flowing as laminar flows, contact with each other at the fluid boundary which can be kept stably by the partition walls arranged with intervals and capable of stirring a fluid containing a raw material for reaction and/or a reaction product, or capable of proceeding a rapid chemical reaction, solvent extraction or separation by stirring a fine particle-containing fluid in the fine channel of the fine channel device, and a chemically operating method using such fine channel device.

Example 7

[0162] In Example 7, a decomposition reaction of p-chlorophenol by laccase having a function of decomposing environmental pollutants, as one of the catalytic reactions, was carried out by using the fine channel device shown in **FIG. 22**(*b*). The fine channel device used had a fine channel **19** having two Y-letter like branch portions, one of which was branched to two channel portions communicated with an inlet port A **28** and an inlet port B **29** and the other of which was branched to two fine channel portions communicated with an outlet port C **30** and an outlet port D **31**. The width of the fine channel was 100 μm, the depth was 25 μm and the length was 400 mm. The inner structure of the fine channel was such that as shown in **FIG. 21, a** large number of projections **20** having a height of 30 μm were formed in one side of the fine channel at positions of each side of the inlet port A and the outlet port C, in the same manner as in Example 4. In a substantially central portion of the fine channel, partition walls **22** having the maximum length of 50 μm and a height of 25 μm were formed intermittently in a flowing direction of fluid with intervals of 50 μm.

[0163] By using the fine channel device, a decomposition reaction of p-chlorophenol by laccase having a function of decomposing environmental pollutants, as one of the catalytic reactions, was carried out. Namely, an isooctane solution containing 100 μM p-chlorophenol, as an organic phase, was fed to one side of the fine channel where the projections **20** were formed, at a flow rate of 5 μL/min from the inlet port A and a succinic acid buffer solution (pH: 5.0) containing 30 μM laccase, as an aqueous phase, was fed at a flow rate of 5 μL/min. Then, amounts of p-chlorophenol in both phases before and after the reaction were measured with a liquid chromatography.

[0164] As a result, it was found that the aqueous phase and the organic phase could be separated at the branch portion at a fluid outlet port side, and the aqueous phase was discharged from the outlet port C and the organic phase was discharged from the outlet port D without causing substantial mutual contamination. Further, the decomposition percentage of p-chlorophenol reached 82% in about 8 sec.

Example 8

[0165] In Example 8, a decomposition reaction of p-chlorophenol by laccase having a function of decomposing environmental pollutants, as one of the catalytic reactions, was carried out by using the fine channel device shown in **FIG. 22**(*b*). The fine channel device used had a fine channel **19** having two Y-letter like branch portions, one of which was branched to two channel portions communicated with an inlet port A **28** and an inlet port B **29** and the other of which was branched to two fine channel portions communicated with an outlet port C **30** and an outlet port D **31**. The width of the fine channel was 100 μm, the depth was 25 μm and the length was 400 mm. The inner structure of the fine channel was such that as shown in **FIG. 22**(*a*), partition walls **22** having the maximum length of 50 μm and a height of 25 μm were formed intermittently in a flowing direction of fluid with intervals of 50 μm in a substantially central portion of the fine channel as shown in **FIG. 22**(*a*).

[0166] An isooctane solution containing 100 μM p-chlorophenol, as an organic phase, in which fine silica particles having an average particle size of 5 μm were incorporated was fed at a flow rate of 5 μL/min from the inlet port A, and a succinic acid buffer solution (pH: 5.0) containing 30 μM laccase, as an aqueous phase, was fed at a flow rate of 5 μL/min from the inlet port B. Then, amounts of p-chlorophenol in both phases before and after the reaction were measured with a liquid chromatography.

[0167] As a result, it was found that fluid separation could be achieved at the branch portion at a side of the fluid outlet port, and the aqueous phase was discharged from the outlet port C and the organic phase was discharged from the outlet port D without causing substantial mutual contamination. Further, the decomposition percentage of p-chlorophenol reached 85% in about 8 sec.

Example 9

[0168] In Example 9, a decomposition reaction of p-chlorophenol by laccase having a function of decomposing environmental pollutants, as one of the catalytic reactions, was carried out by using the fine channel device shown in **FIG. 22**(*b*). The fine channel device used had a fine channel **19** having two Y-letter like branch portions, one of which was branched to two channel portions communicated with an inlet port A **28** and an inlet port B **29** and the other of which was branched to two fine channel portions communicated with an outlet port C **30** and an outlet port D **31**. The width of the fine channel was 100 μm, the depth was 25 μm and the length was 400 mm. The inner structure of the fine channel was such that as shown in **FIG. 22**(*a*), partition walls **22** having the maximum length of 50 μm and a height of 25 μm were formed intermediately in a flowing direction of fluid with intervals of 50 μm in a substantially central portion of the fine channel as shown in **FIG. 22**(*a*).

[0169] By using the fine channel device, an isooctane solution containing 100 μM p-chlorophenol, as an organic phase, was fed at a flow rate of 5 μL/min from the inlet port A and a succinic acid buffer solution (pH: 5.0) containing 30 μM laccase, as an aqueous phase, was fed at a rate of 5 μL/min. from the inlet port B. Then, amounts of p-chlorophenol in both phases before and after the reaction were measured with a liquid chromatography.

[0170] As a result, it was found that fluid separation could be achieved at the branch portion at a side of the fluid outlet port; the aqueous phase could be discharged from the outlet port C and the organic phase could be discharged from the outlet port D without causing substantial mutual contamination. Further, the decomposition percentage of p-chlorophenol reached 80% in about 8 sec.

[0171] From results of Examples 7, 8 and 9, it is understood that the present invention can provide a fine channel device having a fine structure capable of separating at least two kinds of fluid at the branch portion at a side of the fluid