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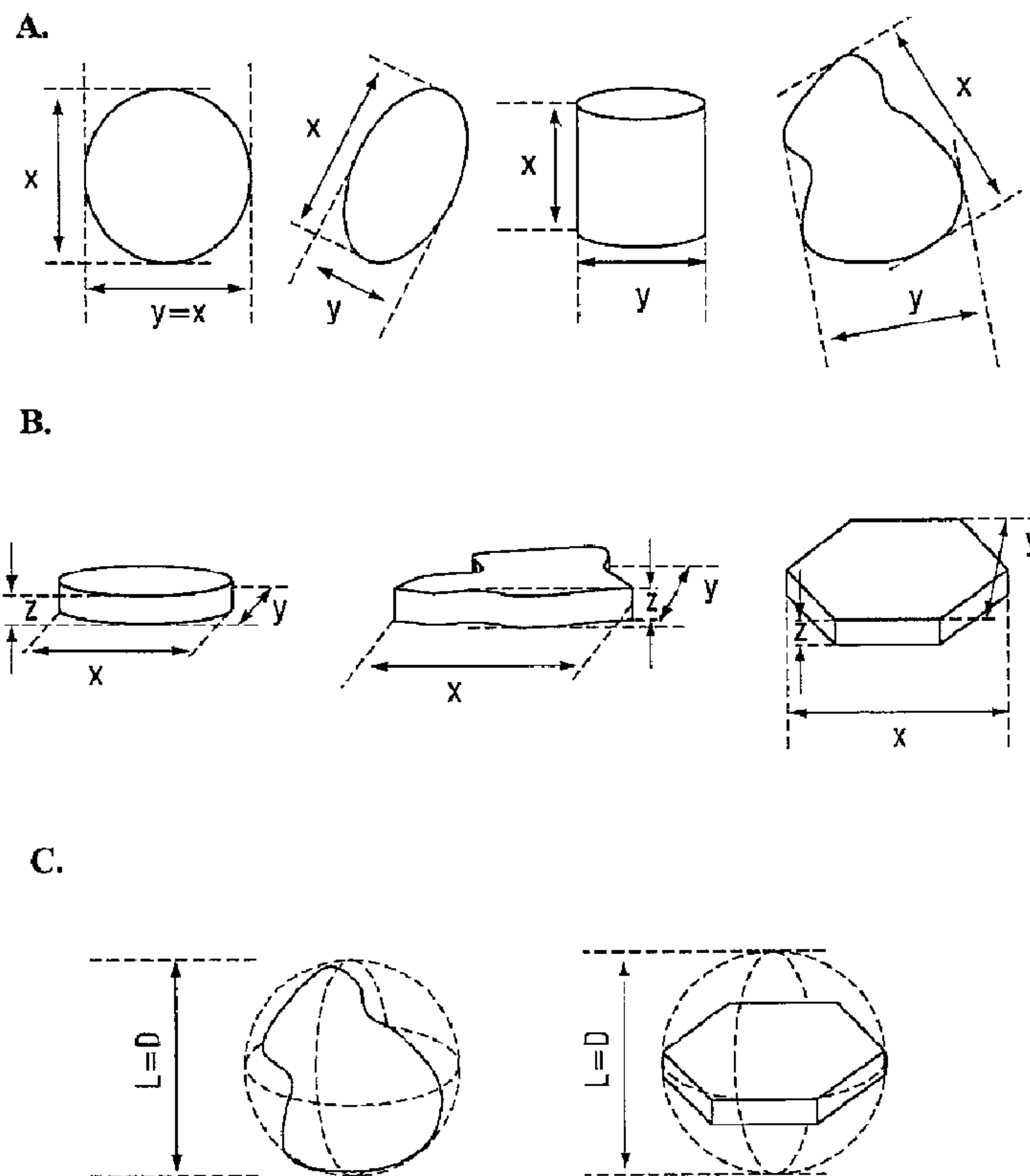
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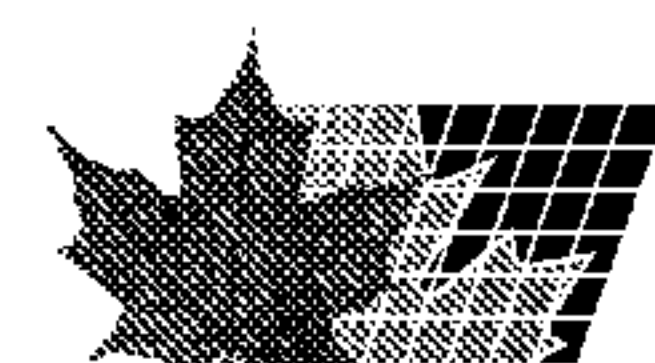
(54) **Titre : PROCÉDES D'ISOLATION DE ZONES ET DEVIATION DE TRAITEMENT**

(54) **Title: METHODS OF ZONAL ISOLATION AND TREATMENT DIVERSION**



(57) **Abrégé/Abstract:**

Methods of treating a subterranean formation penetrated by a well bore, by providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; by introducing the treatment fluid into the well bore; and by creating a plug with the treatment fluid.



53853-37D1

Abstract of the Disclosure

Methods of treating a subterranean formation penetrated by a well bore, by providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; by introducing the treatment fluid into the well bore; and by creating a plug with the treatment fluid.

53853-37D1

METHODS OF ZONAL ISOLATION AND TREATMENT DIVERSION

Related Application

[0001] This application is a divisional of Canadian Patent Application No. 2,776,601 and claims priority from therein.

Background

[0001a] The statements in this section merely provide background information related to the present disclosure and may not constitute prior art.

[0002] Some embodiments relate to methods applied to a well bore penetrating a subterranean formation, and more particularly, methods for zonal isolation.

[0003] Hydrocarbons (oil, condensate, and gas) are typically produced from wells that are drilled into the formations containing them. For a variety of reasons, such as inherently low permeability of the reservoirs or damage to the formation caused by drilling and completion of the well, the flow of hydrocarbons into the well is undesirably low. In this case, the well is "stimulated" for example using hydraulic fracturing, chemical (usually acid) stimulation, or a combination of the two (called acid fracturing or fracture acidizing).

[0004] In hydraulic and acid fracturing, a first, viscous fluid called the pad is typically injected into the formation to initiate and propagate the fracture. This is followed by a second fluid that contains a proppant to keep the fracture open after the pumping pressure is released. Granular proppant materials may include sand, ceramic beads, or other materials. These types of materials are well known to those skilled in the art. In "acid" fracturing, the second fluid contains an acid or other chemical such as a chelating agent that can dissolve part of the rock, causing irregular etching of the fracture face and removal of some of the mineral matter, resulting in the fracture not completely closing when the pumping is stopped. Occasionally, hydraulic fracturing can be done without a highly viscosified fluid (i.e., slick water) to minimize the damage caused by polymers or the cost of other viscosifiers.

[0005] Hydraulic and acid fracturing of horizontal wells as well as multi-layered formations frequently requires using diverting techniques in order to enable fracturing redirection between different zones. The list of these diverting methods includes, but not limited to, using mechanical isolation devices such as packers and well bore plugs, setting bridge plugs, pumping ball sealers, pumping slurried benzoic acid flakes and removable/degradable particulates. As well, other treatment may require use of diverting

53853-37D1

techniques.

[0006] Treatment diversion with particulates is typically based on bridging of particles of the diverting material behind casing and forming a plug by accumulating the rest of the particles at the formed bridge. Several typical problems related to treatment diversion with particulate materials are: reducing bridging ability of diverting slurry during pumping because of dilution with well bore fluid (interface mixing), necessity of using relatively large amount of diverting materials, and poor stability of some diverting agents during pumping and during subsequent treatment stage.

[0007] On the other way, during the drilling of a well bore, various fluids are typically used in the well for a variety of functions. The fluids may be circulated through a drill pipe and drill bit into the well bore, and then may subsequently flow upward through the well bore to the surface. During this circulation, the drilling fluid may act to remove drill cuttings from the bottom of the hole to the surface, to suspend cuttings and weighting material when circulation is interrupted, to control subsurface pressures, to maintain the integrity of the well bore until the well section is cased and cemented, to isolate the fluids from the formation by providing sufficient hydrostatic pressure to prevent the ingress of formation fluids into the well bore, to cool and lubricate the drill string and bit, and/or to maximize penetration rate.

[0008] Lost circulation is a recurring drilling problem, characterized by loss of drilling mud into downhole formations. It can occur naturally in formations that are fractured, highly permeable, porous, cavernous, or vugular. These earth formations can include shale, sands, gravel, shell beds, reef deposits, limestone, dolomite, and chalk, among others. Other problems encountered while drilling and producing oil and gas include stuck pipe, hole collapse, loss of well control, and loss of or decreased production.

[0009] Lost circulation is frequently controlled by including an additive in fluids injected into well bores. The most common additive used to control or cease lost circulation is bentonite which will seal small holes or fractures. Bentonite, in higher concentrations, increases viscosity and slows the fluid flow into the surrounding rock. Other solids, such as ground paper, ground corn cobs and sawdust, have also been used to control fluid loss. Polymers are also sometimes used to increase the viscosity of a well bore fluid and to control fluid loss. Polymer additives, however, are generally more expensive than

53853-37D1

particulates such as bentonite.

[0010] Methods disclosed herewith offer a new way to create diverting techniques, zonal isolation or techniques thereof.

Summary

[0011] In a first aspect, a method of treating a subterranean formation penetrated by a well bore is disclosed. The method provides a treatment fluid including a blend, the blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and creating a plug with the treatment fluid. Also in another embodiment, the second average size is between about 2 and 10 times smaller than the first average particle size.

[0012] In a second aspect, another method of treating a subterranean formation penetrated by a well bore is disclosed. The well bore may contain a casing and at least one hole in the casing, the hole having a diameter . The method provides a treatment fluid including a blend which has a first amount of particulates having a first average particle size between about 50 to 100 % of the diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the hole; creating a plug with said treatment fluid behind casing in the vicinity to the hole or in the hole; and removing the plug. Also, in another embodiment, the second average size is between about 2 and 10 times smaller than the first average particle size.

[0013] In a third aspect, a method of fracturing a subterranean formation penetrated by a well bore is disclosed. The well bore contains a casing and at least one hole on said casing, the hole having a diameter. The method provides a diverting fluid including a blend having a first amount of particulates with a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between

53853-37D1

about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the diverting fluid into the hole; creating a diverting plug utilizing the diverting fluid behind casing in the vicinity to the hole or in the hole; fracturing the subterranean formation; and removing the diverting plug. Also in another embodiment, the second average size is between about 2 and 10 times smaller than the first average particle size.

[0013a] In another aspect there is provided a method of treating a subterranean formation penetrated by a well bore, comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and, creating a plug with said treatment fluid, and wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are non-homogenous.

[0013b] In another aspect there is provided a method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the hole; creating a plug of the hole with said treatment fluid; and removing the plug, and wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are non-homogenous.

[0013c] In another aspect there is provided a method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a diverting fluid comprising a

53853-37D1

blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the diverting fluid into the hole; creating a diverting plug of the hole with said diverting fluid; fracturing the subterranean formation by using said diverting plug; and removing the diverting plug, and wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are non-homogenous.

- 10 **[0013d]** In another aspect there is provided a method of treating a subterranean formation penetrated by a well bore, comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes
15 having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and, creating a plug with said treatment fluid, and wherein the treatment fluid further comprises a degradation accelerating material.

- [0013e]** In another aspect there is provided a method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said
20 hole having a diameter, the method comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first
25 average particle size; introducing the treatment fluid into the hole; creating a plug of the hole with said treatment fluid; and removing the plug, and wherein the treatment fluid further comprises a degradation accelerating material.

[0013f] In another aspect there is provided a method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing,

53853-37D1

said hole having a diameter, the method comprising: providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the diverting fluid into the hole; creating a diverting plug of the hole with said diverting fluid; fracturing the subterranean formation by using said diverting plug; and removing the diverting plug, and wherein the treatment fluid further comprises a degradation accelerating material.

- 10 [0013g] In another aspect there is provided a method of treating a subterranean formation penetrated by a well bore, comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes
15 having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and, creating a plug with said treatment fluid, and wherein at least one of the first amount of particulates or the second amount of particulates comprises proppant.

- [0013h] In another aspect there is provided a method of treating a subterranean formation of a
20 well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a
25 second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the hole; creating a plug of the hole with said treatment fluid; and removing the plug, and wherein at least one of the first amount of particulates or the second amount of particulates comprises proppant.

53853-37D1

[0013i] In another aspect there is provided a method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between
5 about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the diverting fluid into the hole; creating a diverting plug of the hole with said diverting fluid; fracturing the subterranean formation by using said
10 diverting plug; and removing the diverting plug, and wherein at least one of the first amount of particulates or the second amount of particulates comprises proppant.

[0013j] In another aspect there is provided a method of treating a subterranean formation penetrated by a well bore, comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3
15 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and, creating a plug with said treatment fluid, and wherein the treatment fluid further comprises a lost circulation material.

20 [0013k] In another aspect there is provided a method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second
25 average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the hole; creating a plug of the hole with said treatment fluid; and removing the plug, and wherein the treatment fluid further comprises a lost circulation material.

53853-37D1

[0013l] In another aspect there is provided a method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between
5 about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the diverting fluid into the hole; creating a diverting plug of the hole with said diverting fluid; fracturing the subterranean formation by using said
10 diverting plug; and removing the diverting plug, and wherein the treatment fluid further comprises a lost circulation material.

[0013m] In another aspect there is provided a method of treating a subterranean formation penetrated by a well bore, comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3
15 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and, creating a plug with said treatment fluid, and wherein the treatment fluid further comprises fibers having a shape selected from
20 the group consisting of straight, curved, bent, undulated, hollow, generally spherical, rectangular and polygonal.

[0013n] In another aspect there is provided a method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a treatment fluid comprising a
25 blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the hole; creating a plug of the hole
30 with said treatment fluid; and removing the plug, and wherein the treatment fluid further

53853-37D1

comprises fibers having a shape selected from the group consisting of straight, curved, bent, undulated, hollow, generally spherical, rectangular and polygonal.

[0013o] In another aspect there is provided a method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing,

- 5 said hole having a diameter, the method comprising: providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first
- 10 average particle size; introducing the diverting fluid into the hole; creating a diverting plug of the hole with said diverting fluid; fracturing the subterranean formation by using said diverting plug; and removing the diverting plug, and wherein the treatment fluid further comprises fibers having a shape selected from the group consisting of straight, curved, bent, undulated, hollow, generally spherical, rectangular and polygonal.

- 15 [0013p] In another aspect there is provided a method of treating a subterranean formation penetrated by a well bore, comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes
- 20 having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and, creating a plug with said treatment fluid, and wherein the blend further comprises at least one material selected from the group consisting of a polyglycolic acid, polyvinylalcohol, a protein and combinations thereof.

- [0013q] In another aspect there is provided a method of treating a subterranean formation of a
- 25 well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a

53853-37D1

second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the hole; creating a plug of the hole with said treatment fluid; and removing the plug, and wherein the blend further comprises at least one material selected from the group consisting of a polyglycolic acid, polyvinylalcohol, proteins and combinations thereof.

[0013r] In another aspect there is provided a method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the diverting fluid into the hole; creating a diverting plug of the hole with said diverting fluid; fracturing the subterranean formation by using said diverting plug; and removing the diverting plug, and wherein the blend further comprises at least one material selected from the group consisting of a polyglycolic acid, polyvinylalcohol, proteins and combinations thereof.

[0013s] In another aspect there is provided a method of treating a subterranean formation penetrated by a well bore, comprising: providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the well bore; and, creating a plug with said treatment fluid, and wherein the blend comprises at least copolymers of polylactic acid and polyglycolic acid.

[0013t] In another aspect there is provided a method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a treatment fluid comprising a

53853-37D1

blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the treatment fluid into the hole; creating a plug of the hole with said treatment fluid; and removing the plug, and wherein the blend comprises at least copolymers of polylactic acid and polyglycolic acid.

[0013u] In another aspect there is provided a method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising: providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size; introducing the diverting fluid into the hole; creating a diverting plug of the hole with said diverting fluid; fracturing the subterranean formation by using said diverting plug; and removing the diverting plug, and wherein the blend comprises at least copolymers of polylactic acid and polyglycolic acid.

53853-37D1

Brief Description of the Drawings

[0014] Figure 1 shows various illustrations for definitions for particles and flakes. Figure 1A shows particles with ratio between largest and smallest dimensions (aspect ratio) $x/y < 3$; Figure 1B shows flakes x, y and z refer to length, width and thickness respectively; Figure 1C shows illustration for definitions of particle and flake size.

[0015] Figure 1b shows various illustrations for definitions for holes. Figure 1bA shows holes with various geometry; Figure 1bB shows illustration for definitions of hole diameter or hole size.

[0016] Figure 2 shows an illustration of shapes of perforation tunnels: A shows the ideal shape, B shows the shape after erosion.

[0017] Figure 3 shows an illustration of particles size distribution required for reducing plug permeability when the size of the largest particles in the blend is significantly smaller than the size of the void to plug.

[0018] Figure 4 shows an illustration of particles size distribution required for reducing plug permeability when the size of the largest particles in the blend is comparable with the size of the void to plug.

[0019] Figure 5 shows scheme of the apparatus used for optimizing particles size distribution for sealing voids with width of 16mm.

[0020] Figure 6 shows dependence of fluid volume lost during formation of a plug in 16mm slot on the size of the third particles in the blend of particles.

[0021] Figure 7 shows dependence of fluid volume lost during formation of a plug in

53853-37D1

16mm slot on the size and volumetric concentration of the second particles in the blend of particles.

[0022] Figure 8 shows dependence of fluid volume lost during formation of a plug in 16mm slot on the size of the second component (the first flake component) in the blend of particles and flakes.

[0023] Figure 9 shows a simplified scheme of the injection setup for the proposed diverting blends.

[0024] Figure 10 shows scheme of the laboratory setup used for creating a plug of a blend of particles and flakes.

[0025] Figure 11 shows dependence of differential pressure across the plug on pumping rate.

Detailed Description

[0026] At the outset, it should be noted that in the development of any actual embodiments, numerous implementation-specific decisions must be made to achieve the developer's specific goals, such as compliance with system and business related constraints, which can vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time consuming but would nevertheless be a routine undertaking for those of ordinary skill in the art having the benefit of this disclosure.

[0027] The description and examples are presented solely for the purpose of illustrating some embodiments and should not be construed as a limitation to the scope and applicability. In the summary and this detailed description, each numerical value should be read once as modified by the term "about" (unless already expressly so modified), and then read again as not so modified unless otherwise indicated in context. Also, in the summary and this detailed description, it should be understood that a concentration range listed or described as being useful, suitable, or the like, is intended that any and every concentration within the range, including the end points, is to be considered as having been stated. For example, "a range of from 1 to 10" is to be read as indicating each and every possible

53853-37D1

number along the continuum between about 1 and about 10. Thus, even if specific data points within the range, or even no data points within the range, are explicitly identified or refer to only a few specific, it is to be understood that inventors appreciate and understand that any and all data points within the range are to be considered to have been specified, and that inventors possession of the entire range and all points within the range disclosed and enabled the entire range and all points within the range.

[0028] The following definitions are provided in order to aid those skilled in the art in understanding the detailed description.

