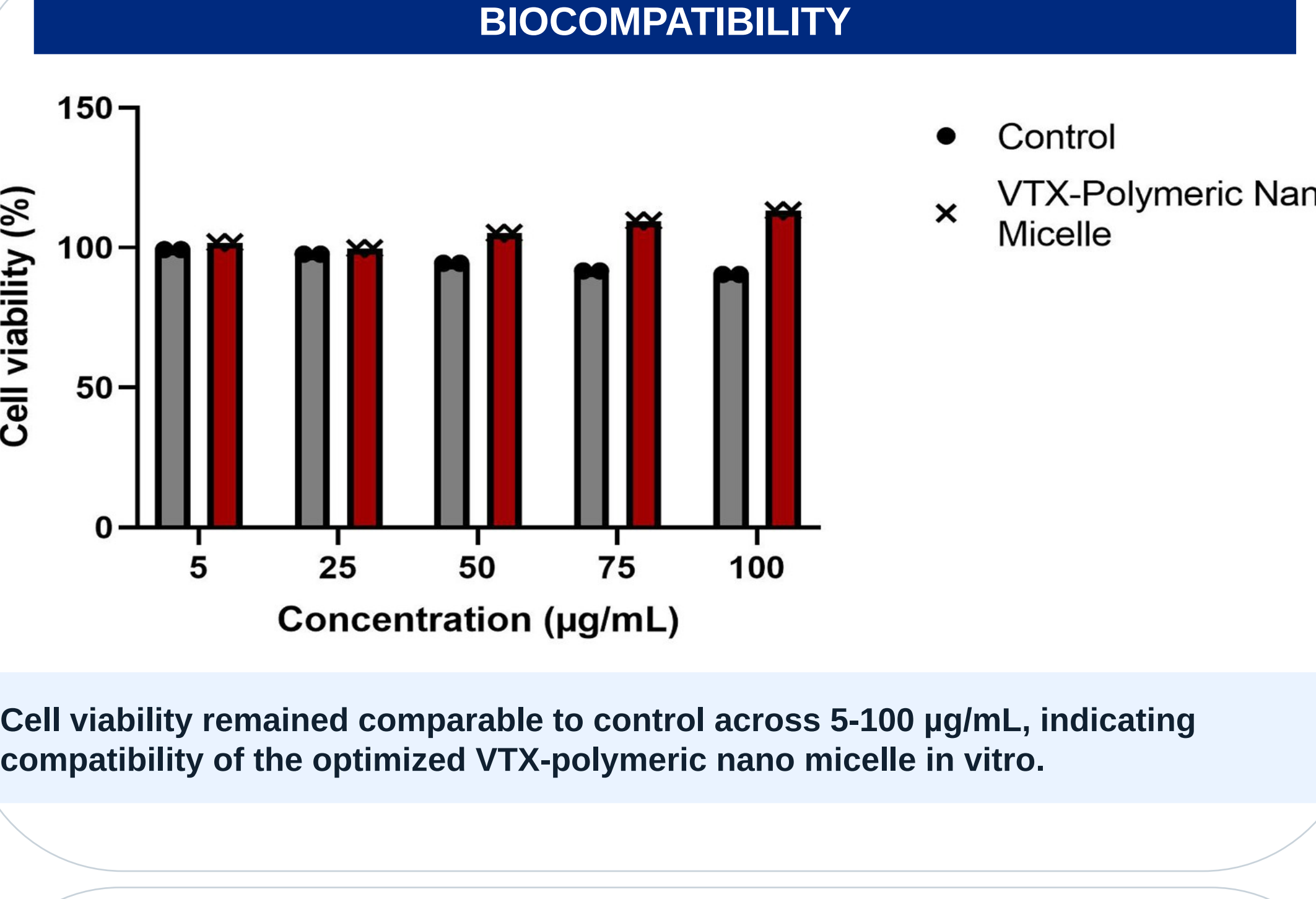
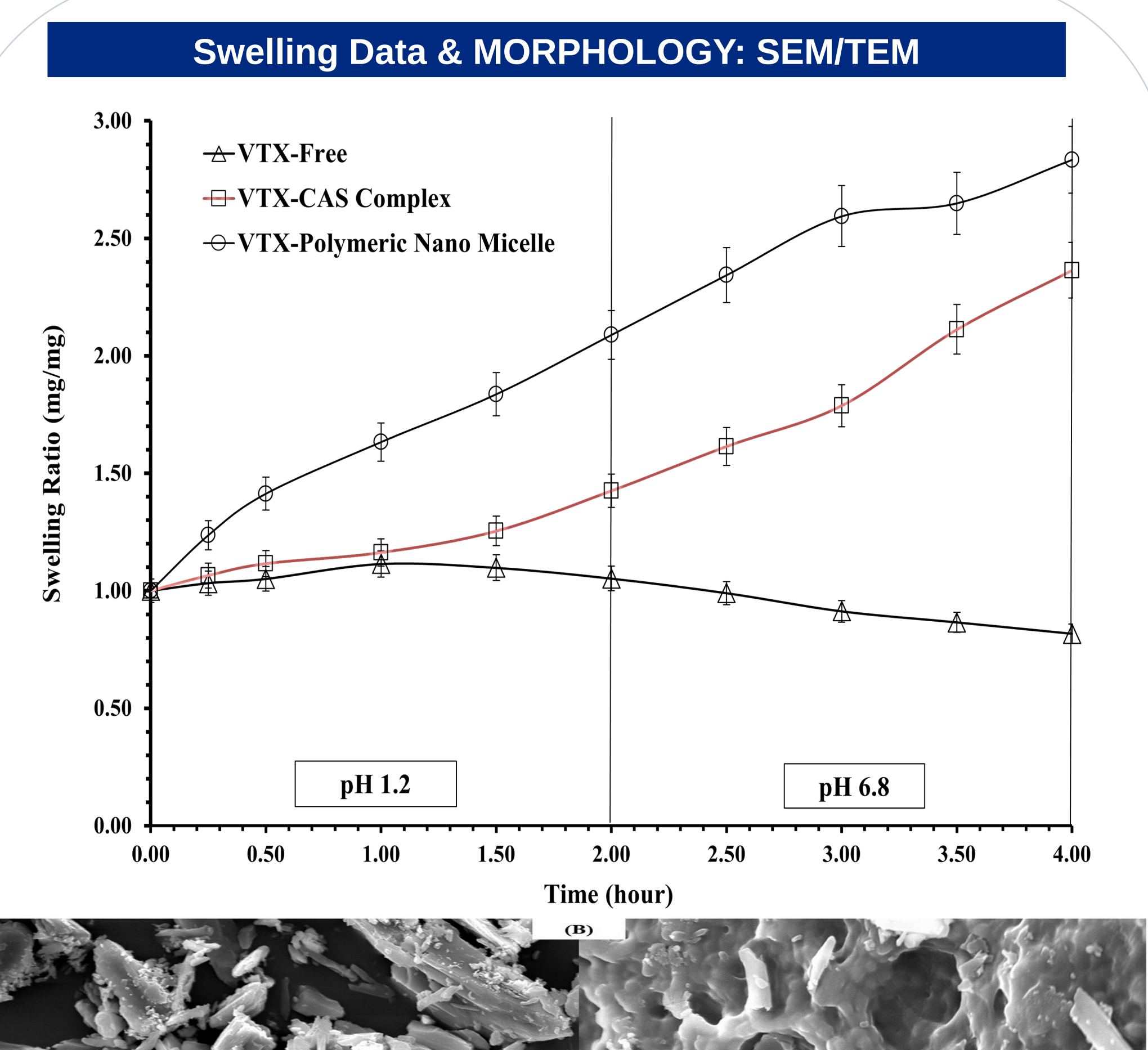


