

Title (en)

Microfluid system and method for sorting clusters of cells and continuously encapsulating them once they are sorted

Title (de)

Mikrofluidsystem und Verfahren zum Sortieren von Zellhaufen und zu ihrer kontinuierlichen Einkapselung nach ihrer Sortierung

Title (fr)

Système microfluidique et procédé pour le tri d'amas de cellules et pour leur encapsulation en continu suite à leur tri

Publication

EP 2119503 B1 20150401 (FR)

Application

EP 09290311 A 20090429

Priority

FR 0802575 A 20080513

Abstract (en)

[origin: EP2119503A2] The microfluidic system comprises a substrate in which a microchannel network (111, 112, 113, 114) is etched and around which a protection hood is sealed and comprising a unit for sorting cells. The sorting unit comprises a diverting unit to separate less cohesive cell clusters of size 20-500 μm , 20-10000 cells such as islets of Langerhans, and two sorting microchannels arranged in parallel in outlet of the unit to convey many types of sorted clusters towards an encapsulation unit. The diverting unit is a passive fluidic hydrodynamic device. The microfluidic system comprises a substrate in which a microchannel network (111, 112, 113, 114) is etched and around which a protection hood is sealed and comprising a unit for sorting cells. The sorting unit comprises a diverting unit to separate less cohesive cell clusters of size 20-500 μm , 20-10000 cells, and two sorting microchannels arranged in parallel in outlet of the unit to convey many types of sorted clusters towards an encapsulation unit. The diverting unit is a passive fluidic hydrodynamic device i.e. for hydrodynamically focusing the deterministic lateral displacement by an arrangement of deviation blocks that comprises a microchannel for hydrodynamic filtration arranged transversely in a main microchannel. An encapsulation unit (120) is arranged for automatically encapsulating the sorted clusters according to their category, and formed in the network connecting with the sorting microchannel. The encapsulation unit is arranged for continuously forming a mechanically resistant and selective permeable biocompatible monolayer or multilayer capsule around each sorted cluster, and comprises many sub-units (121, 122, 123, 124) for encapsulation, which are respectively arranged in parallel with sorting microchannel to form a capsule of predetermined size for enveloping each cluster of that category. Each sub-unit for encapsulation comprises a device, such as T junction device, microfluidic flow-focusing device, device of structured microchannel network and micro nozzle network device, for forming the capsules, and an exchanger of material between an aqueous phase comprising sorted clusters in each category and an immiscible phase with the aqueous phase, i.e. oily phase. The encapsulation unit further comprises a unit for gelling the formed capsules. A microfluidic transfer module is present in the microchannel network for transferring the sorted cluster of a culture medium towards an encapsulation intended to contain in the unit of encapsulation, and contacted with each of the sorting microchannel and for minimizing the losses in the sorting unit. A coupling module of the sorting unit is connected to the encapsulation unit, which is intended to maintain laminar fluid regime in the two units by connecting directly or selectively the encapsulation unit with sorting unit. The coupling module is constituted of intermediate microchannels connecting respectively the sorting microchannels to the encapsulation unit, and has dimensions and a geometry adapted to maintain the laminar regime in upstream and downstream. The coupling module comprises buffer microreservoir for storing sorted clusters in each of which the sorting microchannels open and which are selectively connected to the unit for encapsulation by a microchannel outlet, which is intended to convey the sorted and concentrated clusters and equipped with a fluid valve for example with air bubble or with blocking gel so that the opening and closing of that valve raises and lowers valve respectively the concentration of sorted clusters in each microreservoir according to the number of capsules during formation in the unit for encapsulation.

IPC 8 full level

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CPC (source: EP US)

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CN109943475A; CN102530833A; FR2946895A1; US11458474B2; WO2010146261A3; US10816550B2; US10471425B2; US11318464B2; US11566982B2; US11754476B2; US10946380B2; US11872560B2

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