[0029] The term “treatment”, or “treating”, refers to any subterranean operation that uses a fluid in conjunction with a desired function and/or for a desired purpose. The term “treatment”, or “treating”, does not imply any particular action by the fluid.

[0030] The term “fracturing” refers to the process and methods of breaking down a geological formation and creating a fracture, i.e. the rock formation around a well bore, by pumping fluid at very high pressures (pressure above the determined closure pressure of the formation), in order to increase production rates from a hydrocarbon reservoir. The fracturing methods otherwise use conventional techniques known in the art.

[0031] The term “particulate” or “particle” refers to a solid 3D object with maximal dimension significantly less than 1 meter. Here “dimension” of the object refers to the distance between two arbitrary parallel planes, each plane touching the surface of the object at at least one point. The maximal dimension refers to the biggest distance existing for the object between any two parallel planes and the minimal dimension refers to the smallest distance existing for the object between any two parallel planes. In some embodiments, the particulates used are with a ratio between the maximal and the minimal dimensions (particle aspect ratio x/y) of less than 5 or even of less than 3 (see Figure 1A).

[0032] The term “flake” refers to special type of particulate as defined above. The flake is a solid 3D object having a thickness smaller than its other dimensions, for example its length and width. Flake aspect ratios (diameter/thickness, length/thickness, width/thickness, etc...) may be in the range of from about 5 to about 50 or more (see Figure 1B). For the flake, inventors define the flake aspect ratio as the ratio of the length or width to the thickness. Any suitable ratio of length to width may be used.

53853-37D1

[0033] For the purposes of the disclosure, particles and flakes may have homogeneous structure or may also be non-homogeneous such as porous or made of composite materials.

[0034] The term “particle size”, “particulate size” or “flake size” refers to the diameter of the smallest imaginary circumscribed sphere which includes such particulate or flake as shown in Figure 1C.

[0035] The term “average size” refers to an average size of solids in a group of solids of each type. In each group j of particles or flakes average size can be calculated as mass-weighted value

$$\bar{L}_j = \frac{\sum_{i=1}^N l_i m_i}{\sum_{i=1}^N m_i}$$

Where N - number of particles or flakes in the group, l_i , ($i=1\dots N$)- sizes of individual particles or flakes; m_i ($i=1\dots N$) – masses of individual particles or flakes.

[0036] The term “hole” refers to a 2D object of any geometry defined only by its perimeter as shown in Figure 1bA. The term “hole diameter” or “hole size” refers to the diameter of the biggest imaginary circle which is included in such hole as shown in Figure 1bB.

[0037] While the embodiments described herewith refer to well treatment it is equally applicable to any well operations where zonal isolation is required such as drilling operations, workover operations etc.

[0038] A method of treatment for diversion or for temporally zonal isolation is disclosed. The method uses a composition made of blends of particles or blends of particles and flakes. According to an embodiment, the size of the largest particles or flakes in the blends is slightly smaller than the diameter of perforation holes in the zone to isolate or divert. According to a further embodiment, the size of the particles or flakes in the blends is larger than an average width of the void intended to be closed or temporally isolated. The average width of the void is the smallest width of the void after the perforation hole or another entry in such void, at 10 cm, at 20 cm, at 30 cm or at 50 cm or at 500 cm (when going into the formation from the well bore). Such void may be a perforation tunnel, hydraulic fracture or wormhole. Introducing such blends composition into perforation holes results in

53853-37D1

jamming largest particles in the voids in the proximity of the well bore. Thereafter there is an accumulation of other particles on the formed bridge. In one embodiment, the ratio between particles and flakes in the blends are designed to reduce permeability of the formed plugs.

[0039] According to one aspect of the embodiment, the blends composition enables zonal isolation by creating plugs in the proximity to well bore. In comparison to traditional treatment diversion techniques, the blends composition requires lower amount of diverting material. As well, the following benefits exist: lower risk of well bore plugging, lower risk of formation damage, and better clean up. In the example where the diverting blend is designed for sealing perforation tunnels (e.g. slick-water treatments) the amount of diverting material required for treatment diversion between several perforation clusters may be as low as several kilograms. Further removal of the diverting material is achieved either by self-degradation at downhole conditions or by introducing special chemical agents or by well bore intervention.

[0040] The composition is made of blends of particles or blends of particles and flakes in a carrier fluid. The carrier fluid may be water: fresh water, produced water, seawater. Other non-limiting examples of carrier fluids include hydratable gels (e.g. guar, polysaccharides, xanthan, hydroxy-ethyl-cellulose, etc.), a cross-linked hydratable gel, a viscosified acid (e.g. gel-based), an emulsified acid (e.g. oil outer phase), an energized fluid (e.g. an N₂ or CO₂ based foam), and an oil-based fluid including a gelled, foamed, or otherwise viscosified oil. Additionally, the carrier fluid may be a brine, and/or may include a brine. The carrier fluid may include hydrochloric acid, hydrofluoric acid, ammonium bifluoride, formic acid, acetic acid, lactic acid, glycolic acid, maleic acid, tartaric acid, sulfamic acid, malic acid, citric acid, methyl-sulfamic acid, chloro-acetic acid, an amino-poly-carboxylic acid, 3-hydroxypropionic acid, a poly-amino-poly-carboxylic acid, and/or a salt of any acid. In certain embodiments, the carrier fluid includes a poly-amino-poly-carboxylic acid, and is a trisodium hydroxyl-ethyl-ethylene-diamine triacetate, mono-ammonium salts of hydroxyl-ethyl-ethylene-diamine triacetate, and/or mono-sodium salts of hydroxyl-ethyl-ethylene-diamine tetra-acetate.

[0041] The particle(s) or the flake(s) can be embodied as proppant. Proppant selection involves many compromises imposed by economical and practical considerations. Such

53853-37D1

proppants can be natural or synthetic (including but not limited to glass beads, ceramic beads, sand, and bauxite), coated, or contain chemicals; more than one can be used sequentially or in mixtures of different sizes or different materials. The proppant may be resin coated (curable), or pre-cured resin coated. Proppants and gravels in the same or different wells or treatments can be the same material and/or the same size as one another and the term proppant is intended to include gravel in this disclosure. In some embodiments, irregular shaped particles may be used. International application WO 2009/088317 discloses a method of fracturing with a slurry of proppant containing from 1 to 100 percent of stiff, low elasticity, low deformability elongated particles. US patent application 2007/768393 discloses proppant that is in the form of generally rigid, elastic plate-like particles having a maximum to minimum dimension ratio of more than about 5, the proppant being at least one of formed from a corrosion resistant material or having a corrosion resistant material formed thereon. Each of the above are herein incorporated by reference.

[0042] The particle(s) or the flake(s) can be embodied as degradable material. Nonlimiting examples of degradable materials that may be used include certain polymer materials that are capable of generating acids upon degradation. These polymer materials may herein be referred to as "polymeric acid precursors." These materials are typically solids at room temperature. The polymeric acid precursor materials include the polymers and oligomers that hydrolyze or degrade in certain chemical environments under known and controllable conditions of temperature, time and pH to release organic acid molecules that may be referred to as "monomeric organic acids." As used herein, the expression "monomeric organic acid" or "monomeric acid" may also include dimeric acid or acid with a small number of linked monomer units that function similarly to monomer acids composed of only one monomer unit.

[0043] Polymer materials may include those polyesters obtained by polymerization of hydroxycarboxylic acids, such as the aliphatic polyester of lactic acid, referred to as polylactic acid; glycolic acid, referred to as polyglycolic acid; 3-hydroxybutyric acid, referred to as polyhydroxybutyrate; 2-hydroxyvaleric acid, referred to as polyhydroxyvalerate; epsilon caprolactone, referred to as polyepsilon caprolactone or polyprolactone; the polyesters obtained by esterification of hydroxyl aminoacids such as

53853-37D1

serine, threonine and tyrosine; and the copolymers obtained by mixtures of the monomers listed above. A general structure for the above-described homopolyesters is:



where,

R1, R2, R3, R4 is either H, linear alkyl, such as CH₃, CH₂CH₃ (CH₂)_nCH₃, branched alkyl, aryl, alkylaryl, a functional alkyl group (bearing carboxylic acid groups, amino groups, hydroxyl groups, thiol groups, or others) or a functional aryl group (bearing carboxylic acid groups, amino groups, hydroxyl groups, thiol groups, or others);

x is an integer between 1 and 11;

y is an integer between 0 and 10; and

z is an integer between 2 and 50,000.

[0044] In the appropriate conditions (pH, temperature, water content) polyesters like those described herein can hydrolyze and degrade to yield hydroxycarboxylic acid and compounds that pertain to those acids referred to in the foregoing as “monomeric acids.”

[0045] One example of a suitable polymeric acid precursor, as mentioned above, is the polymer of lactic acid, sometimes called polylactic acid, “PLA,” polylactate or polylactide. Lactic acid is a chiral molecule and has two optical isomers. These are D-lactic acid and L-lactic acid. The poly(L-lactic acid) and poly(D-lactic acid) forms are generally crystalline in nature. Polymerization of a mixture of the L- and D-lactic acids to poly(DL-lactic acid) results in a polymer that is more amorphous in nature. The polymers described herein are essentially linear. The degree of polymerization of the linear polylactic acid can vary from a few units (2-10 units) (oligomers) to several thousands (e.g. 2000-5000). Cyclic structures may also be used. The degree of polymerization of these cyclic structures may be smaller than that of the linear polymers. These cyclic structures may include cyclic dimers.

[0046] Another example is the polymer of glycolic acid (hydroxyacetic acid), also known as polyglycolic acid (“PGA”), or polyglycolide. Other materials suitable as polymeric acid precursors are all those polymers of glycolic acid with itself or other hydroxy-acid-containing moieties, as described in U.S. Patent Nos. 4,848,467; 4,957,165; and 4,986,355, which are herein incorporated by reference.

[0047] The polylactic acid and polyglycolic acid may each be used as homopolymers,

53853-37D1

which may contain less than about 0.1% by weight of other comonomers. As used with reference to polylactic acid, "homopolymer(s)" is meant to include polymers of D-lactic acid, L-lactic acid and/or mixtures or copolymers of pure D-lactic acid and pure L-lactic acid. Additionally, random copolymers of lactic acid and glycolic acid and block copolymers of polylactic acid and polyglycolic acid may be used. Combinations of the described homopolymers and/or the above-described copolymers may also be used.

[0048] Other examples of polyesters of hydroxycarboxylic acids that may be used as polymeric acid precursors are the polymers of hydroxyvaleric acid (polyhydroxyvalerate), hydroxybutyric acid (polyhydroxybutyrate) and their copolymers with other hydroxycarboxylic acids. Polyesters resulting from the ring opening polymerization of lactones such as epsilon caprolactone (polyepsiloncaprolactone) or copolymers of hydroxyacids and lactones may also be used as polymeric acid precursors.

[0049] Polyesters obtained by esterification of other hydroxyl-containing acid-containing monomers such as hydroxyaminoacids may be used as polymeric acid precursors. Naturally occurring aminoacids are L-aminoacids. Among the 20 most common aminoacids the three that contain hydroxyl groups are L-serine, L-threonine, and L-tyrosine. These aminoacids may be polymerized to yield polyesters at the appropriate temperature and using appropriate catalysts by reaction of their alcohol and their carboxylic acid group. D-aminoacids are less common in nature, but their polymers and copolymers may also be used as polymeric acid precursors.

[0050] NatureWorks, LLC, Minnetonka, MN, USA, produces solid cyclic lactic acid dimer called "lactide" and from it produces lactic acid polymers, or polylactates, with varying molecular weights and degrees of crystallinity, under the generic trade name NATUREWORKS™ PLA. The PLA's currently available from NatureWorks, LLC have number averaged molecular weights (Mn) of up to about 100,000 and weight averaged molecular weights (Mw) of up to about 200,000, although any polylactide (made by any process by any manufacturer) may be used. Those available from NatureWorks, LLC typically have crystalline melt temperatures of from about 120 to about 170 °C, but others are obtainable. Poly(d,l-lactide) at various molecular weights is also commercially available from Bio-Invigor, Beijing and Taiwan. Bio-Invigor also supplies polyglycolic acid (also known as polyglycolide) and various copolymers of lactic acid and glycolic acid,

53853-37D1

often called “polyglactin” or poly(lactide-co-glycolide).

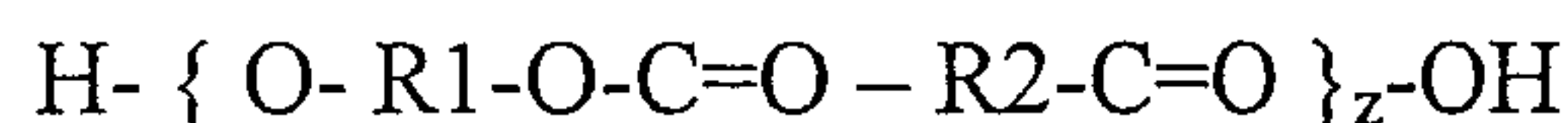
[0051] The extent of the crystallinity can be controlled by the manufacturing method for homopolymers and by the manufacturing method and the ratio and distribution of lactide and glycolide for the copolymers. Additionally, the chirality of the lactic acid used also affects the crystallinity of the polymer. Polyglycolide can be made in a porous form. Some of the polymers dissolve very slowly in water before they hydrolyze.

[0052] Amorphous polymers may be useful in certain applications. An example of a commercially available amorphous polymer is that available as NATUREWORKS 4060D PLA, available from NatureWorks, LLC, which is a poly(DL-lactic acid) and contains approximately 12% by weight of D-lactic acid and has a number average molecular weight (Mn) of approximately 98,000 g/mol and a weight average molecular weight (Mw) of approximately 186,000 g/mol.

[0053] Other polymer materials that may be useful are the polyesters obtained by polymerization of polycarboxylic acid derivatives, such as dicarboxylic acids derivatives with polyhydroxy containing compounds, in particular dihydroxy containing compounds. Polycarboxylic acid derivatives that may be used are those dicarboxylic acids such as oxalic acid, propanedioic acid, malonic acid, fumaric acid, maleic acid, succinic acid, glutaric acid, pentanedioic acid, adipic acid, phthalic acid, isophthalic acid, terphthalic acid, aspartic acid, or glutamic acid; polycarboxylic acid derivatives such as citric acid, poly and oligo acrylic acid and methacrylic acid copolymers; dicarboxylic acid anhydrides, such as, maleic anhydride, succinic anhydride, pentanedioic acid anhydride, adipic anhydride, phthalic anhydride; dicarboxylic acid halides, primarily dicarboxylic acid chlorides, such as propanedioic acid chloride, malonyl chloride, fumaroyl chloride, maleyl chloride, succinyl chloride, glutaroyl chloride, adipoyl chloride, phthaloyl chloride. Useful polyhydroxy containing compounds are those dihydroxy compounds such as ethylene glycol, propylene glycol, 1,4 butanediol, 1,5 pentanediol, 1,6 hexanediol, hydroquinone, resorcinol, bisphenols such as bisphenol acetone (bisphenol A) or bisphenol formaldehyde (bisphenol F); polyols such as glycerol. When both a dicarboxylic acid derivative and a dihydroxy compound are used, a linear polyester results. It is understood that when one type of dicarboxylic acid is used, and one type of dihydroxy compound is used, a linear homopolyester is obtained. When multiple types of polycarboxylic acids and /or

53853-37D1

polyhydroxy containing monomer are used copolyesters are obtained. According to the Flory Stockmayer kinetics, the “functionality” of the polycarboxylic acid monomers (number of acid groups per monomer molecule) and the “functionality” of the polyhydroxy containing monomers (number of hydroxyl groups per monomer molecule) and their respective concentrations, will determine the configuration of the polymer (linear, branched, star, slightly crosslinked or fully crosslinked). All these configurations can be hydrolyzed or “degraded” to carboxylic acid monomers, and therefore can be considered as polymeric acid precursors. As a particular case example, not willing to be comprehensive of all the possible polyester structures one can consider, but just to provide an indication of the general structure of the most simple case one can encounter, the general structure for the linear homopolyesters is:



where,

R1 and R2 , are linear alkyl, branched alkyl, aryl, alkylaryl groups; and z is an integer between 2 and 50,000.

[0054] Other examples of suitable polymeric acid precursors are the polyesters derived from phthalic acid derivatives such as polyethyleneterephthalate (PET), polybutyleneterephthalate (PBT), polyethylenenaphthalate (PEN), and the like.

[0055] In the appropriate conditions (pH, temperature, water content) polyesters like those described herein can “hydrolyze” and “degrade” to yield polycarboxylic acids and polyhydroxy compounds, irrespective of the original polyester being synthesized from either one of the polycarboxylic acid derivatives listed above. The polycarboxylic acid compounds the polymer degradation process will yield are also considered monomeric acids.

[0056] Other examples of polymer materials that may be used are those obtained by the polymerization of sulfonic acid derivatives with polyhydroxy compounds, such as polysulphones or phosphoric acid derivatives with polyhydroxy compounds, such as polyphosphates.

[0057] Such solid polymeric acid precursor material may be capable of undergoing an irreversible breakdown into fundamental acid products downhole. As referred to herein, the term “irreversible” will be understood to mean that the solid polymeric acid precursor

53853-37D1

material, once broken downhole, should not reconstitute while downhole, e.g., the material should break down in situ but should not reconstitute in situ. The term "break down" refers to both the two relatively extreme cases of hydrolytic degradation that the solid polymeric acid precursor material may undergo, e.g., bulk erosion and surface erosion, and any stage of degradation in between these two. This degradation can be a result of, inter alia, a chemical reaction. The rate at which the chemical reaction takes place may depend on, inter alia, the chemicals added, temperature and time. The break down of solid polymeric acid precursor materials may or may not depend, at least in part, on its structure. For instance, the presence of hydrolyzable and/or oxidizable linkages in the backbone often yields a material that will break down as described herein. The rates at which such polymers break down are dependent on factors such as, but not limited to, the type of repetitive unit, composition, sequence, length, molecular geometry, molecular weight, morphology (e.g., crystallinity, size of spherulites, and orientation), hydrophilicity, hydrophobicity, surface area, and additives. The manner in which the polymer breaks down also may be affected by the environment to which the polymer is exposed, e.g., temperature, presence of moisture, oxygen, microorganisms, enzymes, pH, and the like.

[0058] Some suitable examples of solid polymeric acid precursor material that may be used include, but are not limited to, those described in the publication of *Advances in Polymer Science*, Vol. 157 entitled "Degradable Aliphatic Polyesters," edited by A. C. Albertsson, pages 1-138. Examples of polyesters that may be used include homopolymers, random, block, graft, and star- and hyper-branched aliphatic polyesters.

[0059] Another class of suitable solid polymeric acid precursor material that may be used includes polyamides and polyimides. Such polymers may comprise hydrolyzable groups in the polymer backbone that may hydrolyze under the conditions that exist in cement slurries and in a set cement matrix. Such polymers also may generate byproducts that may become sorbed into a cement matrix. Calcium salts are a nonlimiting example of such byproducts. Nonlimiting examples of suitable polyamides include proteins, polyaminoacids, nylon, and poly(caprolactam). Another class of polymers that may be suitable for use are those polymers that may contain hydrolyzable groups, not in the polymer backbone, but as pendant groups. Hydrolysis of the pendant groups may generate a water-soluble polymer and other byproducts that may become sorbed into the cement composition. A nonlimiting

53853-37D1

example of such a polymer includes polyvinylacetate, which upon hydrolysis forms water-soluble polyvinylalcohol and acetate salts.

