

Adsorption of Bilirubin and Bile Acids by New Adsorbent Polymers

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Introduction

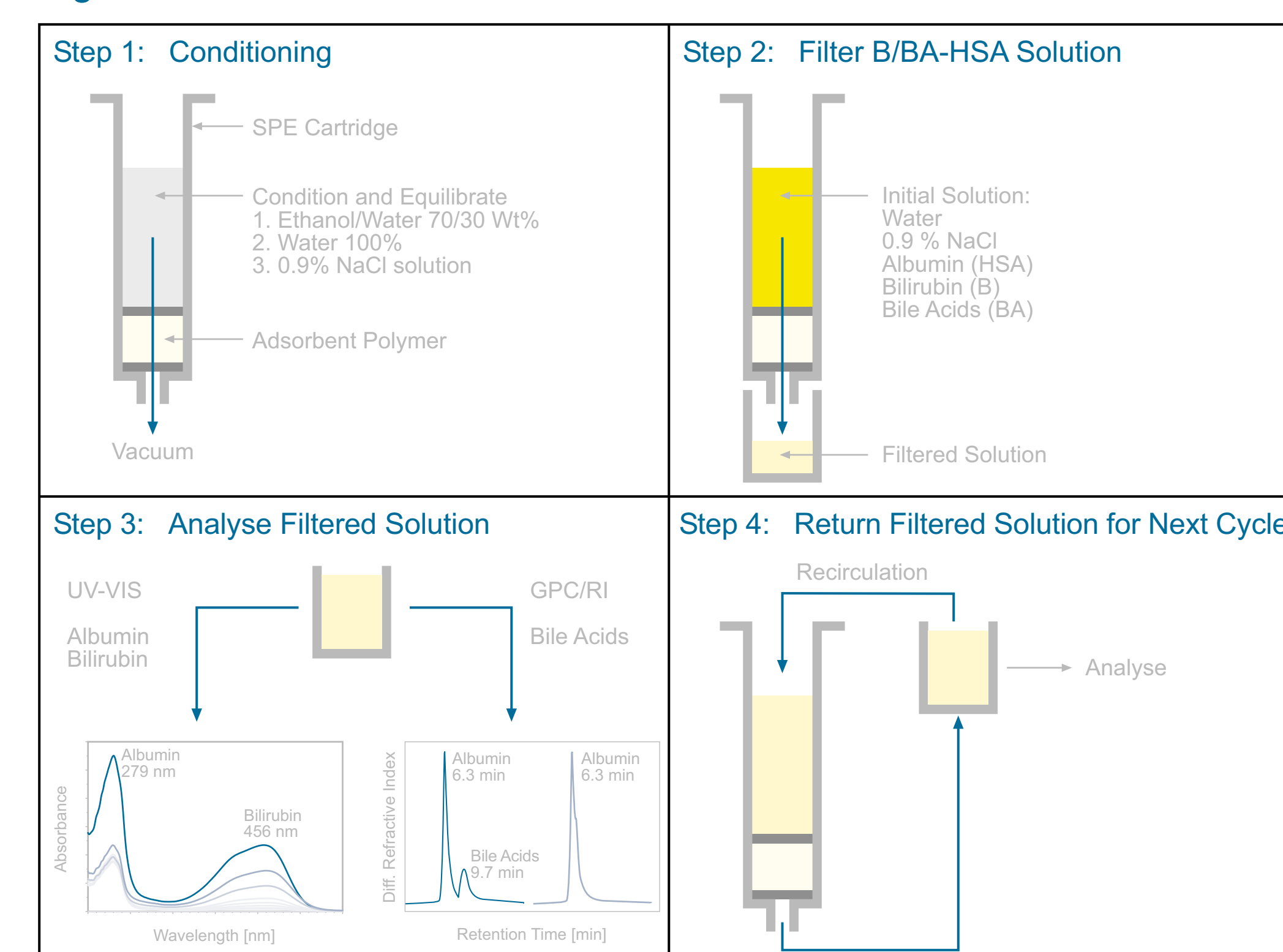
New adsorbent polymers with high adsorption speed and capacity for bilirubin (up to 20 mg bilirubin per gram adsorbent) were presented at the 3rd Albumin Dialysis Symposium in 2001. Based on porous copolymers of divinyl benzene with a polar monomer they combine high specific surface (~650 m²/g) with a tailored surface chemistry for toxine adsorption.