### DISSOLUTION ENHANCEMENT

VTX Solubility (mg/mL)

Formulation	0.1 N HCl	pH 6.8	Water
VTX-free	0.02 ± 0.01	0.01 ± 0.03	0.07 ± 0.05
VTX-CAS Complex	0.93 ± 0.04	1.98 ± 0.08	0.51 ± 0.03
VTX-polymeric NM	7.20 ± 0.13	6.61 ± 0.18	9.79 ± 0.09

PAA nano-micellization lowered logP to 1.44 ± 0.22 and supported greater swelling/adherence/penetration.



### PUBLICATION & TAKEAWAYS

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### PHARMACOKINETIC ADVANTAGE

Key pharmacokinetic outcomes

Parameter	VTX-polymeric NM	VTX-free mini tablet
AUC (ng·h/mL)	35,484 ± 120.40	35,393 ± 111.42
Cmax (ng/mL)	2840 ± 44.11	2116 ± 27.11
Tmax (h)	6.00 ± 0.42	6.00 ± 0.31
Ka (1/h)	0.93 ± 0.11	0.43 ± 0.24
Absorption time	2.00 ± 0.24 h	3.90 ± 0.11 h

### CONCLUSION

- VTX-CAS complexation and PAA nano-micellization together improved dissolution, swelling and penetration.
- The optimized F3 nano micelle showed nanoscale size, positive zeta potential, amorphous character and 50-100 nm morphology.
- The system is a promising oral alternative strategy to improve VTX absorption while avoiding hydrobromide-associated limitations.

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