[0060] The particle(s) or the flake(s) can be embodied as material reacting with chemical agents. Some examples of materials that may be removed by reacting with other agents are carbonates including calcium and magnesium carbonates and mixtures thereof (reactive to acids and chelates); acid soluble cement (reactive to acids); polyesters including esters of lactic hydroxylcarbonic acids and copolymers thereof (can be hydrolyzed with acids and bases); active metals such as magnesium, aluminum, zinc and their alloys (reactive to water, acids and bases) etc. Particles and flakes may also be embodied as material that accelerate degradation of other component of the formed plug. Some non-limited examples of it is using metal oxides (e.g. MgO) or bases (e.g. Mg(OH)₂; Ca(OH)₂) or salts of weak acids (e.g. CaCO₃) for accelerating hydrolysis of polyesters such as polylactic or polyglycolic acids.

[0061] The particle(s) or the flake(s) can be embodied as melting material. Examples of meltable materials that can be melted at downhole conditions hydrocarbons with number of carbon atoms >30; polycaprolactones; paraffin and waxes; carboxylic acids such as benzoic acid and its derivatives; etc. Wax particles can be used. The particles are solid at the temperature of the injected fluid, and that fluid cools the formation sufficiently that the particles enter the formation and remain solid. Aqueous wax are commonly used in wood coatings; engineered wood processing; paper and paperboard converting; protective architectural and industrial coatings; paper coatings; rubber and plastics; inks; textiles; ceramics; and others. They are made by such companies as Hercules Incorporated, Wilmington, Del., U.S.A., under the trade name PARACOL®, Michelman, Cincinnati, Ohio, U.S. A., under the trade name MICHEM®, and ChemCor, Chester, N.Y., U.S.A. Particularly suitable waxes include those commonly used in commercial car washes. In addition to paraffin waxes, other waxes, such as polyethylenes and polypropylenes, may also be used.

[0062] The particle(s) or the flake(s) can be embodied as water-soluble material or hydrocarbon-soluble material. The list of the materials that can be used for dissolving in water includes water-soluble polymers, water-soluble elastomers, carbonic acids, rock salt, amines, inorganic salts). List of the materials that can be used for dissolving in oil includes

53853-37D1

oil-soluble polymers, oil-soluble resins, oil-soluble elastomers, polyethylene, carbonic acids, amines, waxes).

[0063] The particle(s) and the flake(s) size are chosen so the size of the largest particles or flakes is slightly smaller than the diameter of the perforation holes in casing and larger than the average width of the voids behind casing (perforation tunnels, fractures or wormholes). By perforation hole, we mean any type of hole present in the casing. This hole can be a perforation, a jetted hole, hole from a slotted liner, port or any opening in a completion tool, casing fluid exit point. According to a further embodiment, the size of particles or flakes in the blend is designed for reducing permeability of the plugs in the narrow voids behind casing (perforation tunnels, fractures or wormholes). In general the particle or flake used will have an average particle size of less than several centimeters, preferably less than 2 cm, and more preferably less than 1 cm. In one embodiment, some particle or flake will have an average particle size of from about 0.04 mm to about 4.76 mm (about 325 to about 4 U.S. mesh), preferably from about 0.10 mm to about 4.76 mm (about 140 to about 4 U. S. mesh), more preferably from about 0.15 mm to about 3.36 mm (about 100 to about 6 U. S. mesh) or from about 2 mm to about 12 mm.

[0064] According to a further embodiment, the particles blend or the particles/flakes blend composition contains particles or flakes with different particles/flakes size distribution. In one embodiment, the composition comprises particulate materials with defined particles size distribution. One example of realization is disclosed in U.S. patent 7,784,541.

[0065] In certain embodiments, the selection of the size for the first amount of particulates is dependent upon the characteristics of the perforated hole as described above: the size of the largest particles or flakes is slightly smaller than the diameter of the perforation holes in casing. In certain further embodiments, the selection of the size of the first amount of particulates is dependent upon the void behind casing: the size of the particles is larger than the average width of the voids behind casing (perforation tunnels, fractures or wormholes). In certain further embodiments, the selection of the size for the first amount of particulates is dependent upon the characteristics of the perforated hole and the void behind casing: the size of the largest particles or flakes is slightly smaller than the diameter of the perforation holes in casing and larger than the average width of the voids behind

53853-37D1

casing (perforation tunnels, fractures or wormholes). In certain further embodiments, the selection of the size for the first amount of particulates is dependent upon the characteristics of the desired fluid loss characteristics of the first amount of particulates as a fluid loss agent, the size of pores in the formation, and/or the commercially available sizes of particulates of the type comprising the first amount of particulates. The first average particle size is between about 100 micrometers and 2 cm, or between about 100 micrometers and 1 cm or between about 400 micrometers and 1000 micrometers, or between about 3000 micrometers and 10000 micrometers, or between about 6 millimeters and 10 millimeters, or between about 6 millimeters and 8 millimeters. Also in some embodiments, the same chemistry can be used for the first average particle size. Also in some embodiments, different chemistry can be used for the same first average particle size: e.g. in the first average particle size, half of the amount is proppant and the other half is resin coated proppant.

[0066] In certain embodiments, the selection of the size for the second amount of particulates is dependent upon the characteristics of the desired fluid loss characteristics of the second amount of particulates as a fluid loss agent, the size of pores in the formation, and/or the commercially available sizes of particulates of the type comprising the second amount of particulates.

[0067] In certain embodiments, the selection of the size of the second amount of particulates is dependent upon maximizing or optimizing a packed volume fraction (PVF) of the mixture of the first amount of particulates and the second amount of particulates. The packed volume fraction or packing volume fraction (PVF) is the fraction of solid content volume to the total volume content. The particles size distribution required for maximizing PVF in narrow slot may be different from the particles size distribution required for maximizing PVF in a continuum system, this can be seen in figures 3 and 4. Therefore, in certain embodiments, the selection of the size of the second amount of particulates is dependent upon maximizing or optimizing a packed volume fraction (PVF) of the mixture of the first amount of particulates and the second amount of particulates in narrow voids between 2 mm and 2 cm. In certain embodiments, the selection of the size of the second amount of particulates is dependent upon maximizing or optimizing a packed volume fraction (PVF) of the mixture of the first amount of particulates and the second

53853-37D1

amount of particulates in a fracture or slot with width of less than 20 mm. A second average particle size of between about two to ten times smaller than the first amount of particulates contributes to maximizing the PVF of the mixture or the mixture placed in the void to plug, or the mixture placed in a fracture or slot with width of less than 20 mm, but a size between about three to twenty times smaller, and in certain embodiments between about three to fifteen times smaller, and in certain embodiments between about three to ten times smaller will provide a sufficient PVF for most storable compositions. Further, the selection of the size of the second amount of particulates is dependent upon the composition and commercial availability of particulates of the type comprising the second amount of particulates. In certain embodiments, the particulates combine to have a PVF above 0.74 or 0.75 or above 0.80. In certain further embodiments the particulates may have a much higher PVF approaching 0.95.

[0068] In certain embodiments, the selection of the size for the second amount of flakes is dependent upon the characteristics of the desired fluid loss characteristics of the second amount of flakes as a fluid loss agent, the size of pores in the formation, and/or the commercially available sizes of flakes of the type comprising the second amount of flakes. The flake size is in the range of 10-100% of the size of the first amount of particulate, more preferably 20-80% of the size of the first amount of particulate.

[0069] In certain embodiments, the selection of the size of the second amount of flakes is dependent upon maximizing or optimizing a packed volume fraction (PVF) of the mixture of the first amount of particulates and the second amount of flakes. The packed volume fraction or packing volume fraction (PVF) is the fraction of solid content volume to the total volume content. In certain embodiments, the selection of the size of the second amount of flakes is dependent upon maximizing or optimizing a packed volume fraction (PVF) of the mixture of the first amount of particulates and the second amount of flakes in narrow voids between 3 mm and 2 cm. In certain embodiments, the selection of the size of the second amount of flakes is dependent upon maximizing or optimizing a packed volume fraction (PVF) of the mixture of the first amount of particulates and the second amount of flakes in a fracture or slot with width of less than 20 mm. In certain embodiments, PVF may not necessarily be the criterion for selecting the size of flakes.

[0070] In certain further embodiments, the selection of the size for the second amount of

53853-37D1

particulates/flakes is dependent upon the characteristics of the void behind casing and upon maximizing a packed volume fraction (PVF) of the mixture of the first amount of particulates and the second amount of particulates/flakes as discussed above. Also in some embodiments, the same chemistry can be used for the second average particle/flake size. Also in some embodiments, different chemistry can be used for the same second average particle size: e.g. in the second average particle size, half of the amount is PLA and the other half is PGA.

[0071] In certain further embodiments, the composition further includes a third amount of particulates/flakes having a third average particle size that is smaller than the second average particle/flake size. In certain further embodiments, the composition may have a fourth or a fifth amount of particles/flakes. Also in some embodiments, the same chemistry can be used for the third, fourth, or fifth average particle/flake size. Also in some embodiments, different chemistry can be used for the same third average particle size: e.g. in the third average particle size, half of the amount is PLA and the other half is PGA. For the purposes of enhancing the PVF of the composition, more than three or four particles sizes will not typically be required. However, additional particles may be added for other reasons, such as the chemical composition of the additional particles, the ease of manufacturing certain materials into the same particles versus into separate particles, the commercial availability of particles having certain properties, and other reasons understood in the art.

[0072] In certain further embodiments, the composition further has a viscosifying agent. The viscosifying agent may be any crosslinked polymers. The polymer viscosifier can be a metal-crosslinked polymer. Suitable polymers for making the metal-crosslinked polymer viscosifiers include, for example, polysaccharides such as substituted galactomannans, such as guar gums, high-molecular weight polysaccharides composed of mannose and galactose sugars, or guar derivatives such as hydroxypropyl guar (HPG), carboxymethylhydroxypropyl guar (CMHPG) and carboxymethyl guar (CMG), hydrophobically modified guar, guar-containing compounds, and synthetic polymers. Crosslinking agents based on boron, titanium, zirconium or aluminum complexes are typically used to increase the effective molecular weight of the polymer and make them better suited for use in high-temperature wells.

53853-37D1

[0073] Other suitable classes of polymers effective as viscosifying agent include polyvinyl polymers, polymethacrylamides, cellulose ethers, lignosulfonates, and ammonium, alkali metal, and alkaline earth salts thereof. More specific examples of other typical water soluble polymers are acrylic acid-acrylamide copolymers, acrylic acid-methacrylamide copolymers, polyacrylamides, partially hydrolyzed polyacrylamides, partially hydrolyzed polymethacrylamides, polyvinyl alcohol, polyalkyleneoxides, other galactomannans, heteropolysaccharides obtained by the fermentation of starch-derived sugar and ammonium and alkali metal salts thereof.

[0074] Cellulose derivatives are used to a smaller extent, such as hydroxyethylcellulose (HEC) or hydroxypropylcellulose (HPC), carboxymethylhydroxyethylcellulose (CMHEC) and carboxymethylcellulose (CMC), with or without crosslinkers. Xanthan, diutan, and scleroglucan, three biopolymers, have been shown to have excellent particulate-suspension ability even though they are more expensive than guar derivatives and therefore have been used less frequently, unless they can be used at lower concentrations.

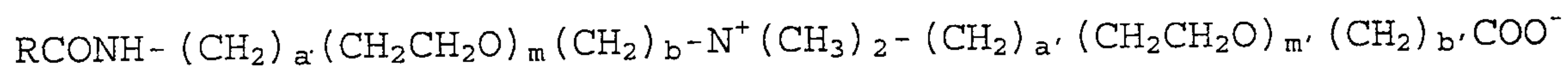
[0075] In other embodiments, the viscosifying agent is made from a crosslinkable, hydratable polymer and a delayed crosslinking agent, wherein the crosslinking agent comprises a complex comprising a metal and a first ligand selected from the group consisting of amino acids, phosphono acids, and salts or derivatives thereof. Also the crosslinked polymer can be made from a polymer comprising pendant ionic moieties, a surfactant comprising oppositely charged moieties, a clay stabilizer, a borate source, and a metal crosslinker. Said embodiments are described in U.S. Patent Publications US2008-0280790 and US2008-0280788 respectively.

[0076] The viscosifying agent may be a viscoelastic surfactant (VES). The VES may be selected from the group consisting of cationic, anionic, zwitterionic, amphoteric, nonionic and combinations thereof. Some non-limiting examples are those cited in U.S. Patents 6,435,277 (Qu et al.) and 6,703,352 (Dahayanake et al.) The viscoelastic surfactants, when used alone or in combination, are capable of forming micelles that form a structure in an aqueous environment that contribute to the increased viscosity of the fluid (also referred to as "viscosifying micelles"). The fluids are normally prepared by mixing in appropriate amounts of VES

53853-37D1

suitable to achieve the desired viscosity. The viscosity of VES fluids may be attributed to the three dimensional structure formed by the components in the fluids. When the concentration of surfactants in a viscoelastic fluid significantly exceeds a critical concentration, and in most cases in the presence of an electrolyte, surfactant molecules aggregate into species such as micelles, which can interact to form a network exhibiting viscous and elastic behavior.

[0077] In general, particularly suitable zwitterionic surfactants have the formula:



in which R is an alkyl group that contains from about 11 to about 23 carbon atoms which may be branched or straight chained and which may be saturated or unsaturated; a, b, a', and b' are each from 0 to 10 and m and m' are each from 0 to 13; a and b are each 1 or 2 if m is not 0 and (a + b) is from 2 to 10 if m is 0; a' and b' are each 1 or 2 when m' is not 0 and (a' + b') is from 1 to 5 if m is 0; (m + m') is from 0 to 14; and CH₂CH₂O may also be OCH₂CH₂. In some embodiments, a zwitterionic surfactants of the family of betaine is used.

[0078] Exemplary cationic viscoelastic surfactants include the amine salts and quaternary amine salts disclosed in U.S. Patent Nos. 5,979,557, and 6,435,277 which are hereby incorporated by reference. Examples of suitable cationic viscoelastic surfactants include cationic surfactants having the structure:



in which R₁ has from about 14 to about 26 carbon atoms and may be branched or straight chained, aromatic, saturated or unsaturated, and may contain a carbonyl, an amide, a retroamide, an imide, a urea, or an amine; R₂, R₃, and R₄ are each independently hydrogen or a C₁ to about C₆ aliphatic group which may be the same or different, branched or straight chained, saturated or unsaturated and one or more than one of which may be substituted with a group that renders the R₂, R₃, and R₄ group more hydrophilic; the R₂, R₃ and R₄ groups may be incorporated into a heterocyclic 5- or 6-member ring structure which includes the nitrogen atom; the R₂, R₃ and R₄ groups may be the same or different; R₁, R₂, R₃ and/or R₄ may contain one or more ethylene oxide and/or propylene oxide units; and X⁻ is an anion. Mixtures of such compounds are also suitable. As a further example, R₁ is

53853-37D1

from about 18 to about 22 carbon atoms and may contain a carbonyl, an amide, or an amine, and R_2 , R_3 , and R_4 are the same as one another and contain from 1 to about 3 carbon atoms.

[0079] Amphoteric viscoelastic surfactants are also suitable. Exemplary amphoteric viscoelastic surfactant systems include those described in U.S. Patent No. 6,703,352, for example amine oxides. Other exemplary viscoelastic surfactant systems include those described in U.S. Patents Nos. 6,239,183; 6,506,710; 7,060,661; 7,303,018; and 7,510,009 for example amidoamine oxides. Mixtures of zwitterionic surfactants and amphoteric surfactants are suitable. An example is a mixture of about 13% isopropanol, about 5% 1-butanol, about 15% ethylene glycol monobutyl ether, about 4% sodium chloride, and 30% water, about 30% cocoamidopropyl betaine, and about 2% cocoamidopropylamine oxide.

[0080] The viscoelastic surfactant system may also be based upon any suitable anionic surfactant. In some embodiments, the anionic surfactant is an alkyl sarcosinate. The alkyl sarcosinate can generally have any number of carbon atoms. Alkyl sarcosinates can have about 12 to about 24 carbon atoms. The alkyl sarcosinate can have about 14 to about 18 carbon atoms. Specific examples of the number of carbon atoms include 12, 14, 16, 18, 20, 22, and 24 carbon atoms. The anionic surfactant is represented by the chemical formula:



wherein R_1 is a hydrophobic chain having about 12 to about 24 carbon atoms, R_2 is hydrogen, methyl, ethyl, propyl, or butyl, and X is carboxyl or sulfonyl. The hydrophobic chain can be an alkyl group, an alkenyl group, an alkylarylalkyl group, or an alkoxyalkyl group. Specific examples of the hydrophobic chain include a tetradecyl group, a hexadecyl group, an octadecentyl group, an octadecyl group, and a docosenoic group.

[0081] In some embodiments, the carrier fluid may optionally further comprise fibers. The fibers may be straight, curved, bent or undulated. Other non-limiting shapes may include hollow, generally spherical, rectangular, polygonal, etc. Fibers or elongated particles may be used in bundles. The fibers may have a length of less than about 1 mm to about 30 mm or more. In certain embodiments the fibers may have a length of 12 mm or less with a diameter or cross dimension of about 200 microns or less, with from about 10 microns to about 200 microns being typical. For elongated materials, the materials may have a ratio

53853-37D1

between any two of the three dimensions of greater than 5 to 1. In certain embodiments, the fibers or elongated materials may have a length of greater than 1 mm, with from about 1 mm to about 30 mm, from about 2 mm to about 25 mm, from about 3 mm to about 20 mm, being typical. In certain applications the fibers or elongated materials may have a length of from about 1 mm to about 10 mm (e.g. 6 mm). The fibers or elongated materials may have a diameter or cross dimension of from about 5 to 100 microns and/or a denier of about 0.1 to about 20, more particularly a denier of about 0.15 to about 6.

[0082] The fiber may be formed from a degradable material or a non-degradable material. The fiber may be organic or inorganic. Non-degradable materials are those wherein the fiber remains substantially in its solid form within the well fluids. Examples of such materials include glass, ceramics, basalt, carbon and carbon-based compound, metals and metal alloys, etc. Polymers and plastics that are non-degradable may also be used as non-degradable fibers. These may include high density plastic materials that are acid and oil-resistant and exhibit a crystallinity of greater than 10%. Other non-limiting examples of polymeric materials include nylons, acrylics, styrenes, polyesters, polyethylene, oil-resistant thermoset resins and combinations of these.

[0083] Degradable fibers may include those materials that can be softened, dissolved, reacted or otherwise made to degrade within the well fluids. Such materials may be soluble in aqueous fluids or in hydrocarbon fluids. Oil-degradable particulate materials may be used that degrade in the produced fluids. Non-limiting examples of degradable materials may include, without limitation, polyvinyl alcohol, polyethylene terephthalate (PET), polyethylene, dissolvable salts, polysaccharides, waxes, benzoic acid, naphthalene based materials, magnesium oxide, sodium bicarbonate, calcium carbonate, sodium chloride, calcium chloride, ammonium sulfate, soluble resins, and the like, and combinations of these. Degradable materials may also include those that are formed from solid-acid precursor materials. These materials may include polylactic acid (PLA), polyglycolic acid (PGA), carboxylic acid, lactide, glycolide, copolymers of PLA or PGA, and the like, and combinations of these. Such materials may also further facilitate the dissolving of the formation in the acid fracturing treatment.

