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(54) **Mixing device and method for producing a homogeneous and stable suspension**

(57) The present invention relates to a method and an apparatus for producing a homogeneous and stable suspension. The apparatus produces a homogeneous and stable suspension avoiding all the problems related to storage of large batches of suspension namely, aggregation, flocculation, coagulation, sedimentation and precipitation. Freshly made suspension can be immediately used for further processing as produced in the precise required amount.

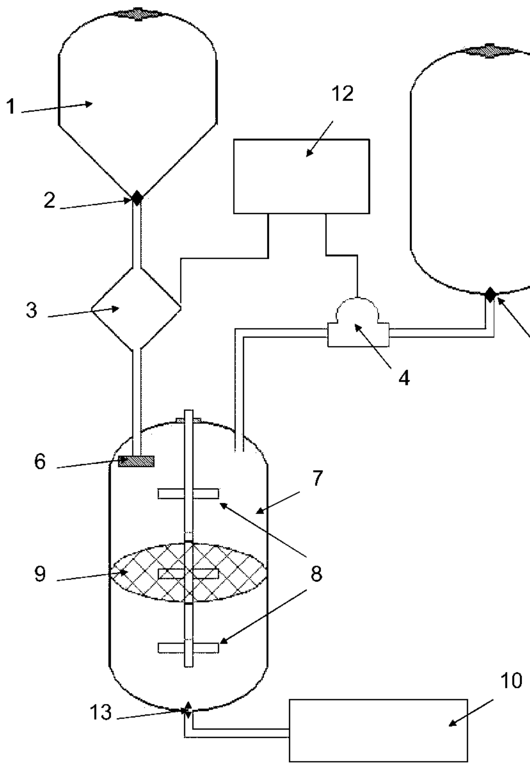

FIG. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a method and an apparatus for producing a homogeneous and stable suspension.

BACKGROUND OF THE INVENTION

[0002] For the purpose of maintaining a non-dissolvable component in a suspension without precipitation and flake formation and at the same time get a suspension to be as homogenous and stable as possible, mixing devices are required. Several solutions to this problem have been provided over the years.

[0003] GB 242,020 discloses an apparatus relating to the extraction, solution and mixture of soluble and insoluble substances. In one aspect the apparatus comprises a first vessel inserted in a second vessel wherein the sides or bottom of the first vessel is perforated allowing an impeller to move fluid from the first vessel to the second vessel.

[0004] US 4,089,050 discloses a device for mixing a powder in a liquid. The mixture of liquid and powder is passed through an impeller and the dispersion obtained is discharged after having passed though a fine mesh grid. By virtue of this arrangement, a small thickness of product having a paste consistency is permitted to accumulate above the grid with the effect of reducing the rate of falling of the paste.

[0005] However, none of these solutions provides a homogeneous and stable suspension. Hence, an improved mixing apparatus which maximize the dispersion of a solid medium into a liquid medium would be advantageous, and in particular a more efficient and/or reliable mixing apparatus which produces a more homogeneous and stable suspension would be advantageous.

SUMMARY OF THE INVENTION

[0006] Accordingly, the invention preferably seeks to mitigate, alleviate or eliminate one or more of the above mentioned disadvantages singly or in any combination by providing a mixing apparatus and method which efficiently produces homogeneous and stable suspension.

[0007] It is a further object of the present invention to provide an alternative to the prior art.

[0008] In particular, it may be seen as an object of the present invention to provide a mixing apparatus that solves the above mentioned problems of the prior art.

[0009] Thus, the above described objects and several other objects are intended to be obtained in a first aspect of the invention by providing an apparatus for mixing at least two media, such as a solid and a liquid medium, to produce a solid-liquid suspension, the apparatus comprising a container in which the mixing takes place, the container comprising: i) at least one inlet through which the solid medium enters into said container, ii) at least one inlet through which the liquid medium enters into said container, iii) rotating means, iv) at least one grid, and v) an outlet through which said solid-liquid suspension leaves the container.

