

passageway, could be placed into a unitary housing to form the upper and lower receptacles (120 and 124, respectively).

[0091] At the end of the upper part 112 distal the lower part 114, is an opening 113 that is dimensioned to receive the plunger 150. At the opposite end of the upper part 112 is a passageway 116 that opens into the lower part 114 of the housing 110. In the illustrated embodiment, the passageway 116, which has a cross-sectional area that is smaller than the cross-sectional area of the upper receptacle 120, is shown as an inward extension of the wall that forms the upper part 112. Alternatively, the passageway 116 could be formed by an insert that fits inside the wall of the upper part 112 adjacent the lower part 114 of the housing 110 (not shown). The insert could form the passageway 116 adjacent the lower part 114 of the housing 110. The relative proportions of the upper part 112, lower part 114, and passageway 116 in FIG. 1A are merely illustrative and can be adapted, as necessary to accommodate various parameters, such as sample volume and/or instrument limitations.

[0092] The plunger 150 comprises a shaft 151 with a handle 152 at one end and a plurality of seals (first lower seal 156 and second lower seal 157) at the opposite end. Optionally, the plunger 150 can comprise one or more upper seals 154 and/or an index mark 153. The relative distances between the handle 152, first lower seal 156 and second lower seal 157 are described below. Also shown in FIG. 1A is optional detection reagent 165 and optional hydrogel 162.

[0093] "Detection reagent" is used herein in its broadest sense. A detection reagent is a reagent that can be used in a reaction to detect a biological analyte. Nonlimiting examples of detection reactions include interaction between binding partners (e.g., antigen-antibody, receptor-ligand, probe-target, and hybridization binding interactions) and/or catalytic reactions (e.g., enzyme-mediated reactions such as, for example, fluorogenic reactions, chromogenic reactions, lumigenic reactions, or polymerization reactions). Detection reagents may participate (e.g., as a binding partner, an enzyme, an enzyme substrate, or an indicator) in the detection reaction and/or may facilitate (e.g., as a buffer, a cofactor, or a component of a coupled reaction) a detection reaction. Exemplary detection reagents include enzymes, including, for example, luciferase, adenylate kinase, peroxidase, alkaline phosphates, apyrase, and the like; enzyme substrates, including, for example, luciferin, methylumbelliferyl phosphate, o-nitrophenylphosphate, p-nitrophenylphosphate, and 5-bromo-4-chloro-3-indoxyl-phosphate; buffers, including, for example, phosphate buffer, TRIS buffer, and HEPES buffer; and cofactors, including, for example, FADH, NADH, coenzyme A, and the like.

[0094] Detection reagents can be included in the housing 110 in various configurations. For example, the detection reagent 165 can comprise a dried or partially-dried coating, as shown in FIG. 1A. Suitable alternative configurations (not shown) for the detection reagent 165 are well known in the art and include, for example, liquid reagents (optionally, in a frangible compartment, such as an ampoule), powders, gels, tablets, lyophilized reagents, coated films, cakes, and dried-down reagents.

[0095] FIG. 1B shows a cross-sectional view of a detection device 100 comprising the housing 110 with the plunger 150 of FIG. 1A. This drawing illustrates a configuration in which the device 100 can be stored before use. The plunger 150 is fully-inserted in the housing 110. In this position, the lower edge of the handle 152 blocks the opening 113 of the upper

part 112 of the housing 110, thereby preventing material from entering or exiting the housing 110. Optional upper seals 154 can also serve to prevent materials from entering or exiting the housing 110. The upper seals 154 are dimensioned to contact the inner surface of the wall of the upper part 112 of the housing 110 and are made of a suitable material (e.g., polypropylene, butyl rubber) to form a barrier, preferably a liquid-resistant barrier.

[0096] When the plunger 150 is in the position shown in FIG. 1B, the first lower seal 156 blocks the passageway 116, thereby isolating the upper receptacle 120 from the lower receptacle 124 of the housing 110. When the plunger 150 is in the position shown in FIG. 1B, a portion of the plunger 150 which includes the second lower seal 157 extends into the lower receptacle 124 and does not contact the walls of lower part 114 of the housing 110. The first lower seal 156 and second lower seal 157 are dimensioned to contact the walls of the passageway 116 and are made of a suitable material (e.g., polypropylene, butyl rubber) to form a barrier, preferably a liquid-resistant barrier in the passageway 116 between the upper receptacle 120 and the lower receptacle 124. Also shown in FIG. 1B is an optional concentration agent 130, located in the upper receptacle 120.

[0097] FIG. 1C shows a cross-sectional view of the device 100 of FIG. 1B with the plunger 150 in a second position. This plunger 150 position can be used, for example, to load a sample into the housing 110. The plunger 150 can be grasped by the handle 152 and withdrawn until the second lower seal 157 is proximate the upper end of the passageway 116. The optional index mark 153 on the plunger shaft 151 can be used (e.g., when it is aligned with the opening 113) to indicate the proper location of the plunger 150 to attain this position. FIG. 1C further comprises a liquid sample 140 that is contacting the concentration agent 130 in the upper receptacle 120. During use, the device 100 can be vortexed or vibrated, for example, to mix the concentration agent 130 and the liquid sample 140. After a period of time, the concentration agent 130 can settle to the bottom of the upper receptacle 120, as shown in FIG. 1C. In some embodiments, an optional taper region 118 is located adjacent the passageway 116. The taper region 118 can be formed from the same material and/or process as the upper part 112 of the housing 110 and/or the passageway 116. In use, the taper region 118 can direct toward the passageway 116 liquid-suspended particles (e.g., cell concentration agent 130) that are sedimenting toward the passageway 116 within the housing 110.

[0098] FIG. 1D shows a cross-sectional view of the device 100 of FIG. 1C with the plunger 150 returned to the first position shown in FIG. 1B. The lower edge of the handle 152 is proximate the opening 113 and a portion 142 of the liquid sample, containing the concentration agent 130 is transferred to the lower receptacle 124, where the portion 142 can interact with a detection reagent 165 (shown in FIG. 1A), if present. Non-limiting examples of interactions between the portion 142 and the detection reagent 165 include dissolution and/or suspension of the detection reagent, binding interactions between the detection reagent and a biological analyte present in the portion, and/or a catalytic reaction. FIG. 1D also shows the portion 142 of the liquid sample contacting the hydrogel 162 in the lower receptacle 124, which can result in the release of a cell extractant from the hydrogel 162.

[0099] In the embodiment illustrated in FIG. 1, the means for isolating the upper receptacle 120 from the lower receptacle 124 comprises the first lower seal 156 and/or second