Electronic Supplementary Material (ESI) for Lab on a Chip

A new on-chip whole blood/plasma separator driven by asymmetric capillary forces

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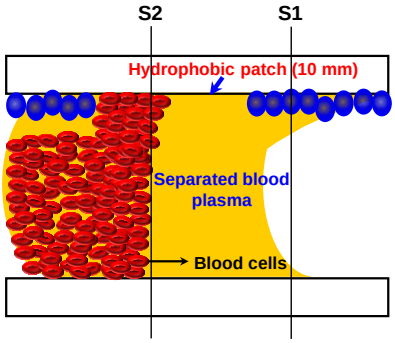
1. Effects of the channel dimensions to the separation results

Volume of the separated blood plasma =

{(Leading edge of the separated blood plasma: S1) – (Leading edge of the blood cells: S2)} ×

(channel width) × (channel depth)



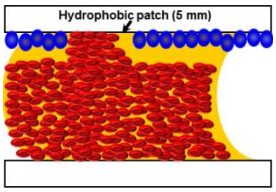
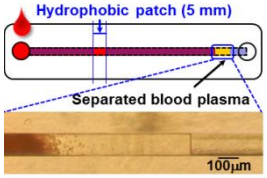
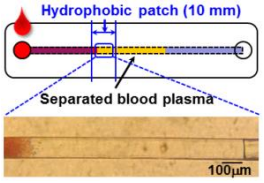
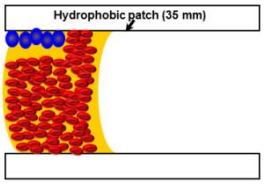
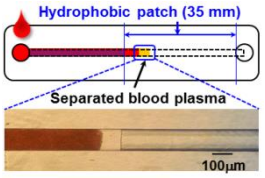
Hydrophobic patch length (mm)	Capillary force in the leading edge		Side view of the separator (100 μm channel width)	Top view of the separator (100 μm channel width)
	Separated blood plasma (S1)	Blood cells (S2)		
< 5	Strong	Strong		
10	Strong	Weak		
35	Weak	Weak		

Table S1. Effects of the length of hydrophobic patch on the separation results of the blood plasma.

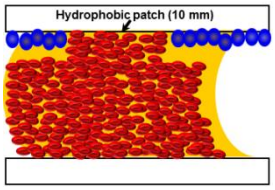
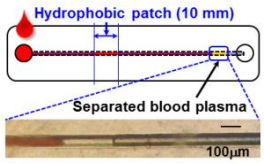
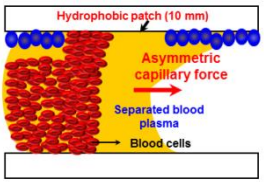
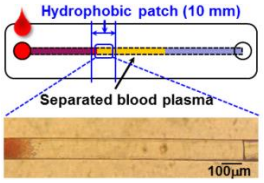
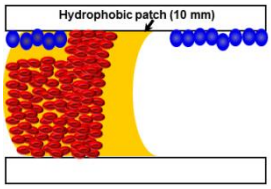
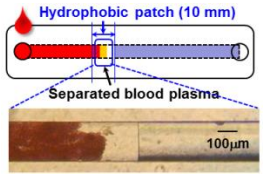
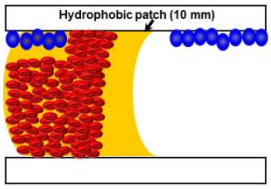
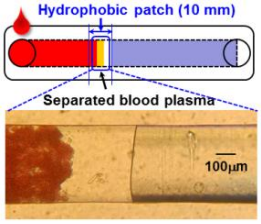
Microchannel width (μm)	Capillary force in the leading edge		Side view of the separator (10 mm hydrophobic patch)	Top view of the separator (10 mm hydrophobic patch)
	Separated blood plasma (S1)	Blood cells (S2)		
50	Strong	Strong		
100	Strong	Weak		
200	Weak	Weak		
400	Weak	Weak		

Table S2. Effects of the width of microchannel on the separation results of the blood plasma.

2. Human whole blood used in this work

The amount of whole blood used in this work was only 3 μL which is very suitable for point-of-care clinical testing (POCT). This small amount of whole blood is important because separating an effective amount of blood plasma from a small amount of whole blood is very useful for neonates, pediatrics, resource-limited environments, and home-care settings for chronic disease.

