

Contact Angle Studies on PDMS surfaces Fouled by Bovine Serum Albumin

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INTRODUCTION: Polydimethylsiloxane (PDMS) elastomer is growing to be a preferred material in microfluidics or life science applications[1]. This is due to its ease of fabrication, low cost, inertness, low toxicity and biocompatibility. Normally, PDMS has a hydrophobic surface, forming a contact angle of around 110° with deionised water. It is due to its hydrophobic nature that the elastomer is prone to bio-fouling, such as non-specific adsorption of biomaterials like proteins[2]. This is a limitation to microfluidic applications that require hydrophobic surfaces where proteins are involved. This study determines the change in wetting of PDMS after fouling by a protein, bovine serum albumin (BSA), by measuring contact angles.

METHODS: PDMS elastomer blocks were prepared by mixing a 10:1 ratio of Sylgard 184® silicone base and curing agent. The fluid mixture was cast into moulds, degassed for 30 minutes, and cured in an oven at 60°C for 2hours.

The contact angle studies were done on a surface under three conditions. The first condition PDMS was fouled with different BSA concentrations (50, 100 and 150 mg/ml) without pre-treatment. On the second condition the surface was precoated with mineral oil before fouling under the respective BSA concentrations. On the third condition, the surface was precoated with a solution of mineral oil with 50µl/ml an oil-soluble surfactant, Span 20®. Precoating was achieved by dipping the elastomer block in a petri dish containing the precoating fluid for 30 minutes.

The surfaces were then fouled by coating them with the different BSA solutions. The fouled PDMS surfaces were then dried in an oven at 60°C for an hour. A Skuor drop-shape analyzer was used to measure the contact angle of deionised water on the surfaces. The amount of BSA on each surface was qualitatively determined by looking at the surfaces under a light microscope.

RESULTS:

Table 1: Effects of coating & BSA Conc. on PDMS surfaces.

Concentration	No coating	Oil	Oil + Span 20
50 mg/l	low	medium	high
100 mg/l	medium	high	Very high
150mg/ml	high	very high	Extremely high

Table 2: Effects of PDMS coating on the contact angle.

Concentration	Coating	Contact angle
clean	none	111.2°
50mg/ml	Oil	102.7°
50mg/ml	Oil-Span 20	100.6°
100mg/ml	Oil	98.5°
100mg/ml	Oil-Span 20	90.5°

DISCUSSION & CONCLUSIONS: An increase in BSA concentration resulted in a high amount of BSA accumulating on the PDMS surfaces. The other observation was that pre-coating the surface with oil and oil-Span 20 solutions also enhanced fouling. Contact angle measurements on fouled surface were difficult due to rough surface. The contact angle was not possible on the surface fouled with 150mg/ml BSA.

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