

Testing New Adsorbent Polymers in a MARS® Setup

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Introduction

New adsorbent polymers with high adsorption speed and capacity for bilirubin and bile acids were presented at the 4th Albumin Dialysis Symposium in 2002. Based on porous copolymers of divinyl benzene with a polar monomer they combine high specific surface with a tailored surface chemistry for optimized toxine adsorption.

This poster presents *in vitro* test results of the performance of the new adsorbents in a MARS® setup with a focus on particle size. Elimination of bilirubin and bile acids is monitored over a period of 180 min and compared to the currently used activated charcoal.

Characterization of Materials

Adsorbent	AP 6	AP 7	AP 8
Size Range [µm]	45–100	71–150	100–200
Size Average (d_{50}) [µm]	58	109	132
Specific Surface [m ² /g]	671	566	630
Bile Acid Capacity [mg/g]	240	210	210

Fig. 1: Scanning electron micrographs of AP 8

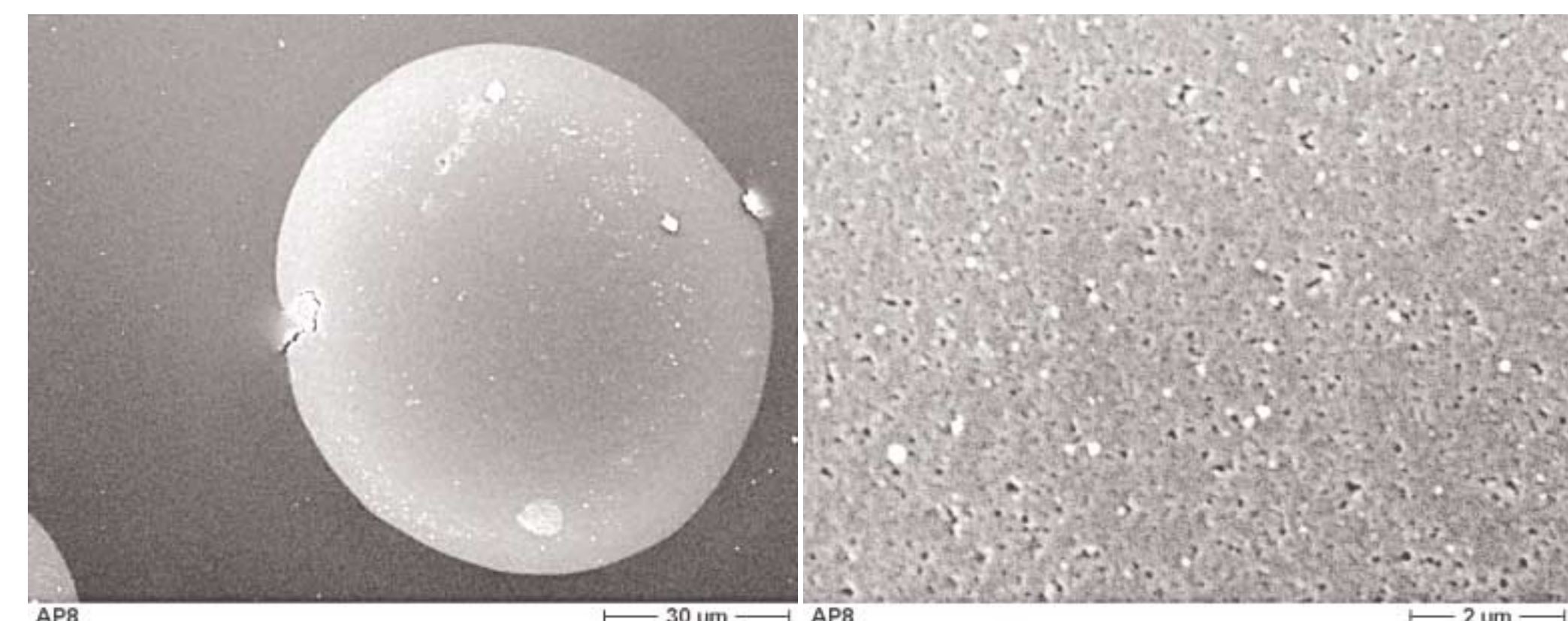
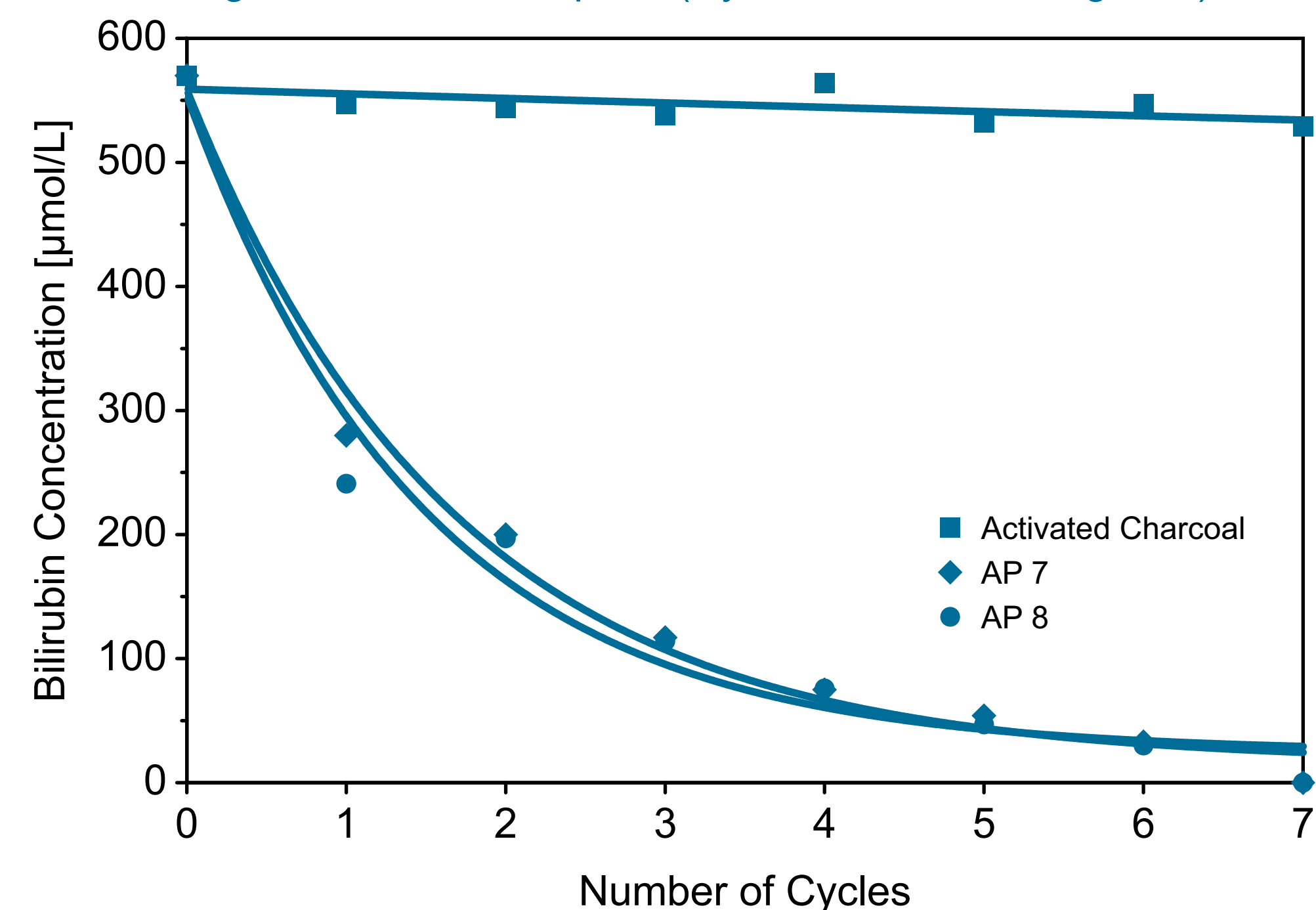
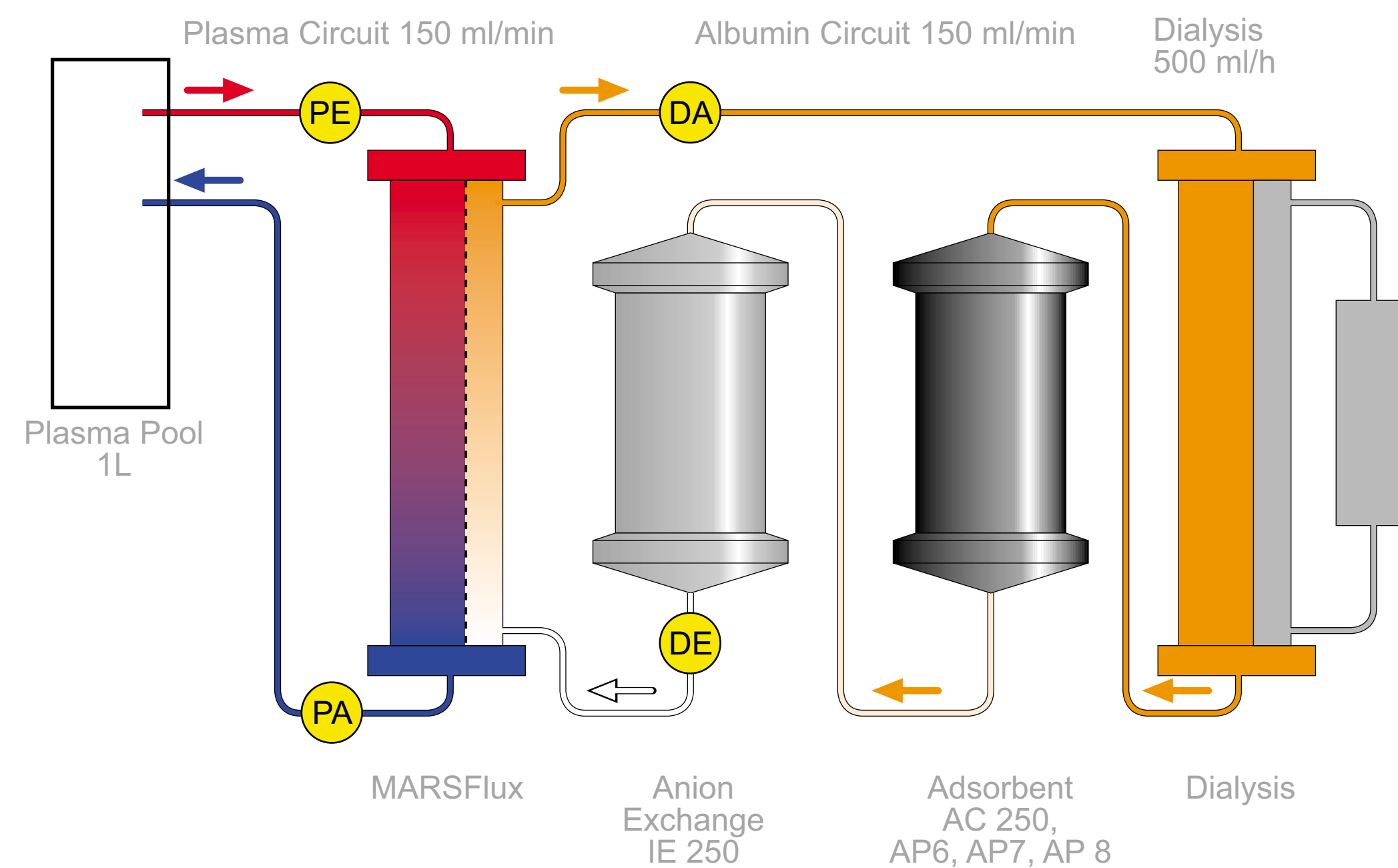