All samples of human whole blood used in this work were procured and used for the blood plasma separator based on the previous procedure [1-3] in the Department of Pathology and Laboratory Medicine at the University of Cincinnati. I obtained some blood samples from several healthy volunteers with the help of Dr. Ha Won Kim and Dr. Motoi Okada (specialist for blood sampling) in the Department of Pathology and Laboratory Medicine. All blood samples were contained in a BD Vacutainer® Plus Plastic K_2EDTA Tube (green top tube) because the green top is the plasma tube used for blood plasma separation [4]. In addition, the blood plasma separation in the device was performed within 2 hours of blood collection because the purpose of this research is to develop a blood plasma separator for the on-site monitoring system with a single droplet of 3 μL human whole blood, enough for a disposable single-use platform for POCT. Blood samples drawn from different volunteers were successfully separated as shown in Fig. 4 and 5.

3. Contact angle measurements

The contact angle measurement is a facile, practical, high-throughput and very powerful method for analyzing the variations of surfaces at the monolayer level. The wettability of the bare COC and spray-coated silica films on COC was characterized in ambient air at room temperature using a contact angle goniometer based on the sessile drop method shown in Fig. S1. The mean contact angles with high purity deionized (DI) water were determined by averaging values measured at five different points on the sample surface. 3 μL of DI water was applied on the sample surfaces using a micropipette.

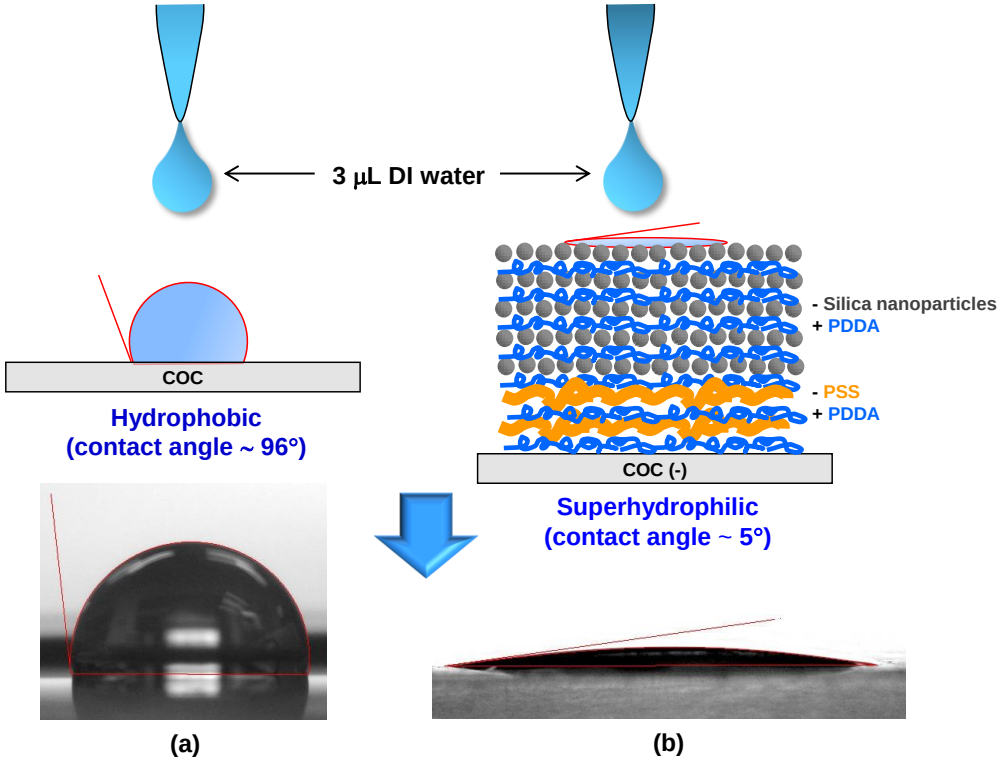


Fig. S1 Description of the contact angle measurements. (a) uncoated bare COC surface, and (b) silica films on COC surface modified by spray layer-by-layer nano-assembly.

References

[1] T. Songjaroen, W. Dungchai, O. Chailapakul, C. S. Henry and W. Laiwattanapaisal, *Lab Chip*, 2012, 12, 3392–3398.

[2] J. S. Shim and C. H. Ahn, *Lab Chip*, 2012, 12, 863–866.

[3] K. H. Chung, Y. H. Choi, J.-H. Yang, C. W. Park, W.-J. Kim, C. S. Ah and G. Y. Sung, *Lab Chip*, 2012, 12, 3272–3276.

[4] http://catalog.bd.com/bdCat/viewProduct.doCustomer?productNumber=367878