[0010] The previously described objects and several other objects are intended to be obtained in a second aspect of the invention by providing a method for mixing at least two media utilizing a mixing apparatus according to the first aspect of the invention, wherein operating of said apparatus produces a stable and homogeneous suspension.

[0011] In the following, a number of preferred and/or optional features, elements, examples and implementations will be summarized. Features or elements described in relation to one embodiment or aspect may be combined with or applied to the other embodiments or aspects where applicable. As an example, a feature or element described in relation to the flexible frame may be implemented as a step in the method where appropriate. Also, explanations of underlying mechanisms of the invention as realized by the inventors are presented for explanatory purposes, and should not be used in ex post facto analysis for deducing the invention.

[0012] The container may be also referred hereafter as blending tank, as the container is the tank where the mixing/blending of the solid medium and liquid medium take place. In some embodiments, according to the first aspect of the invention, the container has a capacity preferably between 1 and 100 liters, more preferably between 2 and 80 liters, even more preferably between 3-50 liters.

[0013] A suspension is herein defined as a system in which a solid medium, i.e. the dispersed phase, is dispersed in a liquid medium, i.e. the dispersing medium or continuous phase. Therefore, suspension may be also referred hereafter as a dispersion of a solid in a liquid. Generally, being a suspension not a colloid and therefore having a suspension a dispersed medium formed by solid particle with a size that allows precipitation, a suspension eventually settles over time if left undisturbed and produces sedimentation of the dispersed phase.

[0014] The apparatus, according to the first aspect of the invention, through the synergic effect of the features disclosed allows for production of suspensions of a solid medium, such as dry powder, into a liquid medium, such as oil, which has a surprising homogeneity and stability.

[0015] Stabilization may be steric or electrostatic stabilization, i.e. based on size or based on the mutual repulsion as the particles of the dispersed phase have similar electrical charges. For example, small particle sizes have enormous surface areas which in turns produce steric stabilization.

[0016] A stable suspension is herein defined as a suspension where the mass of the particles of the dispersed phase is so low that their buoyancy is too weak to overcome the electrostatic repulsion between the particles of the dispersed phase, so as to avoid precipitation.

[0017] Several are the parameters affected by the mixing in the apparatus which lead to the formation of a stable suspension.

[0018] For example, stability may be obtained by optimizing the ratio between the size of the particles in the dispersed phase and the viscosity of the continuous phase.

[0019] The particle size is crucial for obtaining stable suspension. The features described according to the first aspect of the invention allows for reduction of the particle size of the dispersed phase to a minimum. Minimum is intended as the minimum size obtainable taking into consideration the particle size at the inlet of the blending tank.

[0020] A grid is herein defined as any device which performs the function of reduction of lumps into a finely dived state. The presence of the grid allows for reduction of the particle size of the dispersed phase to a value close to, if not equal to, the particle size introduced into the container, e.g. 1 μm.

[0021] The high stability of the suspension formed in the apparatus for mixing according to the first aspect of the invention is also obtained through the synergic effect of all the features of the apparatus which allows mixing without physical deformation of the particles in the dispersed phase, e.g. stretching. Generally, physical deformation allows for increase of the Van der Waals forces over stabilization forces, e.g. electrostatic stabilization, resulting in coagulation and precipitation of the particles suspended. The synergic effect of the features described avoids interparticle attraction which leads to particle aggregation.

[0022] In some embodiments, if any aggregate formation may occur, the at least one grid allows for disaggregation of aggregate bodies of said solid medium into original particle size. Examples of aggregate bodies are flakes, lumps and chunks of solid material. Disaggregation is defined as the separation of an aggregate body into its component parts.

[0023] The synergic effect of the mixing apparatus provides stable suspension also by avoiding particle cluster formation. Clusters, which would fall to the bottom of the suspension, or eventually float on the top if the particles are less dense than the dispersing medium, are avoided as the flow caused by the rotating means keeps the particles in suspension overcoming the gravitational forces.

