ACOUSTIC AFFINITY CELL SELECTION FOR MULTIPLE TARGET RECEPTORS

RELATED APPLICATIONS

[0001] The present application claims the benefit of priority of U.S. Provisional Patent Application No. 63/101,227, filing date August 30, 2019, the entire contents of which is incorporated by reference herein in its entirety.

BACKGROUND

[0002] Separation of biomaterial has been applied in a variety of contexts. For example, separation techniques for separating proteins from other biomaterials are used in a number of analytical processes.

[0003] Acoustophoresis is a technique for separating particles and/or secondary fluids from a primary or host fluid using acoustics, such as acoustic standing waves. Acoustic standing waves can exert forces on particles in a fluid when there is a differential in density and/or compressibility, known as the acoustic contrast factor. The pressure profile in a standing wave contains areas of local minimum pressure amplitudes at standing wave nodes and local maxima at standing wave anti-nodes. Depending on their density and compressibility, the particles can be driven to and trapped at the nodes or anti-nodes of the standing wave. Generally, the higher the frequency of the standing wave, the smaller the particles that can be trapped.

SUMMARY

[0004] This disclosure describes technologies relating to methods, systems, and apparatus for acoustic separation of materials. The materials being separated may be biomaterials. The separation may employ material support structures. The support structures may be beads. A functionalized material may be applied to the support structures that has an affinity for one or more materials to be separated. The support structures may be mixed in a fluid that contains the materials. The fluid mixture may be provided to a fluid column or flow chamber. The support structures can be retained in the column against a fluid or fluid mixture flow through the column by provision of an acoustic standing wave at one end of the column that can prevent the support structures from passing.

[0004a] In a first aspect, the present disclosure provides a separation system, comprising: a vertically oriented column with an opening on each end to permit

a fluid flow therethrough, a portion of the column being configured as a fluidized bed in which a plurality of support structures that are targeted to at least two different types of cellular material are dispersed; an acoustic transducer on one end of the column for generating an acoustic standing wave in the column; and the acoustic transducer being configured to generate the acoustic standing wave to block and retain the support structures in the column against the fluid flow.

[0004b] In a second aspect, the present disclosure provides a method for separating materials, comprising: providing support structures in a column configured as a fluidized bed for binding with at least two different types of cellular material; flowing a fluid mixture that includes the at least two different types of cellular material into the column; and generating an acoustic standing wave with an acoustic transducer near an end of the column to block the support structures from leaving the column with the fluid flow.

[0004c] In a third aspect, the present disclosure provides an acoustic affinity separation method, comprising: providing first affinity beads targeted to a first cellular material in a fluid to a first column; providing second affinity beads targeted to a second cellular material in a fluid to a second column; generating an acoustic standing wave with an acoustic transducer near an end of each of the first column and the second column; flowing a cellular material fluid mixture in the first column and through the acoustic standing wave; configuring the acoustic standing wave in the first column to prevent the first affinity beads from passing through the acoustic standing wave; flowing the cellular material fluid mixture that passed through the acoustic standing wave in the first column to the second column and through the acoustic standing wave of the second column; and configuring the acoustic standing wave in the second column to prevent the second affinity beads from passing through the acoustic standing wave of the second column.

[0005] In accordance with some examples, an acoustic affinity system is implemented that can include the features of being closed, automated and/or