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(54) Title: MICROENABLED CHEMICAL REACTION IN MICROFLUIDIC CHIPS

(57) Abstract: A chemical process to obtain products of higher purity or in shorter time is provided by performing chemical reactions in a reactions volume less than 1 microliter. The advantages of this process are due to better mixing or heat exchange (each 10 fold decrease in reaction volume leads to a 100-fold improvement mixing or heat exchange) or better surface to volume ratio. Better surface to volume ratio is a major factor in reactions critically dependent on surface mediated events such as heterogeneous catalysis. This increase in yield and speed of reaction can be conducted in parallel sets of reaction chambers provided by multilayer glass and silicon chips. Reagents can be added via a microfluidic chip incorporating channels and orthogonal row/column reagent delivery options. This discovery is amendable to solid supported synthesis as well as solution synthesis. Because of the better surface to volume ratio, this process is particularly useful with solid catalyst on the edges of the reaction chamber and can be used for hydrogenation, and hydroformulation. This process is demonstrated in reactions involving nucleophilic aromatic substitution on a solid support.

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INTERNATIONAL SEARCH REPORT

 International application No.
PCT/US00/16056

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : C12Q 1/00, 1/68; A61K/38/00; C07H 21/00, 21/02, 21/04

US CL : Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 435/4, 6, DIGEST 46, DIGEST 49; 422/129, 187, 232, 530/333, 334, 338, 341; 536/25.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST, DIALOG: terms: microreactor, chemical synthesis, catalyst, peptide, nucleotide, DNA, microfluidics, ultramicrotiter, array, library, combinatorial

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 5,472,672 A (BRENNAN) 05 December 1995, see entire document, especially the abstract and claims.	1, 2, 5, 6, 9 -----3, 4, 7, 8, 10-14, 16-20
Y	US 5,474,796 A (BRENNAN) 12 December 1995, see the entire document, especially column 7 lines 45-68 and the abstract.	1-2, 5-12, 14-20
X ----- Y	US 5,585,275 A (HUDSON et al) 17 December 1996, see the entire document, especially the abstract and figures.	1, 2, 6, 9, 11-13, 16-20 ----- 14

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	* & * document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
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Date of the actual completion of the international search

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,008,040 A (TSUKAMOTO et al) 16 April 1991, see entire document especially column 4 lines 44-50.	3, 4
Y	US 5,741,862 A (MULLER er al) 21 April 1998, see entire document.	3, 4
X,P ---- Y,P	US 6,001,311 A (BRENNAN) 14 December 1999, See entire documen especaially claim 86-95.	1, 2, 5, 6, 9, 11-13, 16-20 ----- 3, 4, 7-8, 10, 14
X	US 5605,662 A (HELLER et al) 25 February 1997, see entire document especially the abstract and figures.	1, 2, 6, 9, 11, 14, 15, 16, 17

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