[0024] In the container a measure of stability of the suspension can be evaluated by measuring the sedimentation rate or the flocculation rate, by measuring turbidity or by direct particle counting.

[0025] A homogenous suspension is herein defined as a suspension where the concentration of particles of the dispersed phase is evenly distributed in the continuous phase. A suspension may be therefore defined not-homogenous when depending of the sampling position in the suspension, different concentration of dispersed phase maybe found.

[0026] In some embodiments according to the first aspect of the invention the rotating means is adapted to mix the at least two media and to generate a flow within the container going through said at least one grid.

[0027] The flow generated by the rotating means provides the advantage of further mixing the media and of destroying/disaggregating agglomerate bodies which may be formed during the mixing process.

[0028] Mixing a solid and a liquid medium so as to produce a flow which goes through at least one grid has therefore the function of reducing any compact mass such as flakes, aggregates bodies, lumps and chunks of solid material into a finely dived state. This has the effect of producing a finely divided solid which in turns allows for formation of a homogeneous solid-liquid suspension as previously described.

[0029] The apparatus for mixing and the method according to the first and second aspect of the invention may be used as part of a vacuum infusion manufacturing line, for example for production of extruded food products. The suspension produced, for example between micro organisms and oil, could be used for manufacturing of probiotic based products by being introduced into a vacuum infusion system.

[0030] In this specific application the apparatus for mixing according to one aspect of the invention allows for maximization of the dispersion of the probiotic micro organisms throughout the oil. In that respect a further advantage of the present invention is that the mixing apparatus and method produce a stable and homogenous suspension so that it can be further processed without any further mixing intermediate step.

[0031] In some other embodiments the at least one inlet through which the solid medium enters into the container comprises means for sifting said solid medium.

[0032] Means for sifting may be any device which separate out, by passing through a sieve or other straining devices, coarser elements. For example, means for sifting are meshes, nets, filters, strainers, wire screens, woven strands such as web or nets, made of metal, fibers or composites, such as polymer composites. For example plastic meshes may be extruded, oriented, expanded or tubular. Metal meshes can be woven, welded, expanded, photo-chemically etched or electroformed (screen filters) from steel or other metals.

[0033] From the inlet large and small particles of the solid medium may enter the container. Large particles size in suspension formation are undesired as large particles may increase their size during mixing to a higher extend than smaller particles, which tend to be more soluble and to be dissolved. The presence of sifting means ensures that only particles with small size, determined by the mesh size of the sifting means enter the container. The presence of sifting means also ensures that the particles will have a substantially equal particle size within a range between the value of the mesh size and the minimum value of the powder provided.

[0034] The sifting means also allows for a slow rate of addition. Gradual addition avoids the probability of flocculation of the suspension.

[0035] The sifting means can be designed accordingly to the needs as a function of the solid medium physical/chemical properties, such as average size, morphology and composition. For example, the cell size of the sifting grid may vary from 1 μm to 5 mm.

[0036] Other parameters which may influence the sifting means design are, e.g. type of rotating means used, size of the container, solid medium particle size distribution, liquid medium viscosity. Taking in consideration all the parameters an appropriate sifting means can be designed as to obtain after mixing a homogeneous and stable suspension.

[0037] In some other embodiments the rotating means is located outside the container.

[0038] In these embodiments the container may be a rotating drum, such as a rotating kiln reactor. The container may be journalled for rotation on bearings, while the rotation may be induced by an external variable speed motor, gear and rotating means though a fluid film bearings or rolling element bearings.

[0039] In some embodiments, the container comprises a plurality of protrusions adapted to generate a non laminar flow, such as a turbulent flow within the container.

[0040] Protrusions may be any element inside the container with the function of generating non laminar flow. Examples of protrusions are ribs or ribbons internally connected to the container. Other examples are cavities, fins or blades located along the container.

[0041] In the specific embodiment where the rotating means are located outside the container, protrusions may be also located along a central shaft fixed to the container which rotates together with the container. The rotation of the container comprising these protrusions generates non-laminar flow of the suspension internally contained.