The synthesis of these polymers has been optimized and transferred to a 10 L scale. This poster presents new test results of bilirubin and albumin adsorption properties as a function of particle size and conditioning. Adsorption capacity for bile acids has been investigated additionally.

Dynamic Test Method

- Simulation of albumin recirculation
- Using conventional solid phase extraction (SPE) station
- Polymer adsorbent is conditioned before test
- Aqueous test solution containing albumin, bilirubin and bile acids is filtered through a bed of polymer adsorbent using light vacuum or over pressure
- Samples of filtered solution are analysed for content of albumin, bilirubin and bile acids using UV-VIS spectroscopy and gel permeation chromatography (GPC) or HPLC
- Filtered solution is returned to SPE column, then filtered and analysed again (repeated several cycles)

Fig. 1: Test Method Scheme

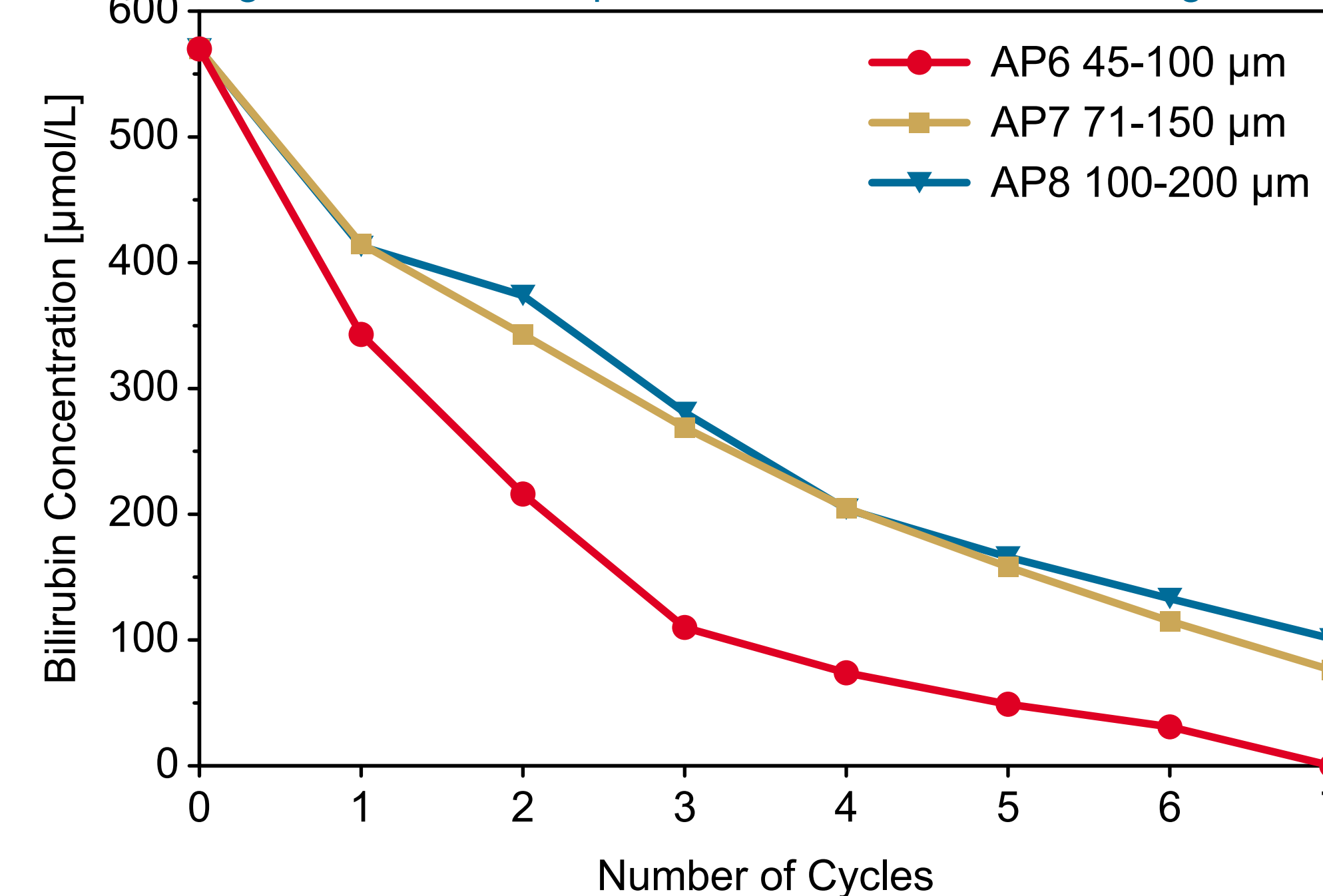


Bilirubin and Albumin Adsorption

Standard Conditioning

- 500 mg of dry adsorbent polymer
- Wash with 10 mL ethanol/water 70/30 wt%
- Wash with 10 mL 100% water
- Wash with 10 mL 0.9% NaCl aqueous solution