Fig 2: Bilirubin Adsorption (Dynamic Recirculating Test)



Test Configuration



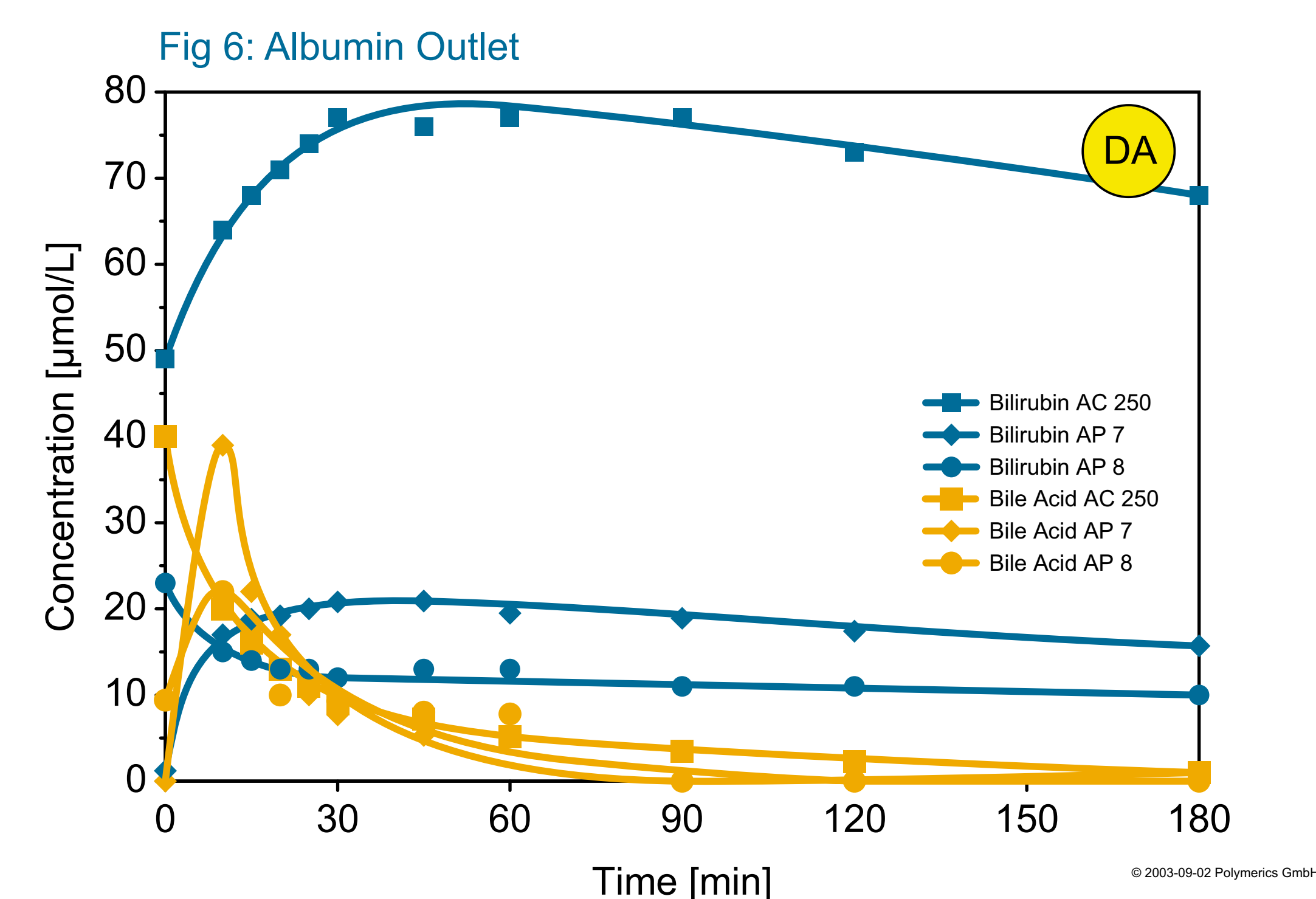
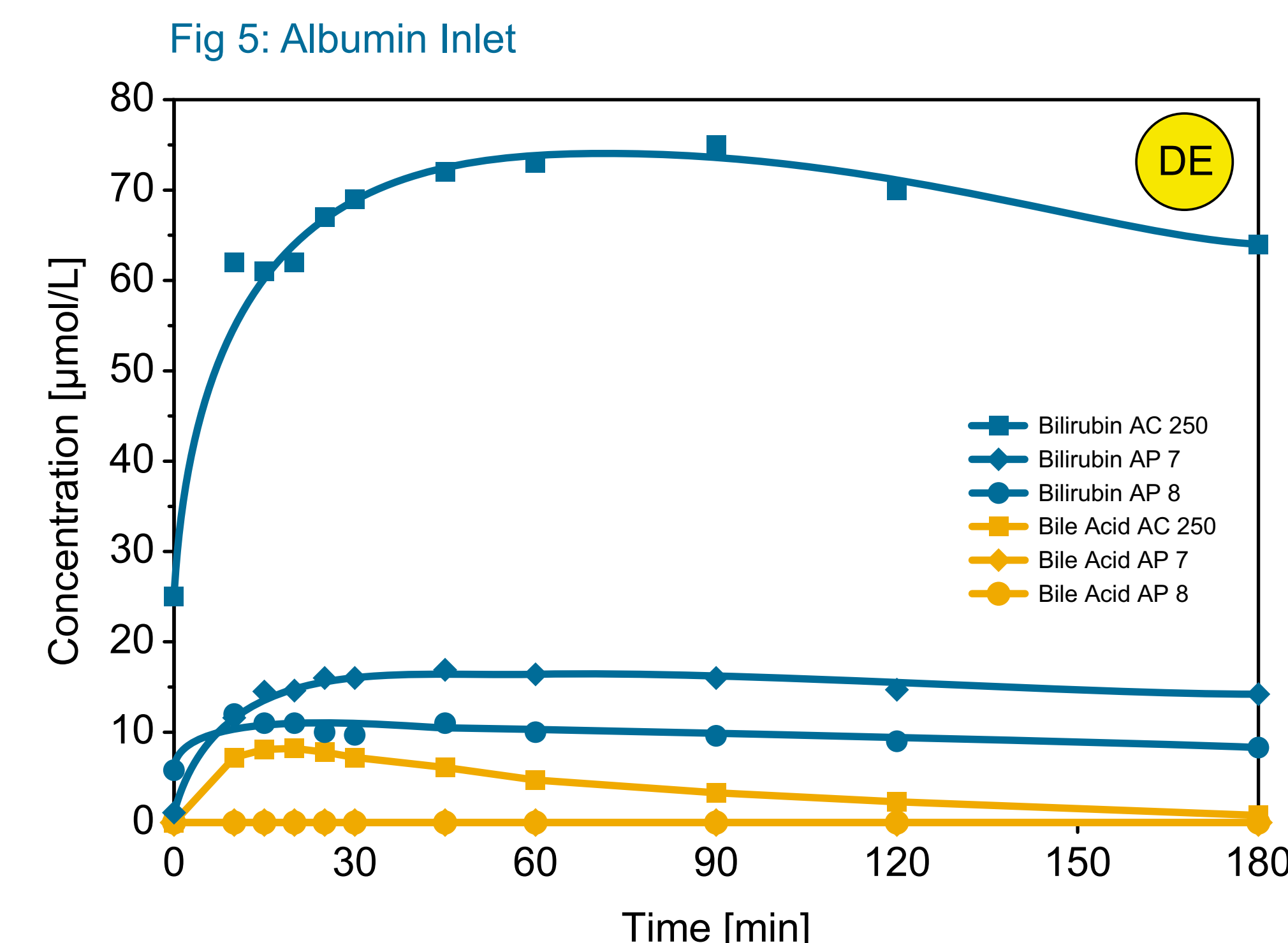
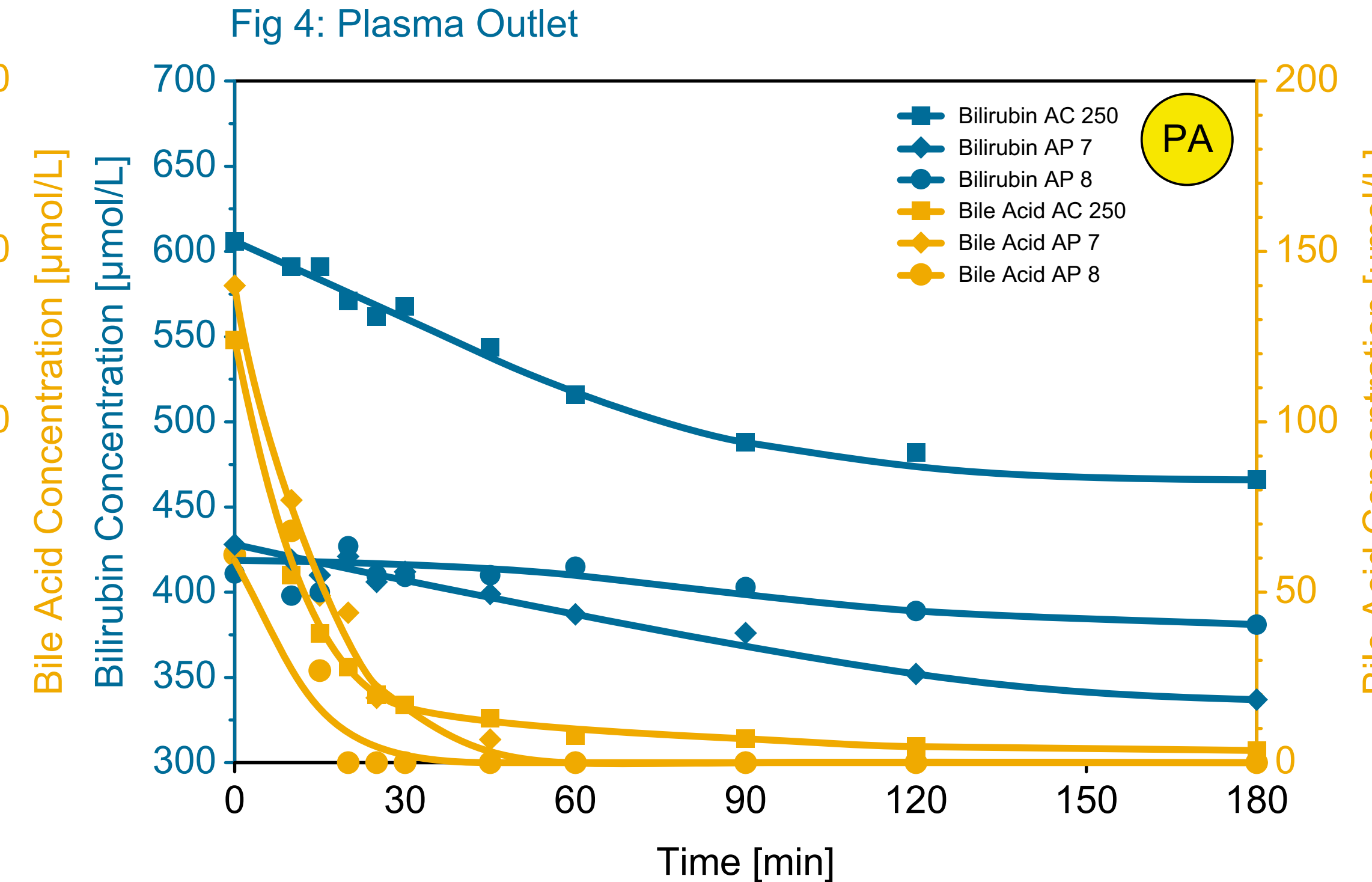
