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ADSORPTION KINETICS OF Β2-MICROGLOBULIN AND PARATHYROID HORMONE BY ADSORBENT MATERIAL: A 12-HOUR IN VITRO PROFILING STUDY

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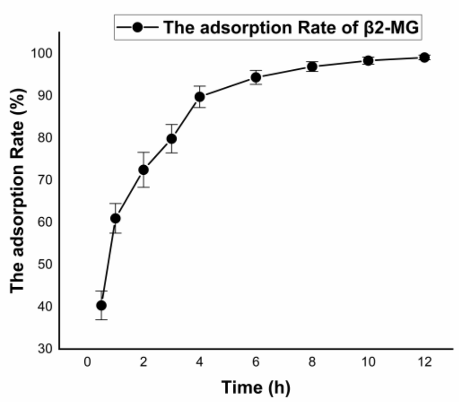
Background: Hemoadsorption combined with hemodialysis (HA-HD) has emerged as a promising therapeutic strategy for enhancing toxin clearance in end-stage renal disease (ESRD). However, the temporal adsorption dynamics of middle-to-large molecular weight uremic toxins, such as β2-microglobulin (β2-MG) and parathyroid hormone (PTH), remain poorly characterized, particularly over extended treatment durations. This study systematically investigates the 12-hour adsorption kinetics of HA130 adsorbent (Jafron Biomedical Co., Zhuhai, China) for β2-MG and PTH, addressing a critical gap in understanding long-term adsorption efficiency and stability.

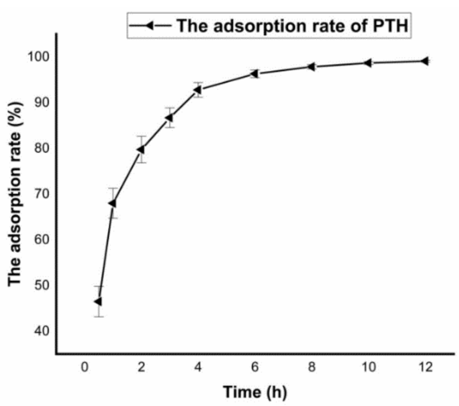
Methods: A certain amount of β2-MG and PTH standard reagents were spiked into bovine serum to simulate the serum of ESRD patients. The bovine serum and absorbent were mixed in a conical flask at a defined ratio. The mixture was incubated in a thermostatic oscillator (37±1°C, 140 rpm) to mimic blood flow conditions. Samples were taken pre-adsorption and at 0.5, 1, 2, 3, 4, 6, 8, 10, and 12 hours post-adsorption(Compared to the initial serum volume, the amount of serum sampled could be negligible), and the concentrations of β2-MG and PTH in samples were determined by chemiluminescence method. The adsorption rate was calculated using the formula: $[(C_0 - C)/C_0] \times 100\%$, where C_0 and C represent initial and timepoint-specific concentrations, respectively.

Results: Both β2-MG and PTH exhibited rapid adsorption, reaching removal rates of 73.7% ± 1.8% and 83.9% ± 2.9%, respectively, at 2 hours. Adsorption slowed thereafter, approaching a plateau by 4 hours (89.8% ± 2.5% for β2-MG and 92.8% ± 1.6% for PTH). No appreciable desorption of either molecule was detected within the 12-hour period.

Conclusion: This kinetic analysis demonstrates the HA adsorbent's sustained binding capacity, achieving significantly higher β2-MG and PTH removal rates at 4 h compared to 2 h. The absence of molecular desorption within 12 hours demonstrates the HA130 material's sustained binding capacity for both toxins beyond the initial rapid uptake phase.

Figure 1 The in vitro adsorption curves of HA130 adsorbent for β2-MG(a) and PTH(b)





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