[0042] In some embodiments the said rotating means is located inside the container.

[0043] In these embodiments the container may be a stationary drum having internal rotating elements, i.e. rotating means, therefore the bearings of the rotating part may be provided on a central shaft.

[0044] When said rotating means is located inside the container, the rotating means comprises a plurality of protrusions generating swirling motions of the solid-liquid suspension.

[0045] In some other embodiments, when the rotating means is located inside the container, the rotating means comprises a plurality of protrusions generating non laminar flow such as a turbulent flow within the container.

[0046] Rotating means is herein defined as rotating elements such as impeller, propeller, blades or rotating discs. The function of these elements is to produce motion within the suspension present in the blending tank so as to generate swirling motion and produce a homogeneous and stable suspension.

[0047] In some embodiments rotating means rotates at speed between 1 and 1000 rpm, more preferably between 3 and 800 rpm, even more preferably between 5 and 500 rpm.

[0048] In some preferred embodiments, when the rotating means is located inside the container the rotating means is or comprise an impeller.

[0049] In some embodiments the rotating means comprises an axial flow impeller. This imposes essentially bulk motion to the suspension as to provide optimal homogenization.

[0050] In some other embodiments the rotating means comprises a radial flow impeller. This imposes essentially shear stress to the suspension so as to produce an optimal mixing in suspension with very viscous continuous phase, e.g. oil.

[0051] In some embodiments, the apparatus for mixing according to the first aspect of the invention further comprises at least one storage tank for storing the solid medium and at least one storage tank for storing the liquid medium both connected to the container.

[0052] In some other embodiments the apparatus for mixing according to the first aspect of the invention further comprises: i) at least one measuring device for measuring the solid medium, located along the connection between the at least one storage tank for storing the solid medium and the container, and ii) at least one measuring device for measuring the liquid medium, located along the connection between the at least one storage tank for storing the liquid medium and the container.

[0053] In some other embodiments the apparatus for mixing further comprises controlling means for controlling the amount of media to be introduced into said container.

[0054] Controlling means may be opening and closing valves in or out of the storage tank for storing the solid or liquid medium or in or out of the measuring devices.

[0055] Controlling means may be also an electronic device which coordinates measuring devices with the needs in the containers.

[0056] In some embodiments according to the second aspect of the invention the method for mixing at least two media in a container to produce a stable and homogeneous suspension comprises: introducing a solid medium into the container, introducing a liquid medium into the container, mixing the at least two media to generate a flow going through at least one grid.

[0057] In some embodiments according to the second aspect of the invention the method further comprises sifting said solid medium while introducing it into said container.

[0058] In some other embodiments according to the second aspect of the invention the method further comprises: measuring a precise amount of the solid medium before introducing it into said container, and measuring a precise amount of the liquid medium before introducing it into the container.

[0059] Precise amount is the amount which is necessary in order to obtain a homogeneous and stable suspension by operating the apparatus for mixing according to the first aspect of the invention.

[0060] When employed in a process line, precise amount is also defined as the precise amount requested for further processing. So that it may be seen as a further advantage of the present invention to provide a mixing apparatus and method which produce stable and homogenous suspensions in the precise amount requested for further processing. Producing suspension in the precise amount needed in the further processing has the advantage that storage of the suspension is not required.

[0061] For example, in vacuum infusion process lines, batches in the order of few liters, e.g. 3-8, are used. However, normally suspension are prepared in large batches, e.g. 250-450 kg to which follows intermediate mixing chambers which will mix the 3-8 liters of oil and 300 gr of dry powder required from the following process. Producing suspension in the precise amount needed in the further processing, e.g. the vacuum infusion process, has the advantage that all the problems related to storage of large batches of suspension namely, aggregation, flocculation, coagulation, sedimentation, precipitation are avoided. Furthermore, mixing devices, which generally are present in suspension storage tanks in order to maintain a stable dispersion, are, in process line which employs the present method, not required as the amount of freshly produced suspension can be immediately used for further processing.