[0084] Also, fibers can be any fibrous material, such as, but not necessarily limited to, natural organic fibers, comminuted plant materials, synthetic polymer fibers (by non-

53853-37D1

limiting example polyester, polyaramide, polyamide, novoloid or a novoloid-type polymer), fibrillated synthetic organic fibers, ceramic fibers, inorganic fibers, metal fibers, metal filaments, carbon fibers, glass fibers, ceramic fibers, natural polymer fibers, and any mixtures thereof. Particularly useful fibers are polyester fibers coated to be highly hydrophilic, such as, but not limited to, DACRON® polyethylene terephthalate (PET) fibers available from Invista Corp., Wichita, Kans., USA, 67220. Other examples of useful fibers include, but are not limited to, polylactic acid polyester fibers, polyglycolic acid polyester fibers, polyvinyl alcohol fibers, and the like.

[0085] In some embodiments, the carrier fluid may optionally further comprise additional additives, including, but not limited to, acids, fluid loss control additives, gas, corrosion inhibitors, scale inhibitors, catalysts, clay control agents, biocides, friction reducers, combinations thereof and the like. For example, in some embodiments, it may be desired to foam the composition using a gas, such as air, nitrogen, or carbon dioxide.

[0086] The composition may be used for carrying out a variety of subterranean treatments, including, but not limited to, drilling operations, fracturing treatments, diverting treatments, zonal isolation and completion operations (e.g., gravel packing). In some embodiments, the composition may be used in treating a portion of a subterranean formation. In certain embodiments, the composition may be introduced into a well bore that penetrates the subterranean formation as a treatment fluid. For example, the treatment fluid may be allowed to contact the subterranean formation for a period of time. In some embodiments, the treatment fluid may be allowed to contact hydrocarbons, formations fluids, and/or subsequently injected treatment fluids. After a chosen time, the treatment fluid may be recovered through the well bore.

[0087] Methods of wellsite and downhole delivery of the composition are the same as for existing particulate diverting materials. Typically such particulate materials are introduced in the pumping fluid and then displaced into the perforations at high pumping rate. The list of injecting equipment may include various dry additive systems, flow-through blenders etc. In one embodiment the blends of particles may be batch mixed and then introduced into the treating fluid in slurred form. Simple flow-through injecting apparatuses may also be used as the one which scheme is shown in Figure 7. In one embodiment the composition may be delivered downhole in a bailer or in a tool comprising bailer and a perforation gun

53853-37D1

as described in US Patent Application 2008/0196896 incorporated herewith by reference. Other way of delivery of the composition can be envisioned for example with a wireline tool, a drill string, through a slickline, with a coil tubing or microcoil, with a downhole tool or any type of other device introduced downhole and able to deliver the composition at a defined location. A microcoil or Microhole Coiled Tubing Drilling Rig (MCTR) is a tool capable of performing an entire "grass-roots" operation in the 0 – 5000ft true vertical depth range including drilling and casing surface, intermediate, and production and liner holes.

[0088] As soon as the volume of diverting blend required for treatment diversion is relatively low there is a risk that particles in the blend will be separated during pumping through the well bore. It may result in poorer treatment diversion because of forming plugs of higher permeability than expected. To avoid this situation long slugs with low concentration of diverting blends may be introduced in the treating fluid for minimizing the risk of particles separation in the main amount of the pumped blend.. In one other embodiment, to avoid this situation diverting blends may be pumped in long slugs at low concentrations which will make volume of the diverting stage comparable with the volume of the well bore. For example for wells with well bore volume of 200bbl (32m³) the volumes of the diverting stage that minimizes the risk of particles separation may be in the range of 20-100bbl (3.2-16m³). For 5-25kg of diverting material it corresponds to the range of concentrations of 0.3-8kg/m³.

[0089] Creating plugs of the proposed diverting blends happens by accumulating particles in the void space behind casing. Examples of such voids may be perforation tunnels, hydraulic fractures or wormholes. Plug creation consists of two steps. In the first step some largest particles in the diverting blend jam in the void creating a bridge. During the next step other particles are being accumulated at the formed bridge resulting in plug formation.

[0090] After treatment, the created plugs are removed. There are several methods that may be applied for removal of the created plugs. If the composition comprises degradable materials, self degradation will occur. If the composition comprises material reacting with chemical agents, those are removed by reacting with other agents. If the composition comprises melting material, melting may result in reduction in mechanical stability of the plug. If the composition comprises water soluble or hydrocarbon soluble materials. Plug removal may be achieved through physical dissolution of at least one of the components of

53853-37D1

the diverting blend in the surrounding fluid. Solubility of the mentioned components may be in significant dependence on temperature. In this situation post-treatment temperature recovery in the sealed zone may trigger the removal of the sealer. Disintegration of at least one component of the composition may occur. Plug removal may be also achieved through disintegration of the sealer into smaller pieces that will be flushed away. List of possible materials that may possess disintegration include plastics such as PLA, polyamides and composite materials comprising degradable plastics and non-degradable fine solids. It worth to mention that some of degradable material pass disintegration stage during degradation process. Example of it is PLA which turns into fragile materials before complete degradation.

[0091] To facilitate a better understanding, the following examples of embodiments are given. In no way should the following examples be read to limit, or define, the scope of the overall invention.

Examples

[0092] A series of experiments were conducted to demonstrate the methods of treatment.

Example 1

[0093] This example demonstrates that the amount of diverting blends required for treatment diversion between several perforation clusters in slick water treatment may be as low as several kilograms when such diverting blends are designed for sealing seals in perforations or in near-well bore zone in the close proximity to such perforations.

[0094] For a fracturing stage comprising simultaneous slick-water fracture treatment of several clusters the following parameters are taken

- Number of perforation clusters: 6
- Diameter of perforation holes: 0.33in (8.4mm)
- Length of a perforation tunnel: 1/3ft (10cm)
- Length of a perforation cluster: 1 ft (0.34 m)
- Perforation density: 6 shots/ft (18 shots/m)

[0095] For the diversion between perforation clusters we assumed that isolation of 1/3 of

53853-37D1

all perforation tunnels is required ($6 \times 6/3=12$ perforations). Volume of each perforation is estimated as a volume of a cone having diameter of a perforation hole and height equal to the length of the perforation tunnel (see Figure 2A). For given numbers the volume of each perforation is:

$$V = \frac{1}{3} \pi R^2 h \sim \frac{1}{3} \times 3.14 \times (0.42)^2 \times 10 \sim 2 \text{ cm}^3$$

[0096] Assuming that actual volume of perforation tunnels during fracturing treatment may be higher by a factor of 100 (e.g. because of surface erosion as in Figure 2B), the total volume of diverting material required for isolation of 12 perforations is:

$$12 \times 2 \times 100 \sim 2000 \text{ cm}^3 = 2L$$

which for a typical range of densities (1-3kg/L) corresponds to 1-6 kilograms of a diverting material.

Example 2

[0097] In this example we illustrate how to design the composition of the particle blend for providing slick water treatment diversion by sealing perforation tunnels.

[0098] For slick-water treatments in shale reservoirs, the typical diameter of perforations is 0.33 in (8.4 mm) and the expected fracture width is in the range of 2-6 mm. That gives that the size of the largest particles in diverting blend should be in the range ~6-8mm for jamming at the fracture entrance.

[0099] It is important to note that recommendations for the particles size distribution in the blend of particles for creating plugs of low permeability are significantly different when large or narrow voids must be plugged. That situation is illustrated by Figure 3 and Figure 4. Moreover, using recommendations for particle size distribution as in Figure 3 for sealing narrow slots results in squeezing all particles through the channels between largest particles in the blend (see Figure 4).

[00100] For defining particle size distribution required for creating plug of low permeability in a perforation tunnel we assumed that the actual width of the perforation tunnel is higher than the diameter of the perforation hole (e.g. because of erosion as shown

53853-37D1

in Figure 2B). Used laboratory setup comprised a syringe 400 connected to a slot 401 with the width in the range of 8-16 mm (see Figure 5). The slot was equipped with a sieve 402 with the size of the openings smaller than the diameter of the largest particles but bigger than the diameter of any other particles in the tested blends. Used blends had the composition shown in Table 1.

N	Particle size	Volume (68.8% total)	Optimal particlesize for enabling low plug permeability (16mm slot)	Optimal particle size ratio (16mm slot)			
1	6.5 mm	25.0	6.5	4.2			
2	0.64-4.5mm	12.5	1.55	1	2.4		
3	0.25-1.3mm	6.3	0.66		1	2.7	
4	0.45-0.042mm	6.3	0.2475			1	5.9
5	0.01-0.115mm	12.5	0.042				1
6	6-14 microns	6.3	~10 microns*				

* The size was not optimized

Table 1

[00101] During performed experiments the slurry comprising 0.5% solution of guar gum and the blend of particles was displaced from the syringe into the slot where the plug was formed. The volume of slurry that came from the slot during plug formation was measured and plotted versus particle size for each type of particles (see example data on Figure 6). In those experiments volumetric concentrations were constants and particles size varied. Optimal particle size was defined as the particles diameter that corresponded to minimal fluid loss during plug formation (see example data in Figure 6). Obtained values for optimal particle sizes in the blend as well as optimal particle size ratios are provided in Table 1.

[00102] In other similar experiments concentrations and sizes of the particles were varied in order to find optimal volumetric concentrations using the described procedure. It was found that the optimal particle size down not depend on the concentration of such particles in the blend (see Figure 7). It was also found that the optimal particle sizes and

53853-37D1

concentrations are not impacted by the changing concentrations and sized of other particulate components in the taken blend.

Example 3

[00103] In this example we illustrate how to design the composition of the blend comprising particles and flakes for providing slick water treatment diversion by sealing perforation tunnels. In this example the blend consists of one large particulate component and several flake components of smaller sizes. The described procedure is similar to the procedure described in the Example 2.

[00104] For slick-water treatments in shale reservoirs, the typical diameter of perforations is 0.33 in (8.4 mm) and the expected fracture width is in the range of 2-6 mm. That gives that the size of the particles of the particulate component in diverting blend should be in the range ~6-8 mm for jamming at the fracture entrance.

[00105] For defining flake size distribution required for creating plug of low permeability in a perforation tunnel we assumed that the actual width of the perforation tunnel is higher than the diameter of the perforation hole (e.g. because of erosion as shown in Figure 2B). Used laboratory setup was the same as in Example 2 and comprised the syringe 400 connected to the slot 401 with the width in the range of 8-16 mm (see Figure 5). The slot was equipped with the sieve 402 with the size of the openings smaller than the diameter of the largest particles in the tested blends. Used blends had the composition shown in Table 2.

[00106] For flake components we used mica flakes with the thickness of ~20 microns. The size of the flakes was defined using sieve analysis. During performed experiments the slurry comprising 0.5% solution of guar gum and the blend of particles and flake components was displaced from the syringe into the slot where the plug was formed. Sizes of the particles and flakes and composition of the blend used in the experiment are shown in Table 2 below.

N	Type	Volume (40% total)	Size	Optimal particle size ratio (16mm slot)
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53853-37D1

1	Spherical particles	28	6.5 mm	2.4			
2	Flakes	4	Varied from 12/14mesh to 4/6 mesh (from 1.54 mm to 4.06 mm)	1			
3	Flakes	4	20/40 mesh (0.6 mm)*				
4	Flakes	4	70/140 mesh (0.15 mm)*				

* The size was not optimized

Table 2

[00107] During performed experiments the volume of slurry that came from the slot during plug formation was measured and plotted versus flakes size. In those experiments volumetric concentrations were constants and the size of the second component (the first flake component) varied. Optimal flake size was defined as the size of that corresponded to minimal fluid loss during plug formation (see example data in Figure 8). The obtained data show, that the leak-off during plug formation is minimal when the size of the second component (the first flake component) in the using diverting blend is >10% of the diameter of the first particulate component.

Example 4

[00108] In this example we provide description of the experiment on creating a plug of a blend of particles and flakes. Formed plug has permeability of 0.6-0.8 Darcy which is enough for providing treatment diversion effect during high-rate slick-water treatments.

[00109] For plug creation, we used laboratory which scheme is shown in Figure 10. The setup consists of an accumulator 500, 3.4mm slot 501 and a pump (not shown) connected to the accumulator. Before the experiment the accumulator was filled with the slurry which comprised the following components:

- Fluid: 0.5% guar gum solution
- Particles (PLA, 4 mm in diameter): 80g/L (0.7ppa)
- Flakes (mica 0.5-1.5mm): 100g/L (0.9ppa)

[00110] Then the composition was displaced into the slot with water at initial

53853-37D1

pumping rate of 100mL/min. Permeability of the formed plug was calculated from the pressure drop across the plug at various pumping rates (see Figure 11). Obtained value was in the range of 0.6-0.8 Darcy.

[00111] The foregoing disclosure and description is illustrative and explanatory, and it can be readily appreciated by those skilled in the art that various changes in the size, shape and materials, as well as in the details of the illustrated construction or combinations of the elements described herein can be made without departing from the scope of the invention.

53853-37D1

CLAIMS:

1. A method of treating a subterranean formation penetrated by a well bore, comprising:

5 providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the well bore; and,

10 creating a plug with said treatment fluid, and

wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are non-homogenous.

2. The method of claim 1, wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

15 3. The method of claim 2, wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

20 4. The method according to claim 1 further comprising removing the plug.

5. The method according to claim 1 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

6. The method of claim 5 wherein the degradable material is a polylactic acid material.

53853-37D1

7. The method according to claim 1 wherein the blend comprises a non-degradable material.
8. The method according to claim 1 wherein the treatment fluid further comprises fibers.
- 5 9. The method according to claim 1 wherein introducing the treatment fluid into the well bore is done with a mechanical container, or a tool comprising a mechanical container and a perforation gun.
10. The method of claim 9 wherein the container is conveyed on a drill string, a wireline, a slickline, a coil tubing or a microcoil.
- 10 11. The method of claim 9 wherein the tool or container moves downhole and the blend is released from the said tool or container.
12. The method of claim 1 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.
13. The method according to claim 1 wherein the first amount of particulates has
15 an aspect ratio smaller than 5.
14. The method according to claim 1 wherein the first average particle size is between about 3 mm and 20 mm.
15. The method according to claim 1 wherein the first average particle size is between about 6 mm and 10 mm.
- 20 16. The method according to claim 1 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.
17. The method of claim 16 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third
25 average size, and a fifth average size smaller than the fourth average size.

53853-37D1

18. The method according to claim 1 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

19. The method according to claim 1 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds
5 0.7.

20. The method according to claim 1 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

21. The method of claim 1 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

10 22. The method of claim 1, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

23. The method of claim 1, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

15 24. A method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter
20 and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the hole;

creating a plug of the hole with said treatment fluid; and

25 removing the plug, and

53853-37D1

wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are non-homogenous.

25. The method of claim 24 wherein the first average particle size is between about 3 mm and 2 cm.

5 26. The method of claim 25 wherein the first average particle size is between about 6 mm and 10 mm.

27. The method according to claim 24 wherein the first amount of particulates has an aspect ratio smaller than 5.

10 28. The method according to claim 24 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

29. The method according to claim 24 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

15 30. The method according to claim 24 wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

20 31. The method of claim 30 wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

32. The method according to claim 24 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

33. The method of claim 32 wherein the degradable material is a polylactic acid material.

53853-37D1

34. The method according to claim 24 wherein the blend comprises a non-degradable material.

35. The method according to claim 24 wherein the treatment fluid further comprises fibers.

5 36. The method according to claim 24 wherein introducing the treatment fluid into the well bore is done with a mechanical container or a tool comprising a mechanical container and a perforation gun.

37. The method of claim 36 wherein the container is conveyed on a wireline, a drill string, a slickline, a coil tubing or a microcoil.

10 38. The method of claim 37 wherein the tool or container moves downhole and the blend is released from the said tool or container.

39. The method of claim 24 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

40. The method according to claim 24 wherein the treatment fluid further
15 comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

41. The method of claim 40 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

20 42. The method according to claim 24 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

43. The method of claim 24 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

53853-37D1

44. The method of claim 24, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

45. The method of claim 24, wherein at least one of the first amount of
5 particulates, the second amount of particulates or the second amount of flakes are composite materials.

46. A method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

10 providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

15 introducing the diverting fluid into the hole;

creating a diverting plug of the hole with said diverting fluid;

fracturing the subterranean formation by using said diverting plug; and

removing the diverting plug, and

20 wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are non-homogenous.

47. The method of claim 46 wherein the first average particle size is between about 6 mm and 20 mm.

48. The method of claim 46 wherein the fracturing the subterranean formation occurs after the creating of the diverting plug.

53853-37D1

49. The method of claim 46, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

50. The method of claim 46, wherein at least one of the first amount of
5 particulates, the second amount of particulates or the second amount of flakes are composite materials.

51. A method of treating a subterranean formation penetrated by a well bore, comprising:

10 providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the well bore; and,

15 creating a plug with said treatment fluid, and

wherein the treatment fluid further comprises a degradation accelerating material.

52. The method of claim 51, wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

20 53. The method of claim 52, wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

25 54. The method according to claim 51 further comprising removing the plug.

53853-37D1

55. The method according to claim 51 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

56. The method of claim 55 wherein the degradable material is a polylactic acid material.

5 57. The method according to claim 51 wherein the blend comprises a non-degradable material.

58. The method according to claim 51 wherein the treatment fluid further comprises fibers.

59. The method according to claim 51 wherein introducing the treatment fluid into
10 the well bore is done with a mechanical container, or a tool comprising a mechanical container and a perforation gun.

60. The method of claim 59 wherein the container is conveyed on a drill string, a wireline, a slickline, a coil tubing or a microcoil.

61. The method of claim 59 wherein the tool or container moves downhole and the
15 blend is released from the said tool or container.

62. The method of claim 51 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

63. The method according to claim 51 wherein the first amount of particulates has an aspect ratio smaller than 5.

20 64. The method according to claim 51 wherein the first average particle size is between about 3 mm and 20 mm.

65. The method according to claim 51 wherein the first average particle size is between about 6 mm and 10 mm.

53853-37D1

66. The method according to claim 51 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

67. The method of claim 66 wherein the treatment fluid further comprises a fourth
5 and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

68. The method according to claim 51 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

69. The method according to claim 51 wherein the treatment fluid is such that a
10 packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

70. The method according to claim 51 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

71. The method of claim 51 wherein the method further comprises subjecting the
15 subterranean formation to a fracturing treatment after the creating of the plug.

72. The method of claim 51, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

73. The method of claim 51, wherein at least one of the first amount of
20 particulates, the second amount of particulates or the second amount of flakes are composite materials.

74. A method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

53853-37D1

providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second
 5 average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the hole;

creating a plug of the hole with said treatment fluid; and

removing the plug, and

wherein the treatment fluid further comprises a degradation accelerating
 10 material.

75. The method of claim 74 wherein the first average particle size is between about 3 mm and 2 cm.

76. The method of claim 75 wherein the first average particle size is between about 6 mm and 10 mm.

15 77. The method according to claim 74 wherein the first amount of particulates has an aspect ratio smaller than 5.