Fig 2: Bilirubin Adsorption with Standard Conditioning



HSA Conditioning

- Same as standard conditioning plus additional wash step with 5 mL of 5% albumin in 0.9% NaCl solution

Composition of Initial Test Solution (5 mL):

5% albumin in 0.9% NaCl solution, 570 µmol/L bilirubin

Fig 3: Bilirubin Adsorption with HSA Conditioning

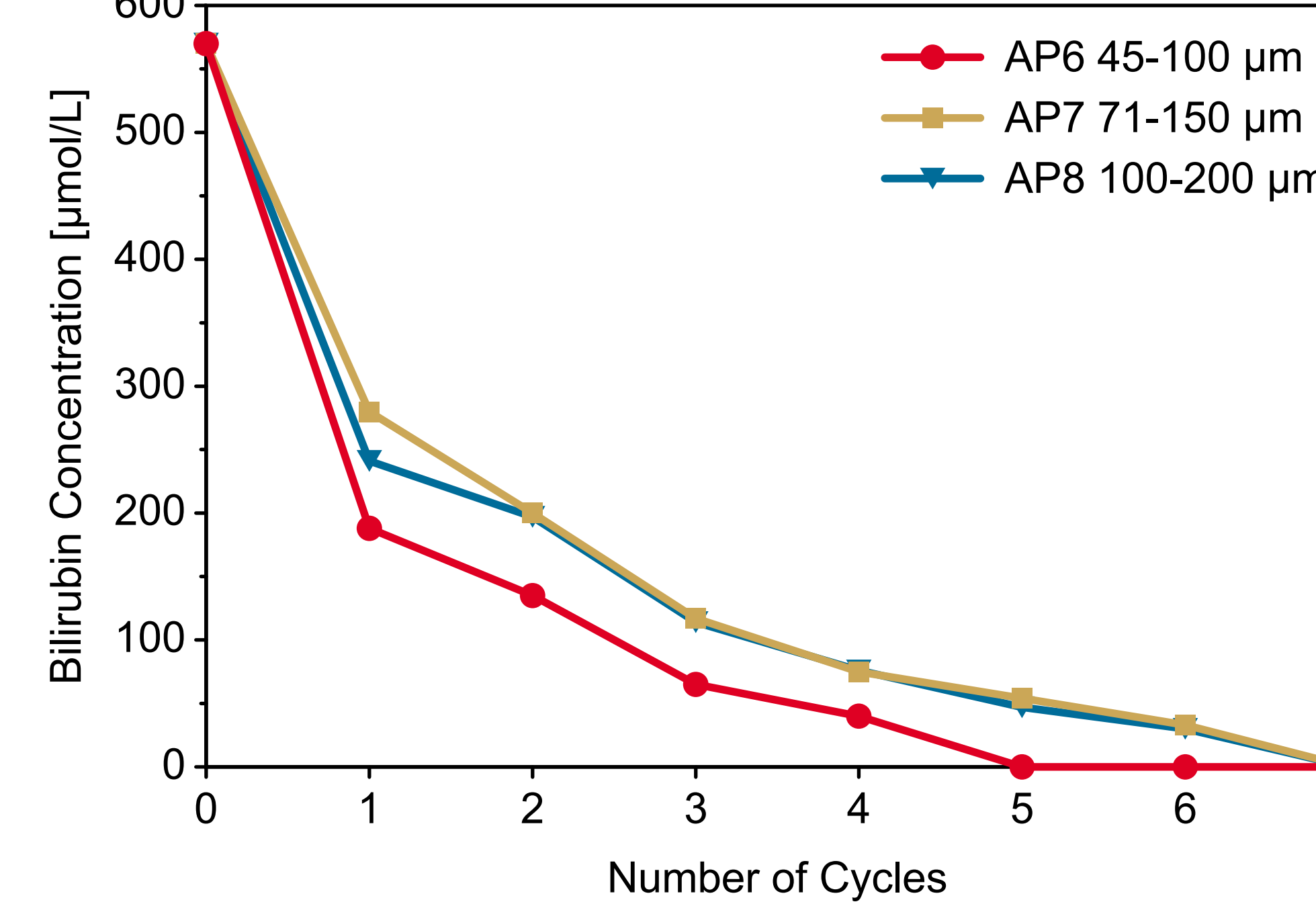


Fig 4: Albumin Adsorption with Standard Conditioning

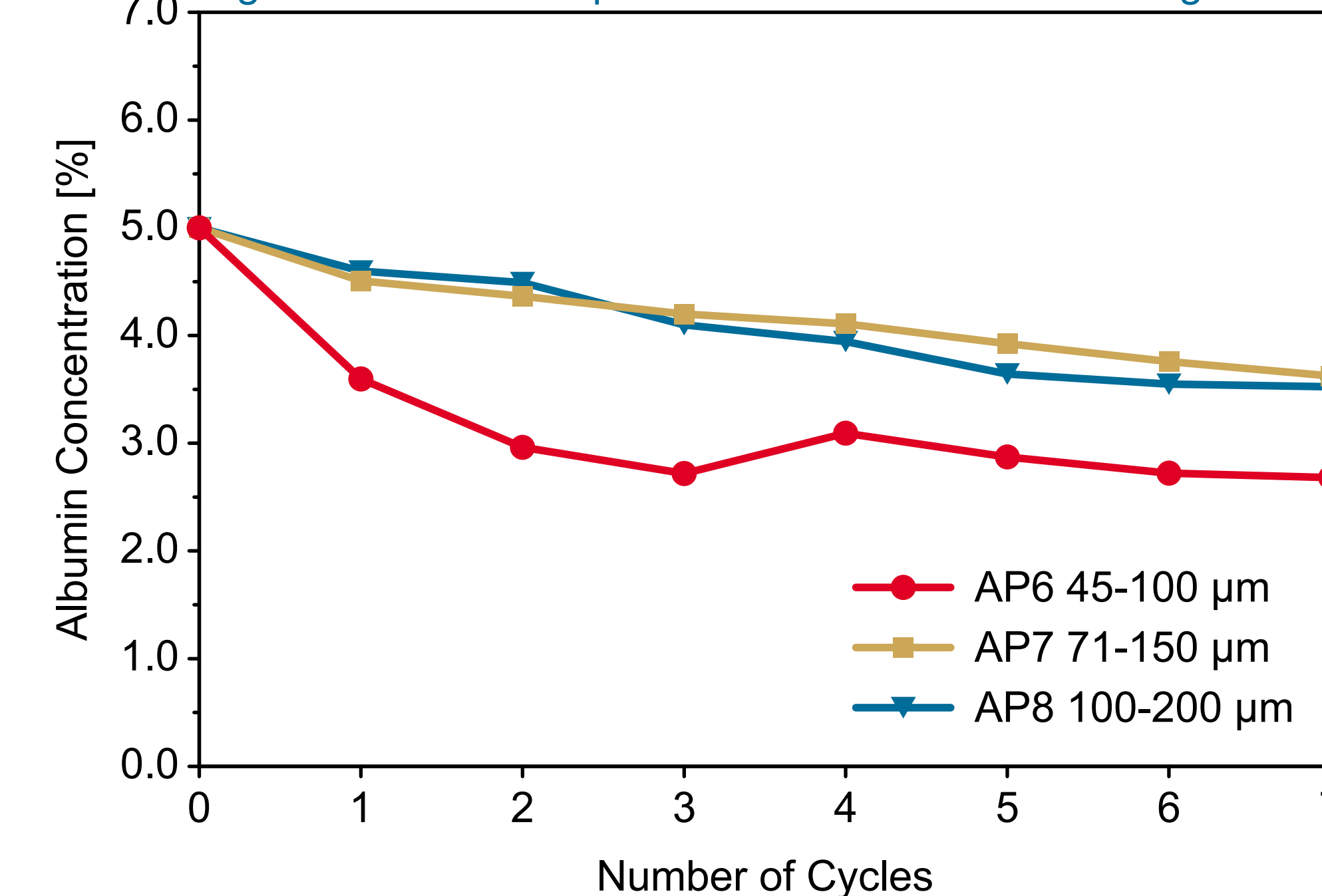
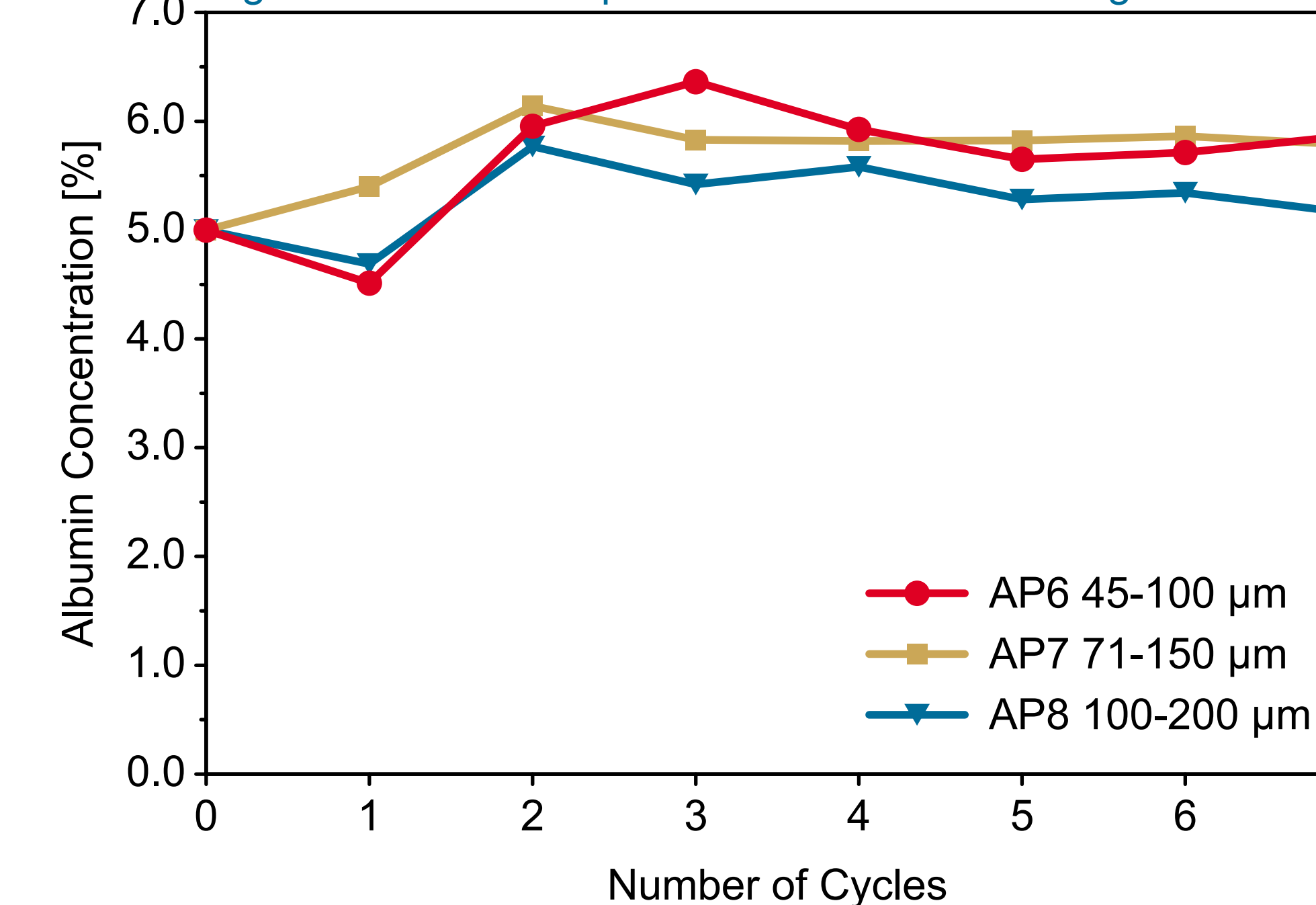