[0062] Specifically, in the vacuum infusion of kibbles with probiotic micro organisms/oil suspension, the production of the precise amount needed in the vacuum infusion process, ensures that probiotic micro organisms are thoroughly mixed just before the particular batch of kibbles is exposed to vacuum. Using a precise amount also allows for minimal exposure to vacuum of the kibble.

[0063] A further advantage obtained by preparing the precise amount required by the following process is that this method avoids temperature increase or any other factors that might affect the dry powder suspended in the liquid for the whole production period in a large tank. This is particular relevant when the dispersed phase contains, for example micro organisms, and the continuous phase, oil.

[0064] The first, second aspect of the present invention may each be combined with any of the other aspects. These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE FIGURES

[0065] The apparatus and method according to the invention will now be described in more detail with regard to the accompanying figures. The figures show one way of implementing the present invention and is not to be construed as being limiting to other possible embodiments falling within the scope of the attached claim set.

Figure 1 shows schematically a preferred embodiment of the invented homogenous suspension blending device.

Figure 2 shows schematically a preferred embodiment of the method used to archive high homogeneity and dispersion stability of the final suspension.

DETAILED DESCRIPTION OF EMBODIMENTS

[0066] Figure 1 shows schematically a preferred embodiment of the invented homogenous suspension blending device. The preferred embodiment of the invented device comprises of two storing means, one tank for storing raw dry powder (1) and one tank for storing raw oil (5). The storing for raw dry powder (1) could have a storage size between 5-350 kg, depending on the capacity of the production line (10), and have to be made of a stable and neutral materials, suitable for storing micro-organisms and/or biological active material, such as stainless steel, polytetrafluoroetylen (PTFE) or food graded plastics. For storing the raw oil (5) a storage tank with a size varying from 5-5000 l, depending on the capacity of the production line (10), and made of any suitable material that servers the purpose such as, but not limited to, stainless steel, plastic, glass or composite materials, could be used. The opening and closing of the outlet mechanisms (2,11) of these two storing tanks (1,5) are controlled by controlling means (3, 4). The outlet mechanism (2) of the tank for storing raw dry powder(1) is controlled by a precise powder scaling system (3) and the outlet mechanism (11) of the tank for storing raw oil (5) is controlled by a precise oil measuring device (4), such as a weighting box or a pump with a flow counter. These are designed to measure precise amounts, of the materials to be blended, either by weight and/or by volume. The powder scaling system (3) and the oil measuring device (4) could be controlled by a controlling mean such as a pre-programmed electronic control device (12). In the electronic control device (12) information regarding the precise powder/oil ratios required for a batch cycle of a suspension with desired characterics are pre-programmed and stored. The precisely measured amount of raw powder and oil is transferred to the blending tank (7) through single or plurality of individual inlets. The volume of the blending tank (7), in this preferred embodiment, could vary from 3-50 l, depending on the needs of the production plant, and be made of a range of materials such as stainless steel, plastic, glass or composite materials, and shapes such as cylindrical, conical, spherical or others. In this embodiment the orientation of the blending tank is vertical, which is having the maximum inclination in respect to the direction of the suspension flow between the inlet of the powder and oil and the outlet of the suspension. In other embodiments the blending tank may be positioned with a different degree of inclination, which may facilitate the flow of a suspension with the desired properties by means of gravity. A different negative inclination may also be achieved by a particular shape of the blending tank, e. g. a conical shape. The powder sifting device (6) a sifting grid with cell size, that could vary from 1 μm to 5 mm, is located between the powder scaling system (3) and the blending tank (7), preferably the sifting device (6) is mounted just before the powder submerges into the raw oil and/or suspension in the blending tank (7). The sifting device (6) removes and/or breaks and/or mashes, e.g. sifts, oversized particles in the powder prior to the powder being introduced into the blending tank (7), hence ensuring that only small and equalised particle sizes of the powder enters the blending tank. To achieve good sifting, a broad range of suitable types of devices could be used such as pneumatic, centrifugal, reclaim, vibration sifters and in a range of suitable materials such as plastic, polytetrafluoroetylen (PTFE), glass, stainless steel, composite materials. The blending tank (7) comprises a plurality of means, in this preferred embodiment these are: rotating means for mixing (8) that could have one or a plurality of rotor(s) and/or impeller(s), these could have different numbers and shapes of the blades depending on the chemical/ physical parameters of the oils, powder and/or suspensions, The blending tank (7) will further comprise one or a plurality of mixing grids (9) used to break the laminar flow and achieve non-laminar flow and/or turbulent flow in the blending and mixing process. These means could further be used to mash and/or break and/or destroy flake formations, sedimentation and clotting which could appear from aggregation of particles during blending processes. For extra modulation of the flow, in the blending tank (7), ribbons and/or ribs (not shown) could be used in conjunction with the mixing grid(s) (9). The design of the mixing grid(s) (9), ribbons and ribs (not shown) are determined by the design of the blending tank (7). For this embodiment, preferred size of the grid cells may vary from 1 mm to 5 cm. A plurality of suspension outlet(s) (13) is/are connected to the blending tank (7) and used to transfer the final suspension product to manufacturing equipments or production plants (10).