78. The method according to claim 74 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

79. The method according to claim 74 wherein the treatment fluid is such that a
 20 packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

80. The method according to claim 74 wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

53853-37D1

81. The method of claim 80 wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

82. The method according to claim 74 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

83. The method of claim 82 wherein the degradable material is a polylactic acid material.

84. The method according to claim 74 wherein the blend comprises a non-degradable material.

85. The method according to claim 74 wherein the treatment fluid further comprises fibers.

86. The method according to claim 74 wherein introducing the treatment fluid into the well bore is done with a mechanical container or a tool comprising a mechanical container and a perforation gun.

87. The method of claim 86 wherein the container is conveyed on a wireline, a drill string, a slickline, a coil tubing or a microcoil.

88. The method of claim 87 wherein the tool or container moves downhole and the blend is released from the said tool or container.

89. The method of claim 84 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

90. The method according to claim 84 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

53853-37D1

91. The method of claim 90 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

92. The method according to claim 74 wherein the second average size is between
5 about 2 and 10 times smaller than the first average particle size.

93. The method of claim 74 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

94. The method of claim 74, wherein a size of the first amount of particulates is
10 larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

95. The method of claim 74, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

96. A method of fracturing a subterranean formation of a well bore, wherein the
15 well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

providing a diverting fluid comprising a blend including a first amount of
particulates having a first average particle size between about 50 to 100 % of said diameter
and a second amount of particulates having a second average size between about 1.6 and 20
20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the diverting fluid into the hole;

creating a diverting plug of the hole with said diverting fluid;

fracturing the subterranean formation by using said diverting plug; and

25 removing the diverting plug, and

53853-37D1

wherein the treatment fluid further comprises a degradation accelerating material.

97. The method of claim 96 wherein the first average particle size is between about 6 mm and 20 mm.

5 98. The method of claim 96 wherein the fracturing the subterranean formation occurs after the creating of the diverting plug.

99. The method of claim 96, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

10 100. The method of claim 96, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

101. A method of treating a subterranean formation penetrated by a well bore, comprising:

15 providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

20 introducing the treatment fluid into the well bore; and,

creating a plug with said treatment fluid, and

wherein at least one of the first amount of particulates or the second amount of particulates comprises proppant.

102. The method of claim 101, wherein the treatment fluid comprises a carrier fluid,
25 and a viscosifying agent or friction reducer.

53853-37D1

103. The method of claim 102, wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.
104. The method according to claim 101 further comprising removing the plug.
105. The method according to claim 101 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.
106. The method of claim 105 wherein the degradable material is a polylactic acid material.
107. The method according to claim 101 wherein the blend comprises a non-degradable material.
108. The method according to claim 101 wherein the treatment fluid further comprises fibers.
109. The method according to claim 101 wherein introducing the treatment fluid into the well bore is done with a mechanical container, or a tool comprising a mechanical container and a perforation gun.
110. The method of claim 109 wherein the container is conveyed on a drill string, a wireline, a slickline, a coil tubing or a microcoil.
111. The method of claim 109 wherein the tool or container moves downhole and the blend is released from the said tool or container.
112. The method of claim 101 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.
113. The method according to claim 101 wherein the first amount of particulates has an aspect ratio smaller than 5.

53853-37D1

114. The method according to claim 101 wherein the first average particle size is between about 3 mm and 20 mm.

115. The method according to claim 101 wherein the first average particle size is between about 6 mm and 10 mm.

5 116. The method according to claim 101 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

117. The method of claim 116 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than
10 the third average size, and a fifth average size smaller than the fourth average size.

118. The method according to claim 101 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

119. The method according to claim 101 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds
15 0.7.

120. The method according to claim 101 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

121. The method of claim 101 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

20 122. The method of claim 101, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

123. The method of claim 101, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite
25 materials.

53853-37D1

124. A method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

5 providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the hole;

10 creating a plug of the hole with said treatment fluid; and

removing the plug, and

wherein at least one of the first amount of particulates or the second amount of particulates comprises proppant.

125. The method of claim 124 wherein the first average particle size is between
15 about 3 mm and 2 cm.

126. The method of claim 125 wherein the first average particle size is between about 6 mm and 10 mm.

127. The method according to claim 124 wherein the first amount of particulates has an aspect ratio smaller than 5.

20 128. The method according to claim 124 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

129. The method according to claim 124 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

53853-37D1

130. The method according to claim 124 wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

131. The method of claim 130 wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving
5 fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

132. The method according to claim 124 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

10 133. The method of claim 132 wherein the degradable material is a polylactic acid material.

134. The method according to claim 124 wherein the blend comprises a non-degradable material.

135. The method according to claim 124 wherein the treatment fluid further
15 comprises fibers.

136. The method according to claim 124 wherein introducing the treatment fluid into the well bore is done with a mechanical container or a tool comprising a mechanical container and a perforation gun.

137. The method of claim 136 wherein the container is conveyed on a wireline, a
20 drill string, a slickline, a coil tubing or a microcoil.

138. The method of claim 137 wherein the tool or container moves downhole and the blend is released from the said tool or container.

139. The method of claim 124 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

53853-37D1

140. The method according to claim 124 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

141. The method of claim 140 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

142. The method according to claim 124 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

143. The method of claim 124 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

144. The method of claim 124, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

145. The method of claim 124, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

146. A method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

20 providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

25 introducing the diverting fluid into the hole;

53853-37D1

creating a diverting plug of the hole with said diverting fluid;

fracturing the subterranean formation by using said diverting plug; and

removing the diverting plug, and

5 wherein at least one of the first amount of particulates or the second amount of particulates comprises proppant.

147. The method of claim 146 wherein the first average particle size is between about 6 mm and 20 mm.

148. The method of claim 146 wherein the fracturing the subterranean formation occurs after the creating of the diverting plug.

10 149. The method of claim 146, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

150. The method of claim 146, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite
15 materials.

151. A method of treating a subterranean formation penetrated by a well bore, comprising:

20 providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the well bore; and,

creating a plug with said treatment fluid, and

53853-37D1

wherein the treatment fluid further comprises a lost circulation material.

152. The method of claim 151, wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

153. The method of claim 152, wherein the carrier fluid is a treatment fluid selected
5 from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

154. The method according to claim 151 further comprising removing the plug.

10 155. The method according to claim 151 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

156. The method of claim 155 wherein the degradable material is a polylactic acid material.

157. The method according to claim 151 wherein the blend comprises a non-
15 degradable material.

158. The method according to claim 151 wherein the treatment fluid further comprises fibers.

159. The method according to claim 151 wherein introducing the treatment fluid
into the well bore is done with a mechanical container, or a tool comprising a mechanical
20 container and a perforation gun.

160. The method of claim 159 wherein the container is conveyed on a drill string, a wireline, a slickline, a coil tubing or a microcoil.

161. The method of claim 159 wherein the tool or container moves downhole and the blend is released from the said tool or container.

53853-37D1

162. The method of claim 151 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

163. The method according to claim 151 wherein the first amount of particulates has an aspect ratio smaller than 5.

5 164. The method according to claim 151 wherein the first average particle size is between about 3 mm and 20 mm.

165. The method according to claim 151 wherein the first average particle size is between about 6 mm and 10 mm.

10 166. The method according to claim 151 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

167. The method of claim 166 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

15 168. The method according to claim 151 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

169. The method according to claim 151 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

20 170. The method according to claim 151 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

171. The method of claim 151 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

53853-37D1

172. The method of claim 151, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

173. The method of claim 151, wherein at least one of the first amount of
5 particulates, the second amount of particulates or the second amount of flakes are composite materials.

174. A method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

10 providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

15 introducing the treatment fluid into the hole;

creating a plug of the hole with said treatment fluid; and

removing the plug, and

wherein the treatment fluid further comprises a lost circulation material.

175. The method of claim 174 wherein the first average particle size is between
20 about 3 mm and 2 cm.

176. The method of claim 175 wherein the first average particle size is between about 6 mm and 10 mm.

177. The method according to claim 174 wherein the first amount of particulates has an aspect ratio smaller than 5.

53853-37D1

178. The method according to claim 174 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

179. The method according to claim 174 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds
5 0.7.

180. The method according to claim 174 wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

181. The method of claim 80 wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving
10 fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

182. The method according to claim 174 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

15 183. The method of claim 182 wherein the degradable material is a polylactic acid material.

184. The method according to claim 174 wherein the blend comprises a non-degradable material.

185. The method according to claim 174 wherein the treatment fluid further
20 comprises fibers.

186. The method according to claim 174 wherein introducing the treatment fluid into the well bore is done with a mechanical container or a tool comprising a mechanical container and a perforation gun.

187. The method of claim 186 wherein the container is conveyed on a wireline, a
25 drill string, a slickline, a coil tubing or a microcoil.

53853-37D1

188. The method of claim 187 wherein the tool or container moves downhole and the blend is released from the said tool or container.

189. The method of claim 184 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

5 190. The method according to claim 184 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

191. The method of claim 190 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than
10 the third average size, and a fifth average size smaller than the fourth average size.

192. The method according to claim 174 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

193. The method of claim 174 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

15 194. The method of claim 174, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

195. The method of claim 174, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite
20 materials.

196. A method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

25 providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter

53853-37D1

and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the diverting fluid into the hole;

5 creating a diverting plug of the hole with said diverting fluid;

fracturing the subterranean formation by using said diverting plug; and

removing the diverting plug, and

wherein the treatment fluid further comprises a lost circulation material.

197. The method of claim 196 wherein the first average particle size is between
10 about 6 mm and 20 mm.

198. The method of claim 196 wherein the fracturing the subterranean formation occurs after the creating of the diverting plug.

199. The method of claim 196, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be
15 closed or temporally isolated.

200. The method of claim 196, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

201. A method of treating a subterranean formation penetrated by a well bore,
20 comprising:

providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller

53853-37D1

than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the well bore; and,

creating a plug with said treatment fluid, and

- 5 wherein the treatment fluid further comprises fibers having a shape selected from the group consisting of straight, curved, bent, undulated, hollow, generally spherical, rectangular and polygonal.

202. The method of claim 201, wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

- 10 203. The method of claim 202, wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

- 15 204. The method according to claim 201 further comprising removing the plug.

205. The method according to claim 201 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

206. The method of claim 205 wherein the degradable material is a polylactic acid material.

- 20 207. The method according to claim 201 wherein the blend comprises a non-degradable material.

208. The method according to claim 201 wherein introducing the treatment fluid into the well bore is done with a mechanical container, or a tool comprising a mechanical container and a perforation gun.

53853-37D1

209. The method of claim 208 wherein the container is conveyed on a drill string, a wireline, a slickline, a coil tubing or a microcoil.

210. The method of claim 208 wherein the tool or container moves downhole and the blend is released from the said tool or container.

5 211. The method of claim 201 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

212. The method according to claim 201 wherein the first amount of particulates has an aspect ratio smaller than 5.

10 213. The method according to claim 201 wherein the first average particle size is between about 3 mm and 20 mm.

214. The method according to claim 201 wherein the first average particle size is between about 6 mm and 10 mm.

15 215. The method according to claim 201 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

216. The method of claim 215 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

20 217. The method according to claim 201 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

218. The method according to claim 201 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

25 219. The method according to claim 201 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

53853-37D1

220. The method of claim 201 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

221. The method of claim 201, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be
5 closed or temporally isolated.

222. The method of claim 201 wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

223. A method of treating a subterranean formation of a well bore, wherein the well
10 bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20
15 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the hole;

creating a plug of the hole with said treatment fluid; and

removing the plug, and

20 wherein the treatment fluid further comprises fibers having a shape selected from the group consisting of straight, curved, bent, undulated, hollow, generally spherical, rectangular and polygonal.

224. The method of claim 223 wherein the first average particle size is between about 3 mm and 2 cm.

53853-37D1

225. The method of claim 224 wherein the first average particle size is between about 6 mm and 10 mm.

226. The method according to claim 223 wherein the first amount of particulates has an aspect ratio smaller than 5.

5 227. The method according to claim 223 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

228. The method according to claim 223 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

10 229. The method according to claim 223 wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

230. The method of claim 229 wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution
15 fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

231. The method according to claim 223 wherein the blend comprises a degradable material, a soluble material, or a meltable material at downhole conditions.

232. The method of claim 231 wherein the degradable material is a polylactic acid
20 material.

233. The method according to claim 223 wherein the blend comprises a non-degradable material.

234. The method according to claim 223 wherein introducing the treatment fluid into the well bore is done with a mechanical container or a tool comprising a mechanical
25 container and a perforation gun.

53853-37D1

235. The method of claim 223 wherein the container is conveyed on a wireline, a drill string, a slickline, a coil tubing or a microcoil.

236. The method of claim 235 wherein the tool or container moves downhole and the blend is released from the said tool or container.

5 237. The method of claim 223 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

238. The method according to claim 223 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

10 239. The method of claim 238 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

240. The method according to claim 223 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

15 241. The method of claim 223 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

242. The method of claim 223, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

20 243. The method of claim 223, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

244. A method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter,
25 the method comprising:

53853-37D1

providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second
 5 average size up to 10 times smaller than the first average particle size;

introducing the diverting fluid into the hole;

creating a diverting plug of the hole with said diverting fluid;

fracturing the subterranean formation by using said diverting plug; and

removing the diverting plug, and

10 wherein the treatment fluid further comprises fibers having a shape selected from the group consisting of straight, curved, bent, undulated, hollow, generally spherical, rectangular and polygonal.

245. The method of claim 244 wherein the first average particle size is between about 6 mm and 20 mm.

15 246. The method of claim 244 wherein the fracturing the subterranean formation occurs after the creating of the diverting plug.

247. The method of claim 244, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

20 248. The method of claim 244, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite materials.

249. A method of treating a subterranean formation penetrated by a well bore, comprising:

53853-37D1

providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 3 mm and 2 cm and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the well bore; and,

creating a plug with said treatment fluid, and

wherein the blend further comprises at least one material selected from the group consisting of a polyglycolic acid, polyvinylalcohol, a protein and combinations thereof.

10 250. The method of claim 249, wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

251. The method of claim 250, wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

252. The method according to claim 249 wherein the blend comprises a non-degradable material.

253. The method according to claim 249 wherein the treatment fluid further comprises fibers.

254. The method according to claim 249 wherein introducing the treatment fluid into the well bore is done with a mechanical container, or a tool comprising a mechanical container and a perforation gun.

255. The method of claim 254 wherein the container is conveyed on a drill string, a wireline, a slickline, a coil tubing or a microcoil.

53853-37D1

256. The method of claim 254 wherein the tool or container moves downhole and the blend is released from the said tool or container.

257. The method of claim 249 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

5 258. The method according to claim 249 wherein the first amount of particulates has an aspect ratio smaller than 5.

259. The method according to claim 249 wherein the first average particle size is between about 3 mm and 20 mm.

10 260. The method according to claim 249 wherein the first average particle size is between about 6 mm and 10 mm.

261. The method according to claim 249 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

15 262. The method of claim 261 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

263. The method according to claim 249 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

20 264. The method according to claim 249 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

265. The method according to claim 249 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

25 266. The method of claim 249 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

53853-37D1

267. The method of claim 249, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

268. The method of claim 249, wherein at least one of the first amount of
5 particulates, the second amount of particulates or the second amount of flakes are composite materials.

269. A method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

10 providing a treatment fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

15 introducing the treatment fluid into the hole;

creating a plug of the hole with said treatment fluid; and

removing the plug, and

wherein the blend further comprises at least one material selected from the group consisting of a polyglycolic acid, polyvinylalcohol, proteins and combinations thereof.

20 270. The method of claim 269 wherein the first average particle size is between about 3 mm and 2 cm.

271. The method of claim 270 wherein the first average particle size is between about 6 mm and 10 mm.

272. The method according to claim 269 wherein the first amount of particulates has
25 an aspect ratio smaller than 5.

53853-37D1

273. The method according to claim 269 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

274. The method according to claim 269 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds
5 0.7.

275. The method according to claim 269 wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

276. The method of claim 275 wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving
10 fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

277. The method according to claim 269 wherein the treatment fluid further comprises fibers.

15 278. The method according to claim 269 wherein introducing the treatment fluid into the well bore is done with a mechanical container or a tool comprising a mechanical container and a perforation gun.

279. The method of claim 278 wherein the container is conveyed on a wireline, a drill string, a slickline, a coil tubing or a microcoil.

20 280. The method of claim 279 wherein the tool or container moves downhole and the blend is released from the said tool or container.

281. The method of claim 269 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

53853-37D1

282. The method according to claim 269 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

283. The method of claim 282 wherein the treatment fluid further comprises a
5 fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

284. The method according to claim 269 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

285. The method of claim 269 wherein the method further comprises subjecting the
10 subterranean formation to a fracturing treatment after the creating of the plug.

286. The method of claim 269, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

287. The method of claim 269, wherein at least one of the first amount of
15 particulates, the second amount of particulates or the second amount of flakes are composite materials.

288. A method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

20 providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

25 introducing the diverting fluid into the hole;

53853-37D1

creating a diverting plug of the hole with said diverting fluid;

fracturing the subterranean formation by using said diverting plug; and

removing the diverting plug, and

wherein the blend further comprises at least one material selected from the
 5 group consisting of a polyglycolic acid, polyvinylalcohol, proteins and combinations thereof.

289. The method of claim 288 wherein the first average particle size is between
 about 6 mm and 20 mm.

290. The method of claim 288 wherein the fracturing the subterranean formation
 occurs after the creating of the diverting plug.

10 291. The method of claim 288, wherein a size of the first amount of particulates is
 larger than an average width of a void within the subterranean formation that is intended to be
 closed or temporally isolated.

292. The method of claim 288, wherein at least one of the first amount of
 particulates, the second amount of particulates or the second amount of flakes are composite
 15 materials.

293. A method of treating a subterranean formation penetrated by a well bore,
 comprising:

providing a treatment fluid comprising a blend including a first amount of
 particulates having a first average particle size between about 3 mm and 2 cm and a second
 20 amount of particulates having a second average size between about 1.6 and 20 times smaller
 than the first average particle size or a second amount of flakes having a second average size
 up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the well bore; and,

creating a plug with said treatment fluid, and

53853-37D1

wherein the blend comprises at least copolymers of polylactic acid and polyglycolic acid.

294. The method of claim 293, wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

5 295. The method of claim 294, wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

10 296. The method according to claim 293 wherein the blend comprises a non-degradable material.

297. The method according to claim 293 wherein the treatment fluid further comprises fibers.

15 298. The method according to claim 293 wherein introducing the treatment fluid into the well bore is done with a mechanical container, or a tool comprising a mechanical container and a perforation gun.

299. The method of claim 298 wherein the container is conveyed on a drill string, a wireline, a slickline, a coil tubing or a microcoil.

20 300. The method of claim 298 wherein the tool or container moves downhole and the blend is released from the said tool or container.

301. The method of claim 293 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

302. The method according to claim 293 wherein the first amount of particulates has an aspect ratio smaller than 5.

53853-37D1

303. The method according to claim 293 wherein the first average particle size is between about 3 mm and 20 mm.

304. The method according to claim 293 wherein the first average particle size is between about 6 mm and 10 mm.

5 305. The method according to claim 293 wherein the treatment fluid further comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

306. The method of claim 305 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than
10 the third average size, and a fifth average size smaller than the fourth average size.

307. The method according to claim 293 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

308. The method according to claim 293 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds
15 0.7.

309. The method according to claim 293 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

310. The method of claim 293 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

20 311. The method of claim 293, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

312. The method of claim 293, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite
25 materials.

53853-37D1

313. A method of treating a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

providing a treatment fluid comprising a blend including a first amount of
5 particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the treatment fluid into the hole;

10 creating a plug of the hole with said treatment fluid; and

removing the plug, and

wherein the blend comprises at least copolymers of polylactic acid and polyglycolic acid.