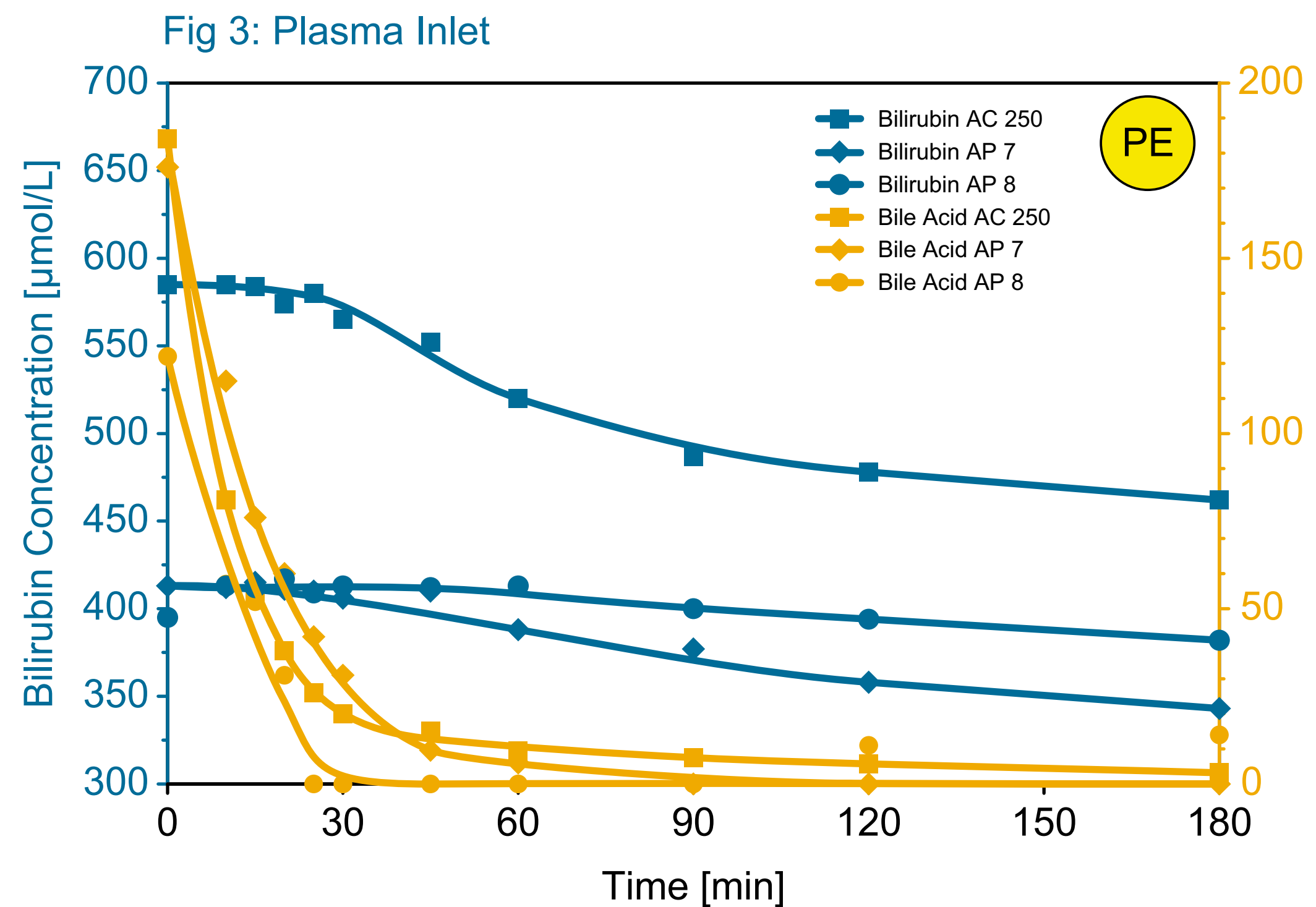
Initial Plasma Pool Concentrations