[0067] Figure 2 shows schematically the method used to achieve high homogeneity and dispersion stability of the final suspension, according to an embodiment of the invention. A batch cycle starts by precisely measuring a required amount of raw oil for one run of the production line or manufacturing plant (20). Raw oil from a storage tank (15) is precisely measured using an oil measuring device (18) such as a weighting box or a pump with a flow counter. The amount of oil used in a batch cycle is determined by the needs of the production plant and could be up to the maximum capacity of the blending tank (19) according to one aspect of the invention. The maximum capacity may vary from the maximum size of the blending tank may receive to an optimal capacity modulated to obtain optimal mixing flow, e.g. 3-50 l. The size of the blending tank (19) is smaller if compared to what is normally used in an average production line. This provides the advantage of reducing flake formation, sedimentation and clotting. The amount of raw oil, that should be precisely measured and taken out from the oil storing tank (15) for each batch cycle, may be stored in a pre-programmed electronic control device (16). This electric control device (16) may also stores parameters on how much dry powder is needed for each batch and for different cycle. The electric control device (16) could also be used to store information and control such parameters such as temperature and speed of mixing as well as other parameters that could be used to optimise the blending and mixing process in order to receive the desired property of the suspension, regarding homogeneity and dispersion stability. After the blending tank (19) has received the pre-programmed amount of raw oil, following the measuring of the precise amount of dry powder, the addition of the dry powder begins. The amount of powder is preferable in the range of 10g to 5kg per batch cycle. In a preferred embodiment 40g of powder per litre of raw oil may be used. The precise amount of powder, from a dry powder storing tank (14), is measured using a precise powder scaling system (17) controlled by an electronic control device (16).

[0068] When the required amount of dry powder is measured, the powder is transferred to a sifting device. Sifting the powder before introducing it to the raw oil and/or suspension will equalize the particle size, of the already small particles in the powder, leading to better solubility and therefore a better homogeneity and dispersion stability of the final suspension. After being sifted, the powder is gradually introduced and mixed with the raw oil and/or suspension in the blending tank (19) hence avoiding flocculation and therefore achieving the wanted dispersion stability and homogeneity of the suspension. To further increase the homogeneity and dispersion stability of the suspension different means, such as grids that could be used in conjunction with ribbons and/or ribs, are used to break laminar flow and to create and maintain a preferred non-laminar flow and/or turbulent flow in the blending tank (19). The ribbons and ribs could be used as extra features in conjunction with the grids to further modulate the flow in the tank. The grid means could also be used for break and/or mash flake formations, sedimentation and/or clotting that could appear in the suspension during the blending process. The size, shape and material of the blending tank (19), mixing means and means for achieving non-laminar flow and/or turbulent flow could vary from different production and batches depending on the need of the production line (20) and the physical and/or chemical properties of the raw oil and/or the dry powder being used. After one cycle is finished, the blending tank will be emptied through one or a plurality of outlets and the suspension transferred to the production line or manufacturing plant (20).