314. The method of claim 313 wherein the first average particle size is between
15 about 3 mm and 2 cm.

315. The method of claim 314 wherein the first average particle size is between about 6 mm and 10 mm:

316. The method according to claim 313 wherein the first amount of particulates has an aspect ratio smaller than 5.

20 317. The method according to claim 313 wherein the treatment fluid is such that a packed volume fraction of the blend exceeds 0.7.

318. The method according to claim 313 wherein the treatment fluid is such that a packed volume fraction of the blend placed in a slot having width of less than 20 mm exceeds 0.7.

53853-37D1

319. The method according to claim 313 wherein the treatment fluid comprises a carrier fluid, and a viscosifying agent or friction reducer.

320. The method of claim 319 wherein the carrier fluid is a treatment fluid selected from the group consisting of slickwater, spacer, mutual solvent, flush, formation dissolving
5 fluid, fracturing fluid, scale dissolution fluid, paraffin dissolution fluid, asphaltene dissolution fluid, diverter fluid, water control agent, chelating agent, viscoelastic diverting acid, self-diverting acid, acid, and mixtures thereof.

321. The method according to claim 313 wherein the treatment fluid further comprises fibers.

10 322. The method according to claim 313 wherein introducing the treatment fluid into the well bore is done with a mechanical container or a tool comprising a mechanical container and a perforation gun.

323. The method of claim 322 wherein the container is conveyed on a wireline, a drill string, a slickline, a coil tubing or a microcoil.

15 324. The method of claim 323 wherein the tool or container moves downhole and the blend is released from the said tool or container.

325. The method of claim 313 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment.

326. The method according to claim 313 wherein the treatment fluid further
20 comprises a third amount of particulates or flakes having a third average size smaller than the second average size.

327. The method of claim 326 wherein the treatment fluid further comprises a fourth and a fifth amount of particulates or flakes having a fourth average size smaller than the third average size, and a fifth average size smaller than the fourth average size.

53853-37D1

328. The method according to claim 313 wherein the second average size is between about 2 and 10 times smaller than the first average particle size.

329. The method of claim 313 wherein the method further comprises subjecting the subterranean formation to a fracturing treatment after the creating of the plug.

5 330. The method of claim 313, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

331. The method of claim 313, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite
10 materials.

332. A method of fracturing a subterranean formation of a well bore, wherein the well bore comprises a casing and at least one hole on said casing, said hole having a diameter, the method comprising:

15 providing a diverting fluid comprising a blend including a first amount of particulates having a first average particle size between about 50 to 100 % of said diameter and a second amount of particulates having a second average size between about 1.6 and 20 times smaller than the first average particle size or a second amount of flakes having a second average size up to 10 times smaller than the first average particle size;

introducing the diverting fluid into the hole;

20 creating a diverting plug of the hole with said diverting fluid;

fracturing the subterranean formation by using said diverting plug; and

removing the diverting plug, and

wherein the blend comprises at least copolymers of polylactic acid and polyglycolic acid.

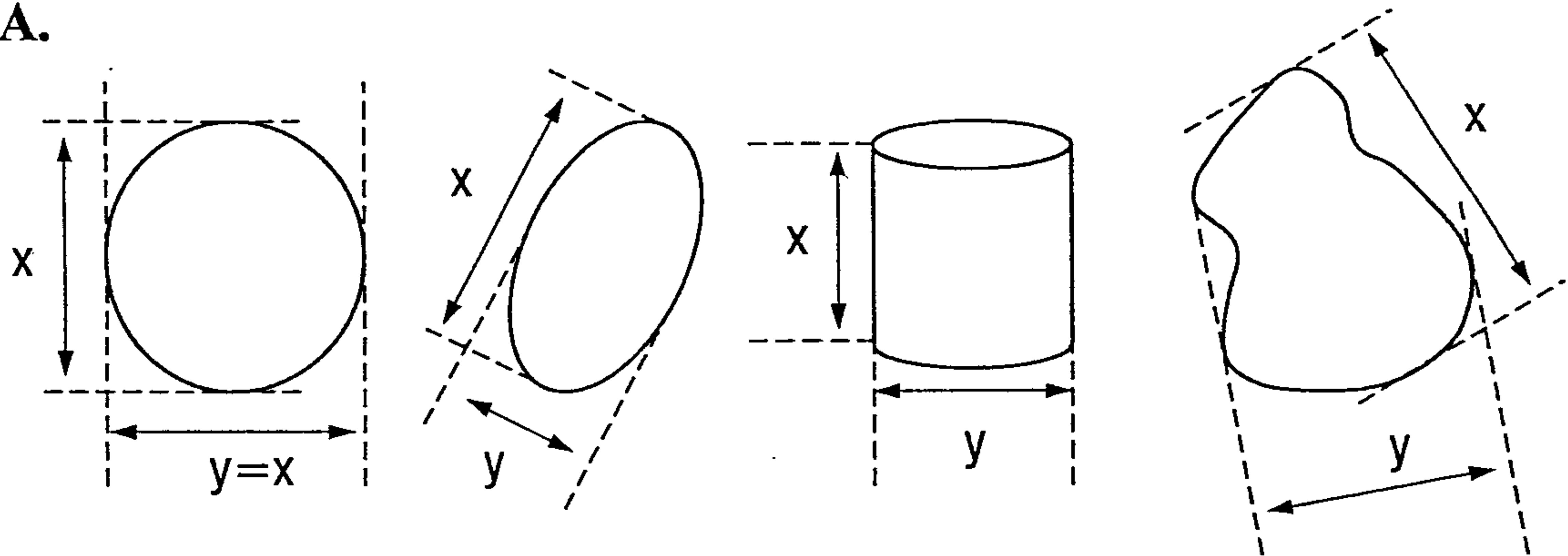
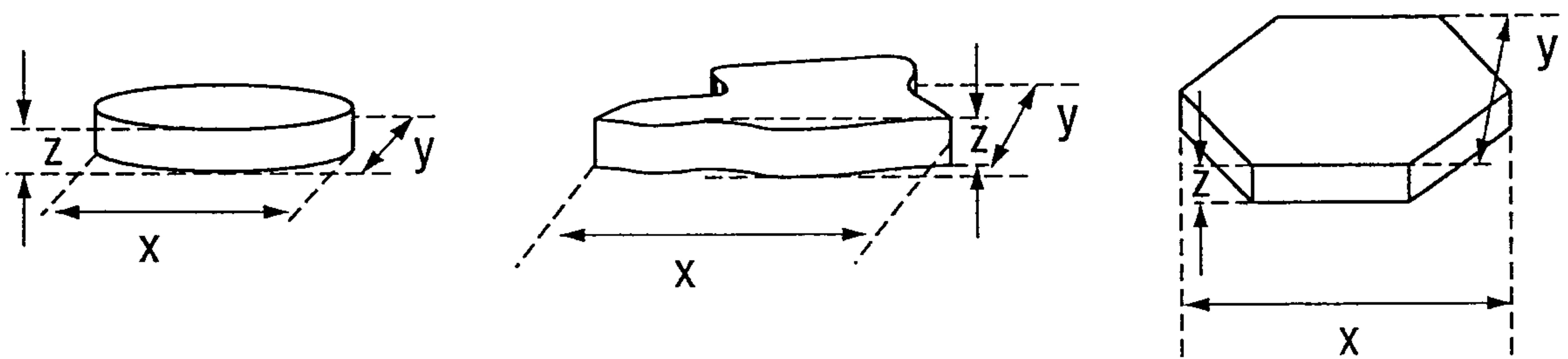
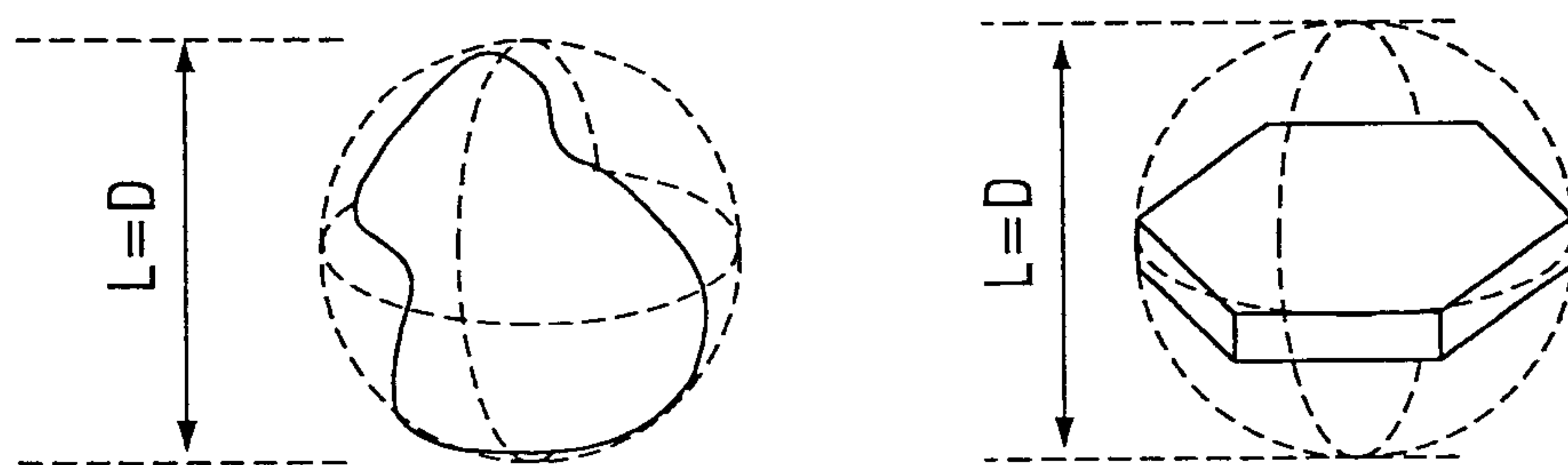
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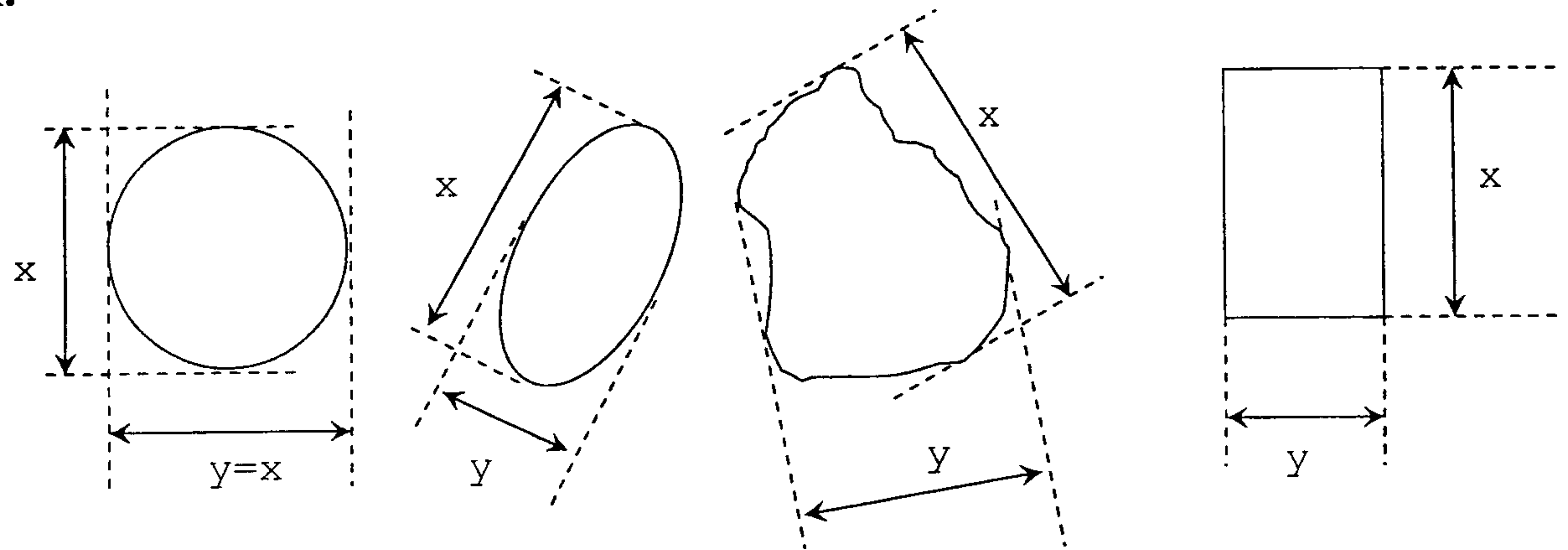
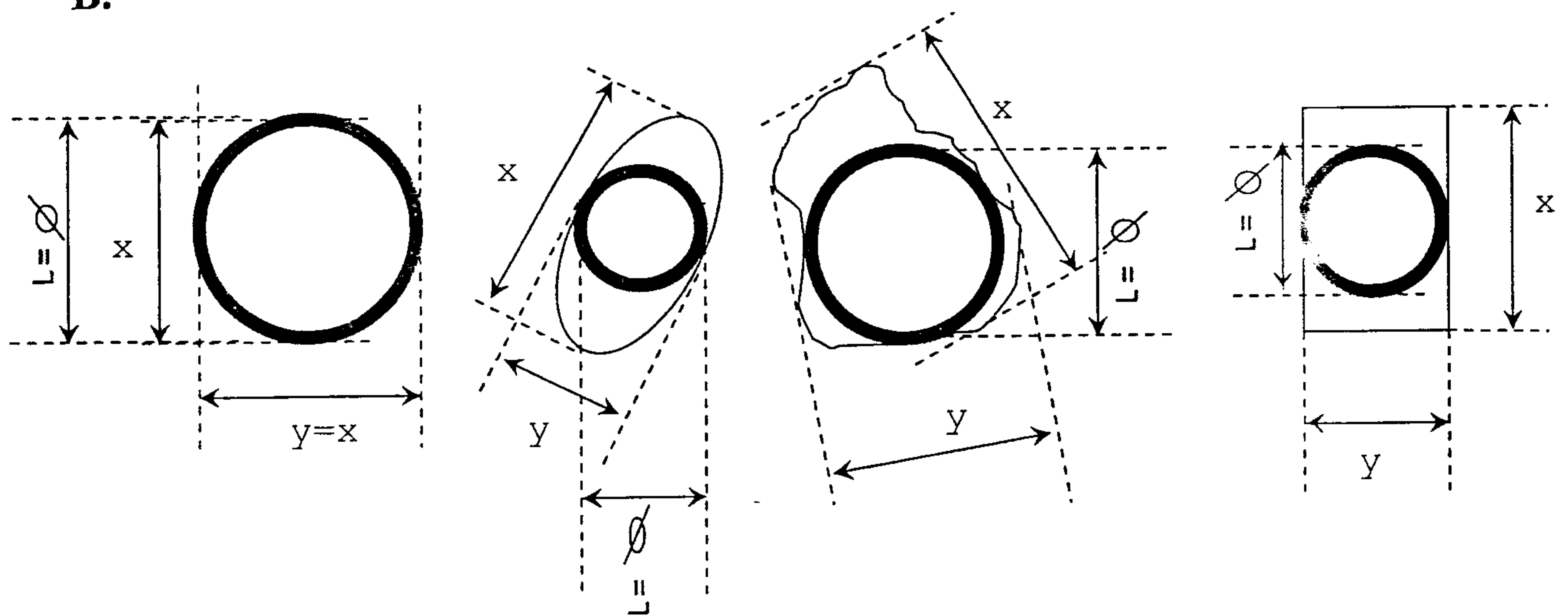
333. The method of claim 332 wherein the first average particle size is between about 6 mm and 20 mm.

334. The method of claim 332 wherein the fracturing the subterranean formation occurs after the creating of the diverting plug.

5 335. The method of claim 332, wherein a size of the first amount of particulates is larger than an average width of a void within the subterranean formation that is intended to be closed or temporally isolated.

336. The method of claim 332, wherein at least one of the first amount of particulates, the second amount of particulates or the second amount of flakes are composite
10 materials.

