

Characterization of Hydrodynamic Focusing Behavior in a Flow Cytometer

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ABSTRACT

Hydrodynamic focusing behavior is studied for two fluids coflowing at different velocities inside a flow cytometer. In this work, a three-dimensional two-fluid model has been established to describe the flow transport behavior and coupling effects of the sample and water sheath streams. Adopting the Eulerian system, both sample and sheath fluids are treated as continuous media. The theoretical model comprises two groups of transient conservation equations of mass and momentum with inclusion of the interfacial momentum exchange between two fluids. The governing equations are solved numerically with an iterative SIMPLEC algorithm to determine the flow properties. As the ratio of sheath velocity to sample velocity is varied from 2.5 to 70, both predicted focusing width and length agree reasonably well with the Lee's experimental data. In addition, the present study examines the pressure drop across a cytometer as well as the focusing time necessitated for completing one hydrodynamic focusing event in detail.

Keywords : Two-fluid Model, Hydrodynamic focusing, Flow Cytometer

Table of Contents

目錄 封面內頁 簽名頁 授權書.....	iii	中文摘要.....	iii
.....v 英文摘要.....	v	.....vi 誌謝.....	vi
.....vii 目錄.....	vii	.....viii 圖目錄.....	viii
.....x 表目錄.....	x	.....xii 符號說明.....	xii
.....xiii 第一章 緒論.....	xiii	.....
.....1 1.1 研究動機.....	1	.....1 1.2 文獻回顧.....	2
.....5 研究目的.....	5	.....2 1.3 第二章 理論方法.....	7
.....7 理論分析.....	7	.....7 2.1 2.1 理論模型.....	7
.....12 與討論.....	12	.....7 2.2 2.2 數值方法.....	10
.....15 驗證.....	15	.....10 第三章 結果與討論.....	13
.....22 22 參考文獻.....	22	.....12 3.1 3.1 取樣管之設計、網格及邊界條件之設定.....	13
.....24 24 圖目錄 圖 1 : 傳統細胞計數器裝置示意圖.....	24	.....13 3.2 3.2 理論模型驗證.....	16
.....29 圖 2(a) : 微型流體細胞計數器結構示意圖.....	29	.....16 第四章 結論.....	16
.....30 圖 2(b) : 結合完整後之微型計數器.....	30	.....
.....31 圖 3 : 1 × N 連續式進樣晶片.....	31	.....
.....31 圖 4 : M × N 連續式進樣晶片.....	31	.....24 圖目錄 圖 1 : 傳統細胞計數器裝置示意圖.....	24
.....32 圖 5 : SIMPLEC 演算法流程圖.....	32	.....29 圖 2(a) : 微型流體細胞計數器結構示意圖.....	29
.....32 圖 6 : 微取樣管參數設計圖.....	32	.....30 圖 2(b) : 結合完整後之微型計數器.....	30
.....32 圖 7 : 微取樣管幾何尺寸及網格分佈圖.....	32	.....31 圖 3 : 1 × N 連續式進樣晶片.....	31
.....33 圖 8 : 微取樣管實體圖.....	33	.....31 圖 4 : M × N 連續式進樣晶片.....	31
.....34 圖 9 : 不同格點配置下聚焦寬度比較圖.....	34	.....32 圖 5 : SIMPLEC 演算法流程圖.....	32
.....35 圖 10 : 微流體水力聚焦之寬度圖.....	35	.....32 圖 6 : 微取樣管參數設計圖.....	32
.....36 圖 11 : 微流體水力聚焦之長度圖.....	36	.....32 圖 7 : 微取樣管幾何尺寸及網格分佈圖.....	32
.....37 圖 12 : 微流道水力聚焦現象速度向量圖.....	37	.....33 圖 8 : 微取樣管實體圖.....	33
.....39 圖 13 : 相對取樣流入口與出口間壓力降圖.....	39	.....34 圖 9 : 不同格點配置下聚焦寬度比較圖.....	34
.....40 圖 14(a) : 沿中心線(A-A1)之軸向速度變化圖.....	40	.....35 圖 10 : 微流體水力聚焦之寬度圖.....	35
.....41 圖 14(b) : 沿橫向線(A-A1)之壓力變化圖.....	41	.....36 圖 11 : 微流體水力聚焦之長度圖.....	36
.....42 圖 15(a) : 沿中心線(B-B1)之軸向速度變化圖.....	42	.....37 圖 12 : 微流道水力聚焦現象速度向量圖.....	37
.....43 圖 15(b) : 沿中心線(B-B1)之軸向壓力變化圖.....	43	.....39 圖 13 : 相對取樣流入口與出口間壓力降圖.....	39
.....44 圖 16 : 取樣流 $s = 0.5$ 等位線之暫態時變圖.....	44	.....40 圖 14(a) : 沿中心線(A-A1)之軸向速度變化圖.....	40
.....45 圖 17 : 不同流速比之水力聚焦時間圖.....	45	.....41 圖 14(b) : 沿橫向線(A-A1)之壓力變化圖.....	41
.....45 圖 18(a) : 不同設計與操作參數之幾何型構.....	45	.....42 圖 15(a) : 沿中心線(B-B1)之軸向速度變化圖.....	42
.....45 圖 18(b) : 內部不同噴嘴擺設位置圖.....	45	.....43 圖 15(b) : 沿中心線(B-B1)之軸向壓力變化圖.....	43
.....46 圖 19 : 內部噴嘴直徑大小比較圖.....	46	.....44 圖 16 : 取樣流 $s = 0.5$ 等位線之暫態時變圖.....	44
.....47 圖 20(a) : 內部直線噴嘴幾何型構.....	47	.....45 圖 17 : 不同流速比之水力聚焦時間圖.....	45
.....47 圖 20(b) : 內部曲線噴嘴與直線噴嘴比較圖.....	47	.....45 圖 18(a) : 不同設計與操作參數之幾何型構.....	45
.....48 圖 21 : 外部噴嘴之不同幾何長度比較圖.....	48	.....45 圖 18(b) : 內部不同噴嘴擺設位置圖.....	45
.....49 圖 22 : 取樣流染劑與血液之聚焦寬度比較.....	49	.....46 圖 19 : 內部噴嘴直徑大小比較圖.....	46
.....50 圖 23(a) : 三維立體圖.....	50	.....47 圖 20(a) : 內部直線噴嘴幾何型構.....	47
.....50 圖 23(b) : 三視圖.....	50	.....47 圖 20(b) : 內部曲線噴嘴與直線噴嘴比較圖.....	47
.....51 圖 24 : 三維取樣流 $s = 0.5$ 等位線之暫態時變圖.....	51	.....48 圖 21 : 外部噴嘴之不同幾何長度比較圖.....	48
.....52 表目錄 表 1 : 水與血液物理特性列表.....	5248 圖 22 : 取樣流染劑與血液之聚焦寬度比較.....	48
.....52 表 2 : 網格點分佈配置.....	5249 圖 23(a) : 三維立體圖.....	49
.....52	5250 圖 23(b) : 三視圖.....	50

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