	AC250	AP 7	AP 8
Albumin [g/L]	43.5	46.0	52.1
Bilirubin [µmol/L]	585	413	395
Glycocholic Acid [µmol/L]	184	176	122
Heparin [IE/L]	2000	2000	2000

Initial Albumin Circuit Concentrations

	AC250	AP 7	AP 8
Albumin [g/L]	151.0	121.1	111.9

Test Data



Results

Flow Rate

Maximum flow rate depends on particle size and size distribution (narrow is better):

Adsorbent	AP 6	AP 7	AP 8
Size Range [µm]	45–100	71–150	100–200
Size Average (d_{50}) [µm]	58	109	132
Maximum Flow [mL/min]	80	190	150

Clearance

$$\text{Clearance} = D / AUC$$

D: eliminated toxine amount

AUC: area under curve $c = c_0 e^{-kt}$ with $t = 0 \dots 30$ min

Adsorbent	AC250	AP 6	AP 7	AP 8
Bilirubin [ml/min]	2.1	3.5	1.7	4.6
Bile Acid [ml/min]	82	36	56	83

Toxine Levels

- Bilirubin level is much lower in albumin circuit (DA, DE) with AP 7 and AP 8 than with AC250.
- Bile acids are completely removed from albumin circuit by AP 7 and AP 8 (DE).

Conclusions

- Adsorbent polymers for a MARS® setup should have $d_{50} \geq 108 \mu\text{m}$ and narrow size distribution.
- Adsorbent polymers reduce bilirubin level of $c_0 = 400 \mu\text{mol/L}$ with similar clearance (AP 7) or twice as high clearance (AP 8) than AC 250.
- AP 8 removes bile acids completely within 30 min from the plasma pool.
- The MARSFlux® membrane seems to be the rate determining factor for bilirubin reduction in the plasma pool.

Acknowledgements

The authors would like to thank Dr. Steffen Mitzner of University of Rostock for making possible the tests in the MARS® setup and for overall support. Financial support of this project by the German Federal Ministry of Economy under reg.# 1123/01 is gratefully acknowledged.