A.**B.****C.****Figure 1**

A.**B.****Figure 1b**

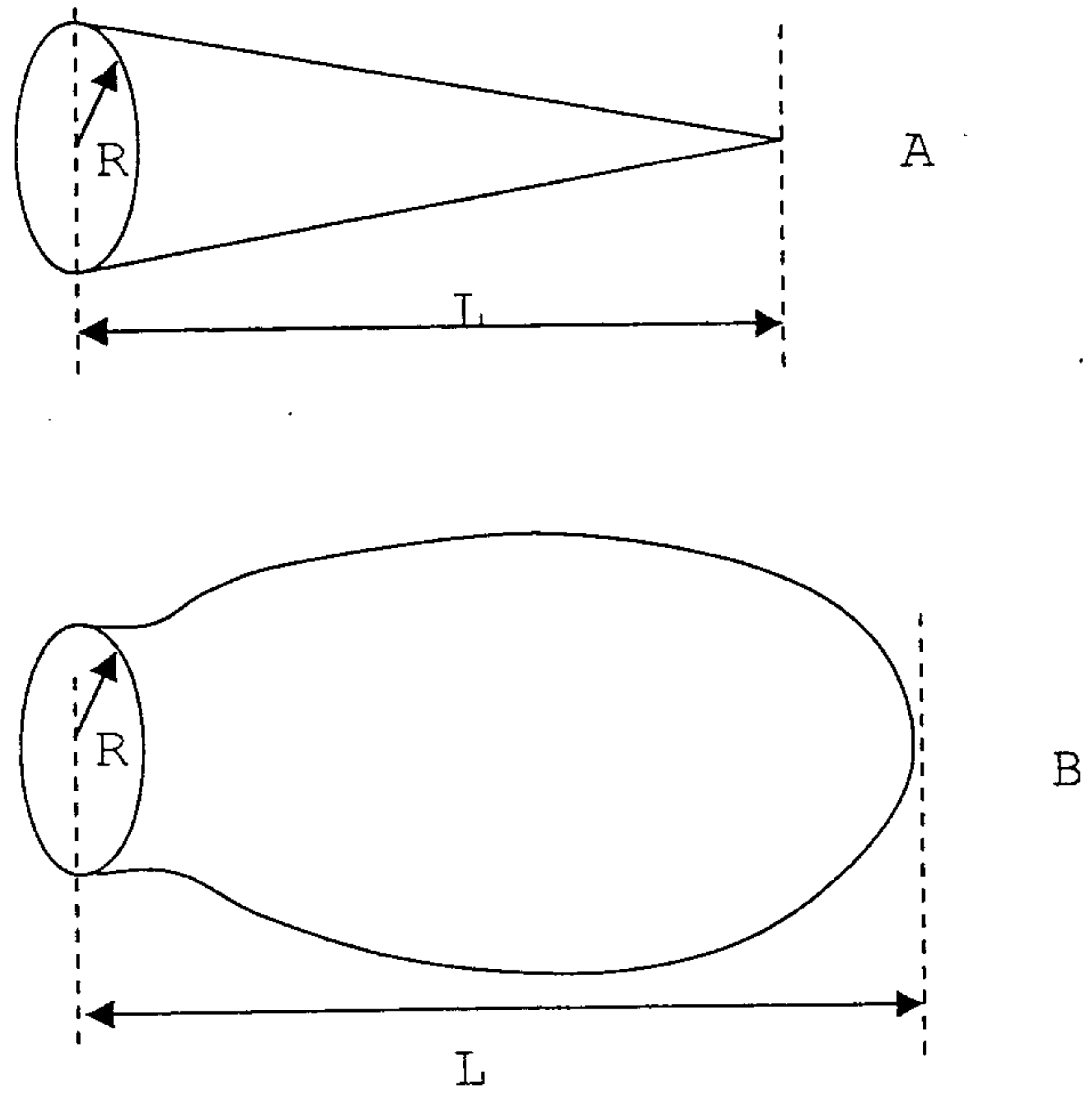


Figure 2

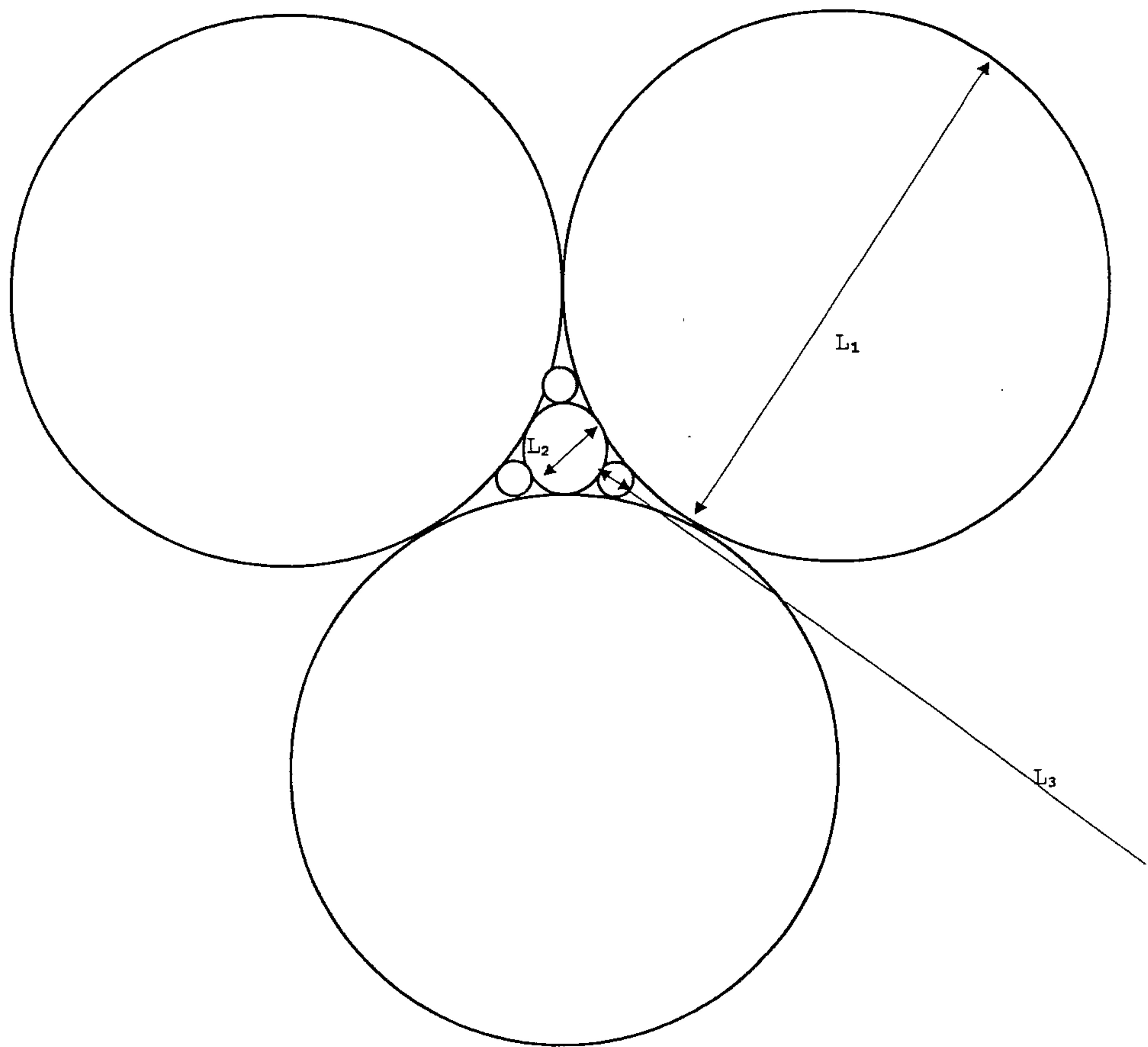


Figure 3

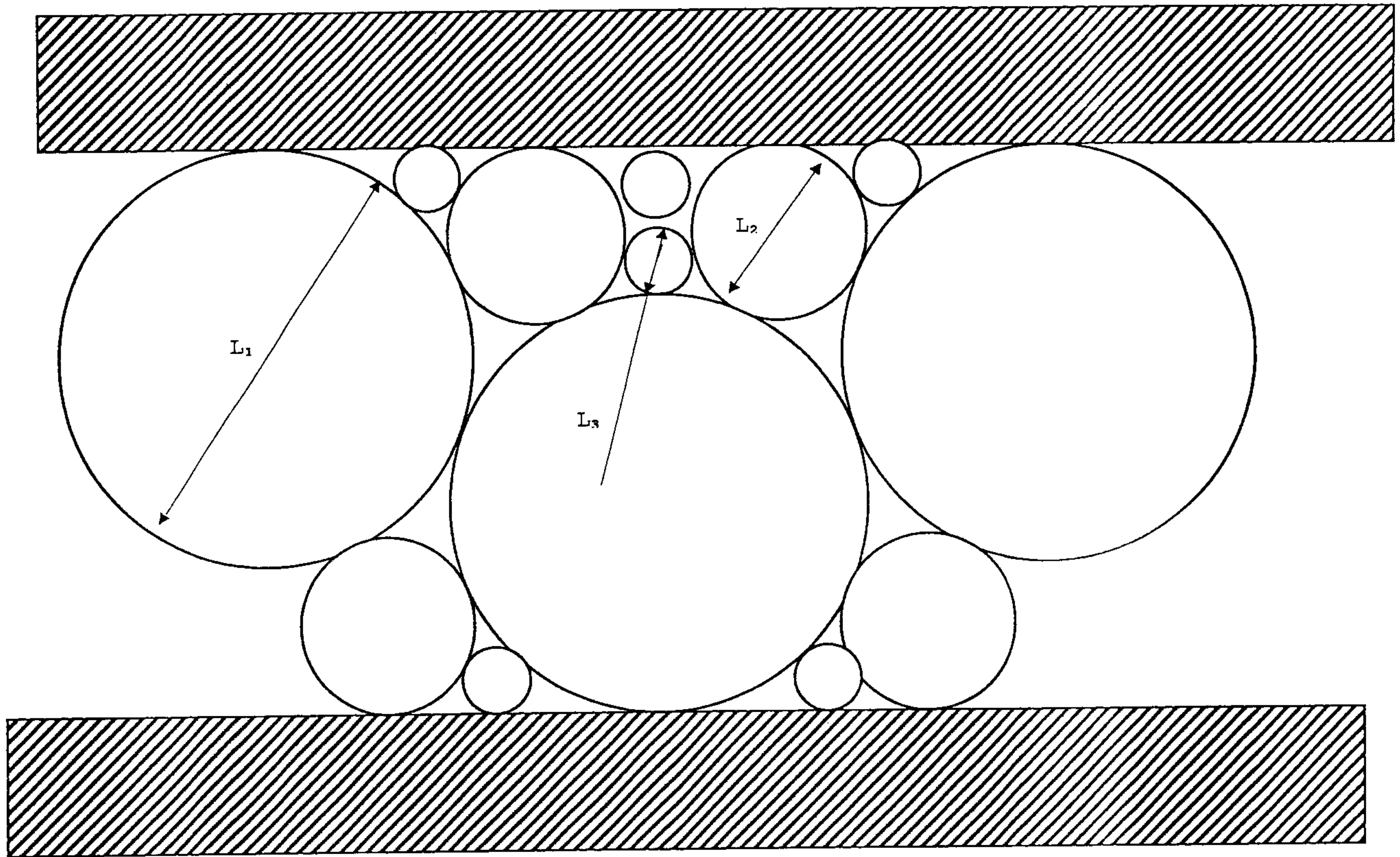


Figure 4

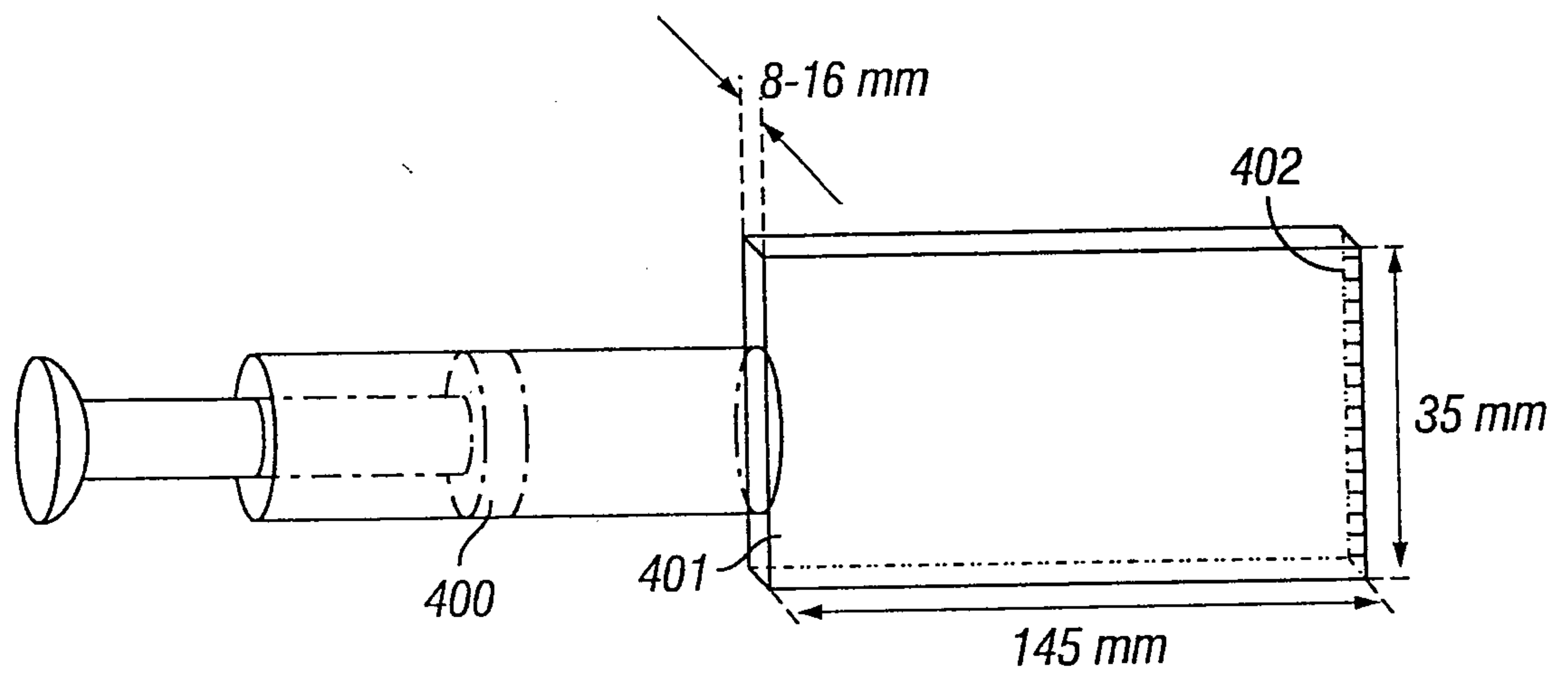
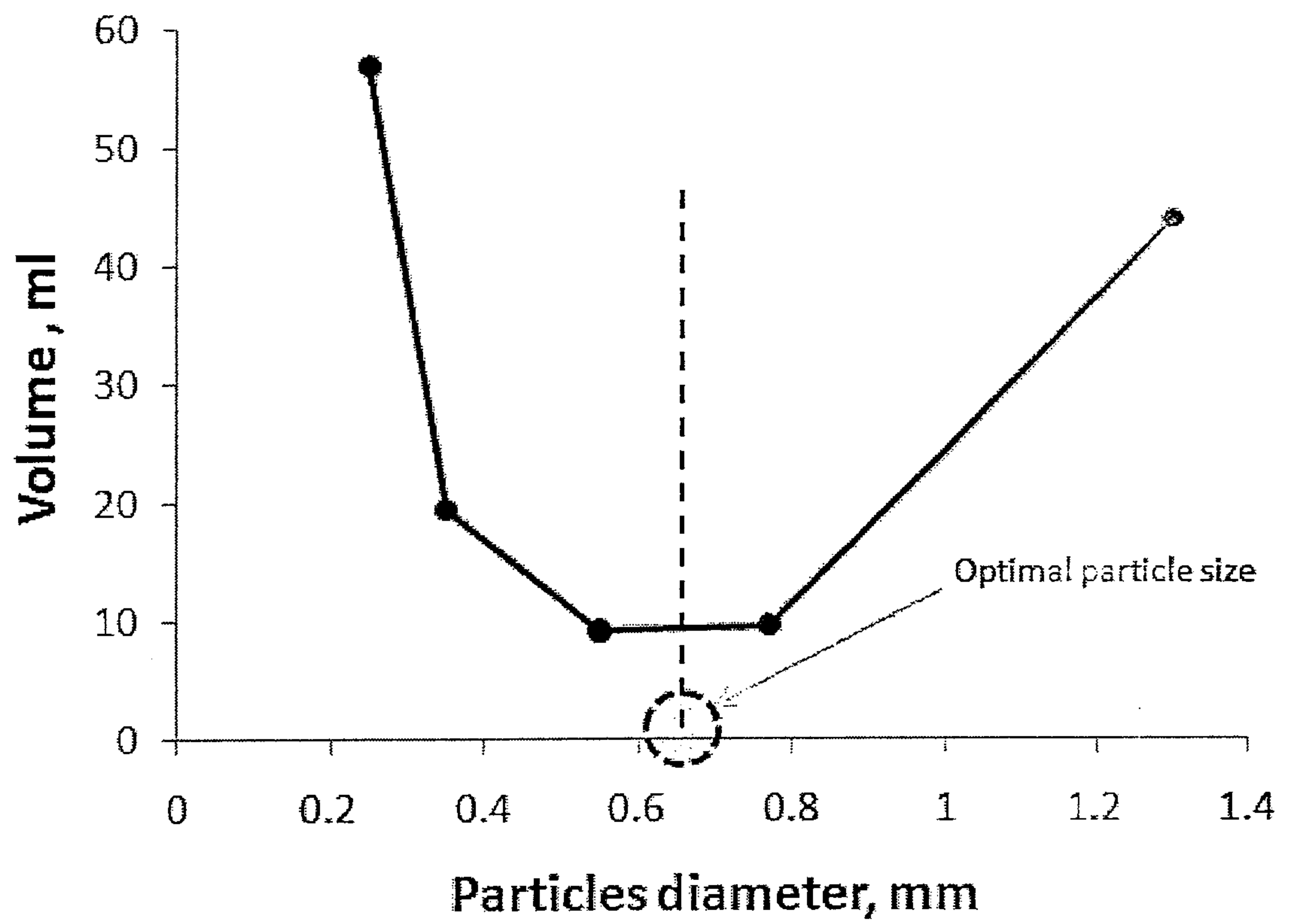
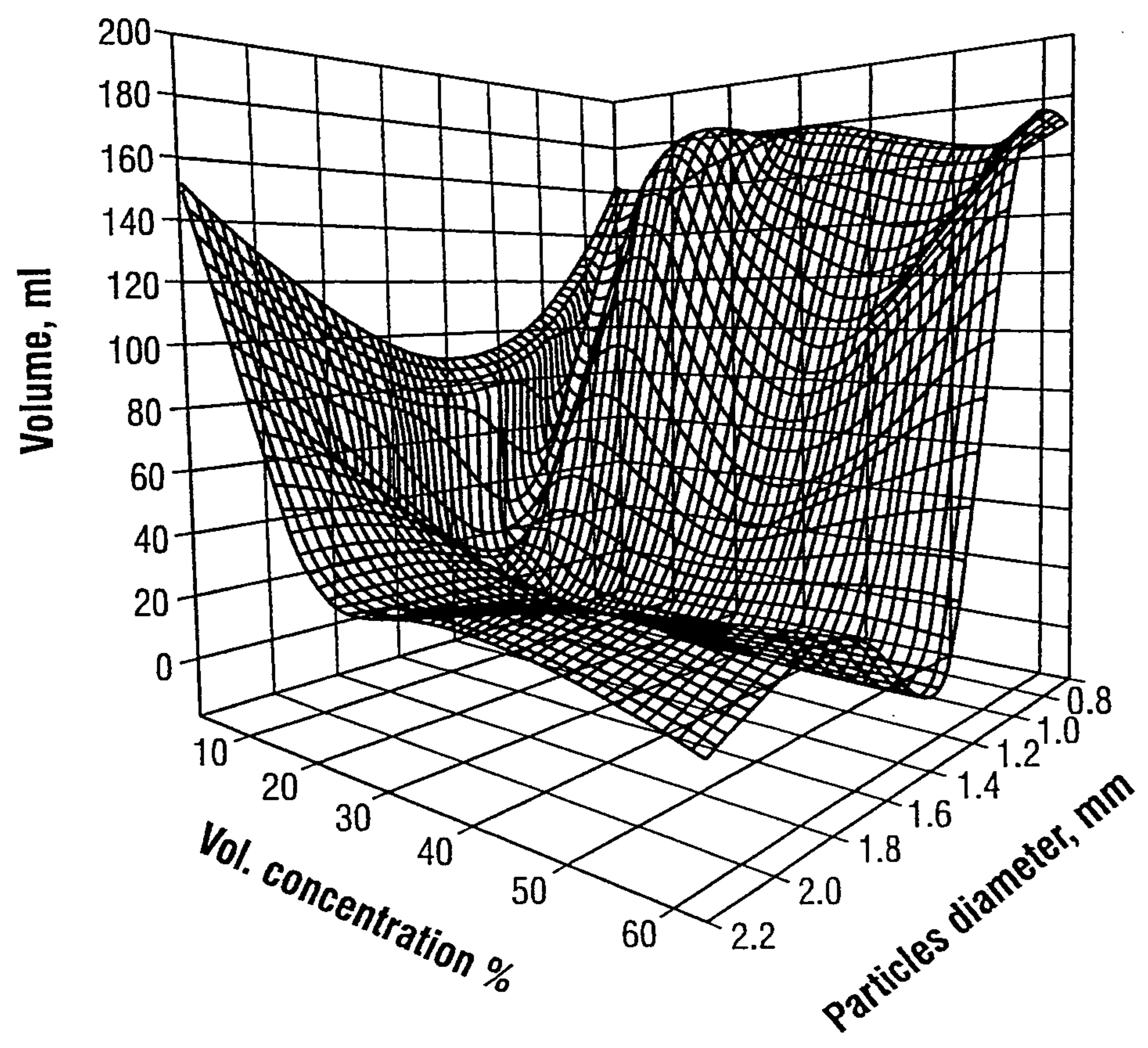