[0069] Although the present invention has been described in connection with the specified embodiments, it should not be construed as being in any way limited to the presented examples. The scope of the present invention is set out by the accompanying claim set. In the context of the claims, the terms "comprising" or "comprises" do not exclude other possible elements or steps. Also, the mentioning of references such as "a" or "an" etc. should not be construed as excluding a plurality. The use of reference signs in the claims with respect to elements indicated in the figures shall also not be construed as limiting the scope of the invention. Furthermore, individual features mentioned in different claims, may possibly be advantageously combined, and the mentioning of these features in different claims does not exclude that a combination of features is not possible and advantageous.

Claims

1. An apparatus for mixing at least two media, such as a solid and a liquid medium, to produce a solid-liquid suspension, said apparatus comprising a container in which the mixing takes place, the container comprising

    - at least one inlet through which said solid medium enters into said container,
    - at least one inlet through which said liquid medium enters into said container,
    - rotating means,
    - at least one grid, and
    - an outlet through which said solid-liquid suspension leaves the container.

2. An apparatus for mixing according to claim 1, wherein said rotating means is adapted to mix said at least two media and to generate a flow within the container going through said at least one grid.

3. An apparatus for mixing according to claim 1 or 2, wherein said at least one inlet through which the solid medium enters into the container comprises means for sifting said solid medium.

4. An apparatus for mixing according to any of the preceding claims, wherein said rotating means is located outside the container.

5. An apparatus for mixing according to claims 1-3, wherein said rotating means is located inside the container.

6. An apparatus for mixing according to claim 5, wherein said rotating means comprises a plurality of protrusions generating swirling motions of said solid-liquid suspension.

7. An apparatus for mixing according to claims 5 or 6, wherein said rotating means comprises a plurality of protrusions generating non laminar flow such as a turbulent flow within the container.

8. An apparatus for mixing according to claims 5-7, wherein said rotating means is or comprise an impeller.

9. An apparatus for mixing according to any of the preceding claims, wherein said container comprises a plurality of protrusions adapted to generate a non laminar flow, such as a turbulent flow within the container.

10. An apparatus for mixing according to any of the preceding claims wherein said at least one grid allows for disaggregation of aggregate bodies of said solid medium.

11. An apparatus for mixing according to any of the preceding claims, the apparatus further comprising at least one storage tank for storing said solid medium and at least one storage tank for storing said liquid medium both connected to said container.

12. An apparatus for mixing according to claim 11, the apparatus further comprising

    - at least one measuring device for measuring said solid medium, located along the connection between said at least one storage tank for storing said solid medium and said container, and
    - at least one measuring device for measuring said liquid medium, located along the connection between said at least one storage tank for storing said liquid medium and said container.

13. An apparatus for mixing according to claim 12, the apparatus further comprising controlling means for controlling the amount of media to be introduced into said container.

14. An apparatus for mixing according to any of the preceding claims wherein said container has a capacity preferably between 1 and 100 liters.

15. An apparatus for mixing according to any of the preceding claims wherein said rotating means rotate at speed between 1 and 1000 rpm.

16. A method for mixing at least two media utilizing a mixing apparatus according to any of the preceding claims, wherein operating of said apparatus produces a stable and homogeneous suspension.

17. A method for mixing at least two media in a container to produce a stable and homogeneous suspension, the method comprising

    - introducing a solid medium into said container,
    - introducing a liquid medium into said container
    - mixing said at least two media to generate a flow going through at least one grid.

18. A method for mixing according to claim 17, the method further comprising sifting said solid medium while

introducing it into said container.

19. A method for mixing according to claim 17 or 18, the method further comprising

- measuring a precise amount of said solid medium before introducing it into said container, and
- measuring a precise amount of said liquid medium before introducing it into said container.