Fig 5: Albumin Adsorption with HSA Conditioning



Results after Standard Conditioning

- Small particles (AP 6) show fastest bilirubin adsorption
- Albumin capacity of adsorbent polymer depends on particle size: 150 mg albumin per gram polymer (AP 7, AP 8), 250 mg albumin per gram polymer (AP 6)
- Adsorbent polymer with standard conditioning is saturated with albumin after 4th cycle

Results after HSA Conditioning

- Small particles show fastest adsorption
- Accelerated bilirubin adsorption for all particle sizes
- No further albumin adsorption after HSA conditioning

Bile Acid Adsorption

Conditioning

- 200 mg adsorbent polymer
- Wash 3 × 3 mL alcohol/water 70/30 wt%
- Wash 3 × 3 mL water
- Wash 3 × 3 mL 0.9% NaCl solution

Test Procedure

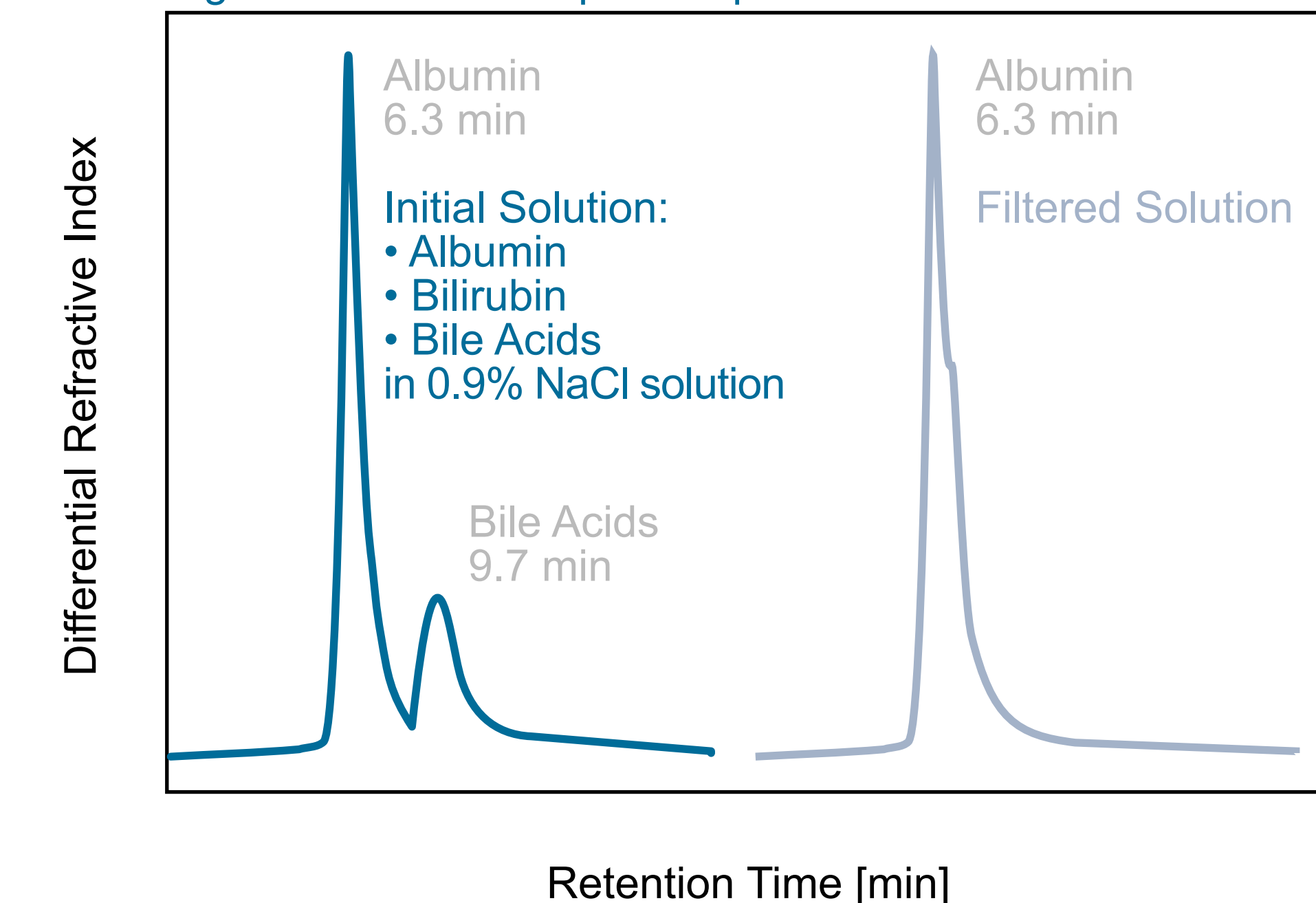
Load with 3 mL 0.9% NaCl solution containing 1 mg/mL bile acids until bile acids can be detected by GPC/RI in the filtered solution (no recirculation)

Results

Polymer	Bile Acid Capacity [mg BA/g Polymer]
AP 6 (45–100 µm)	240
AP 7 (71–150 µm)	210
AP 8 (100–200 µm)	210

Additional tests have been conducted with GPC/RI analysis of the filtered solutions to show bile acid adsorption in the presence of albumin.

Fig 6: Bile acid adsorption in presence of albumin



Summary

- Adsorption depends on particle size
- Albumin conditioning improves adsorption properties
- The new adsorbent polymers show very high bile acid capacity

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