Figure 5

**Figure 6**

**Figure 7**

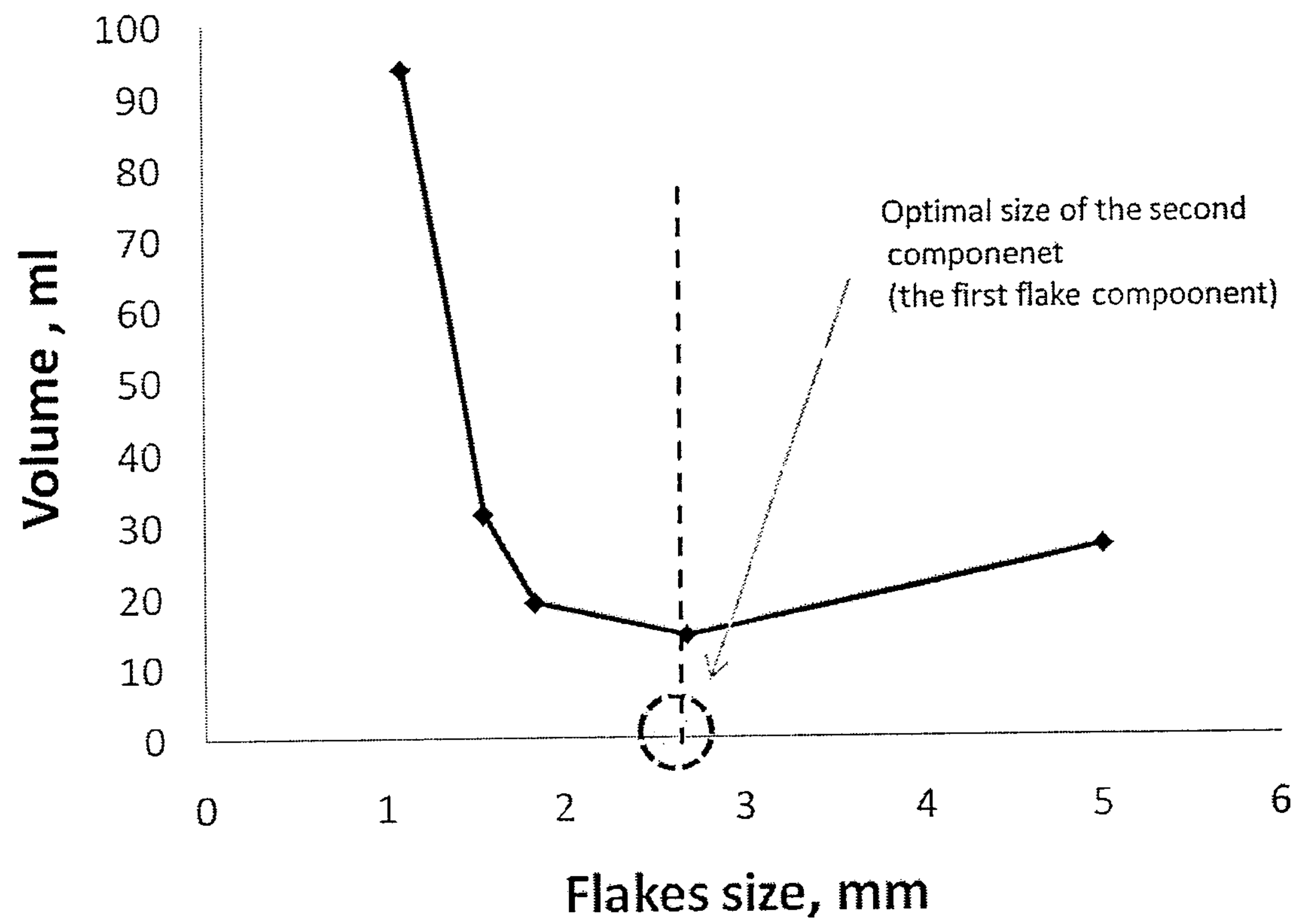


Figure 8

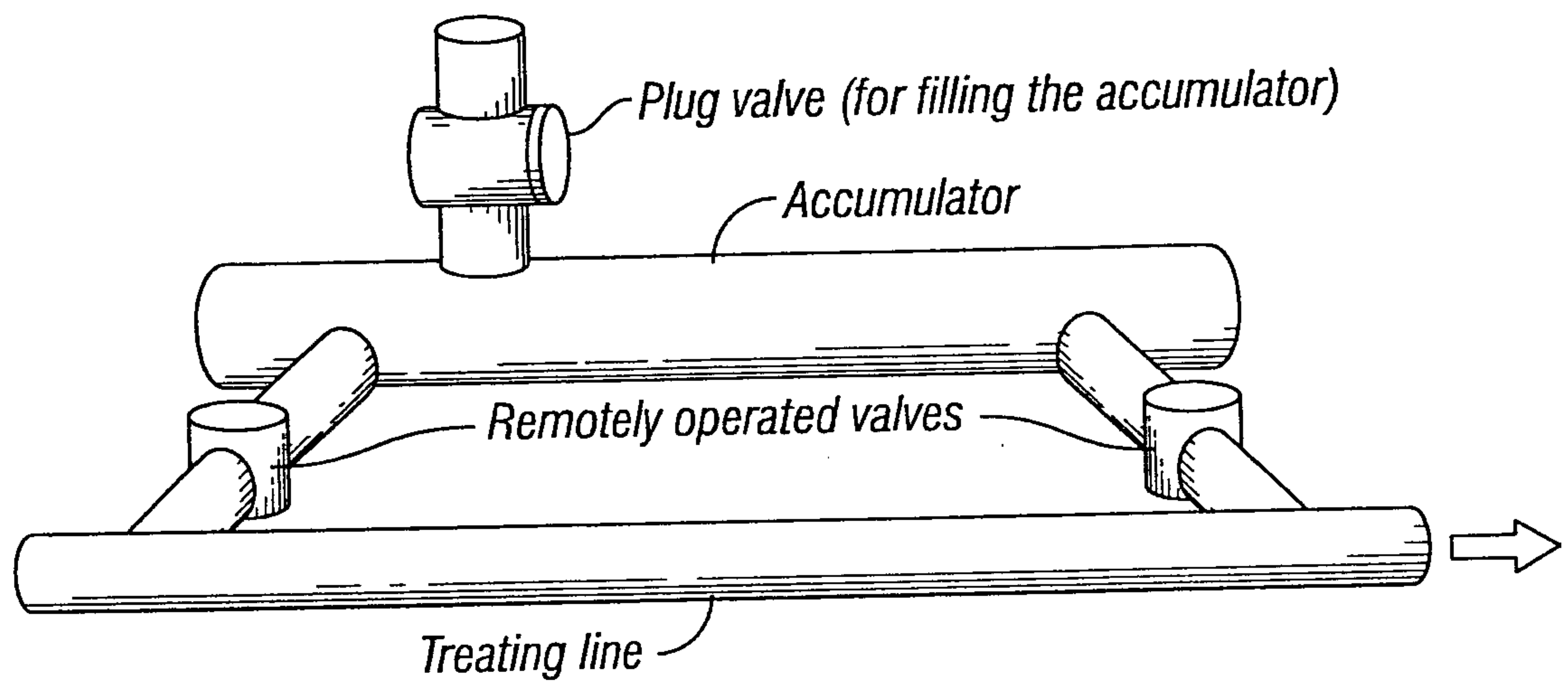


Figure 9

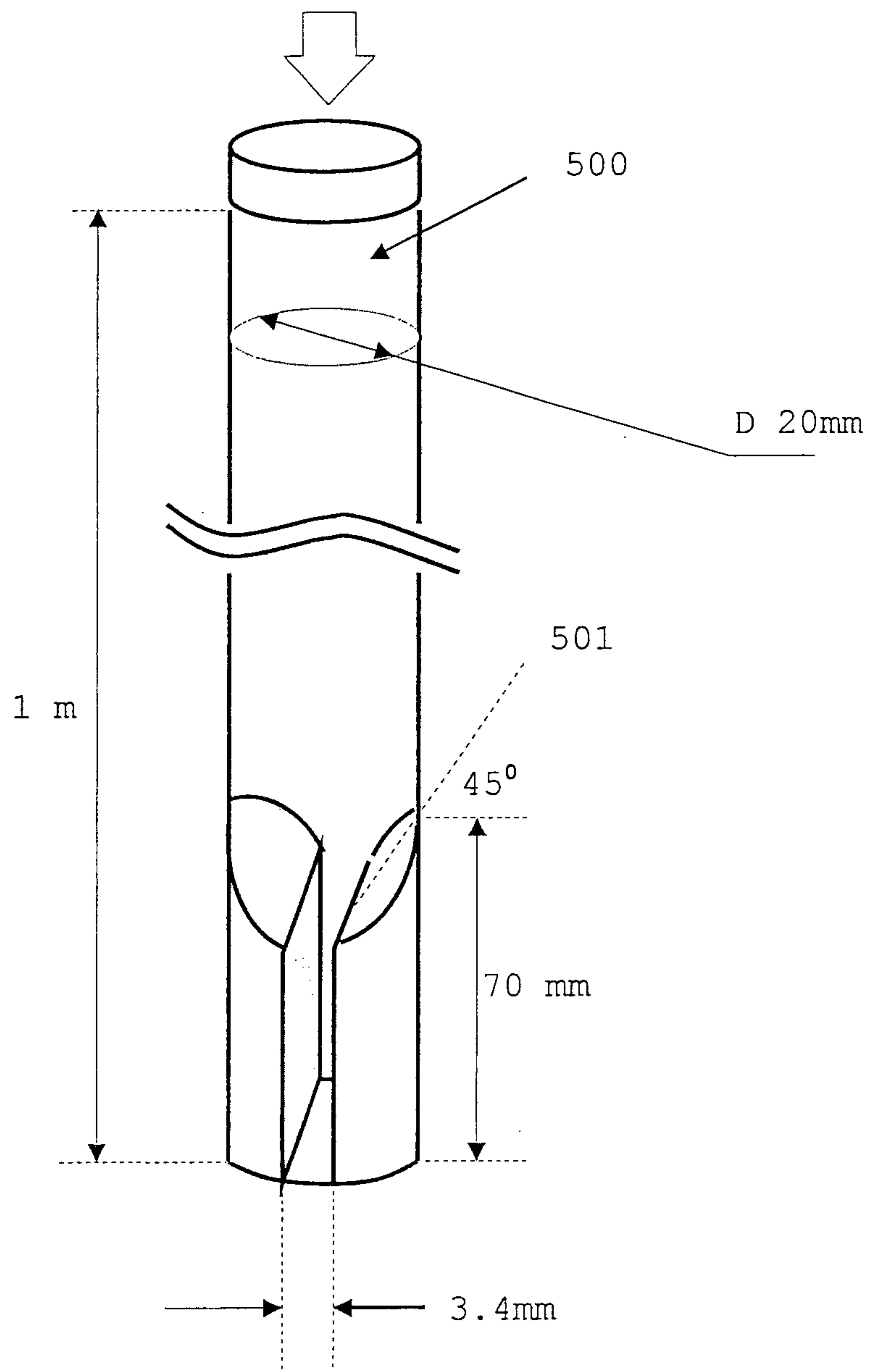
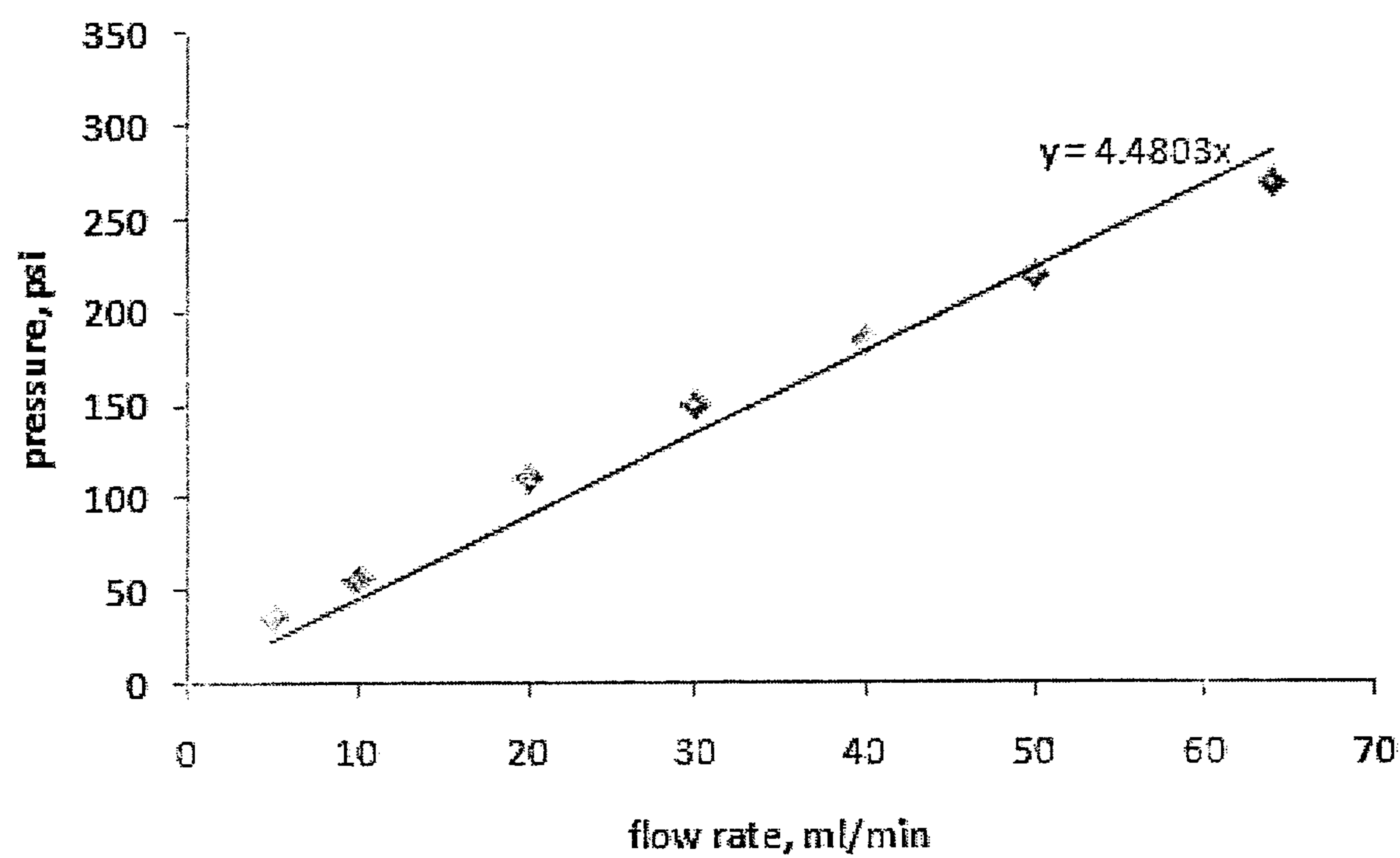
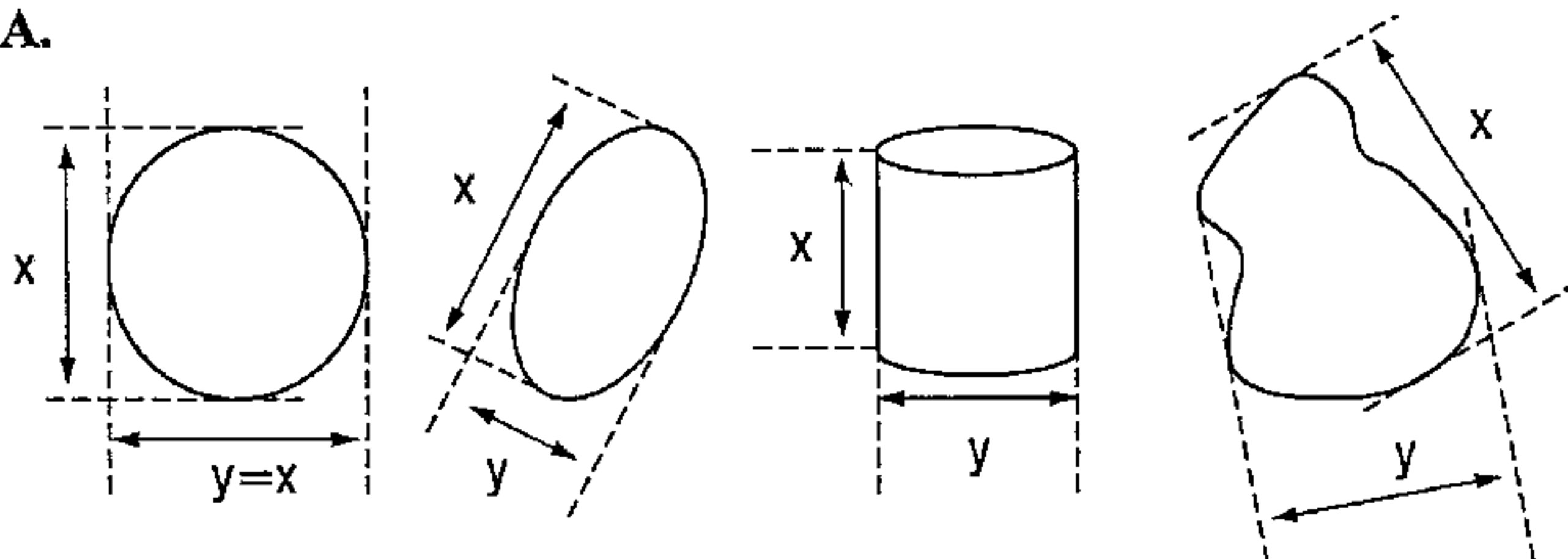
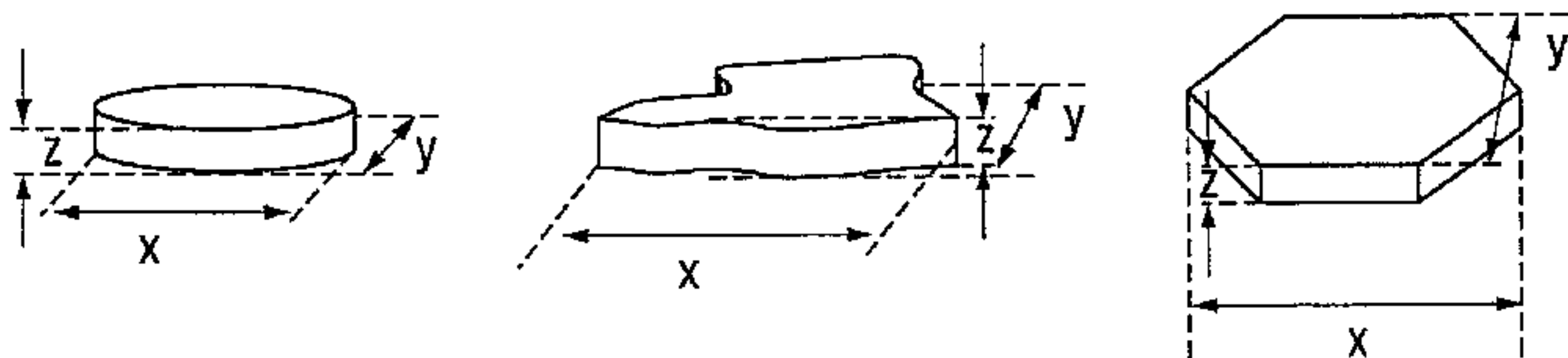


Figure 10

**Figure 11**

A.**B.****C.**