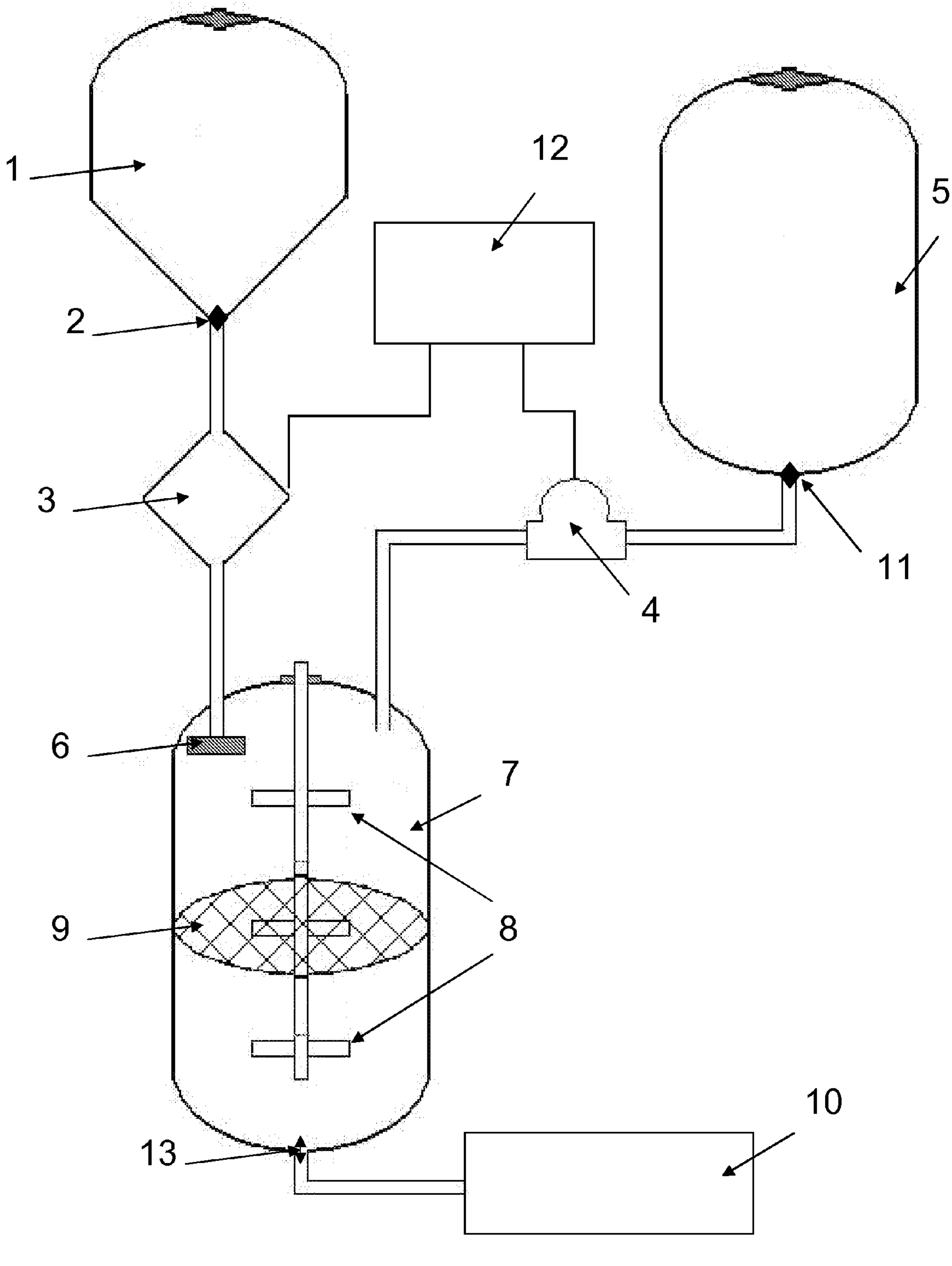

FIG. 1

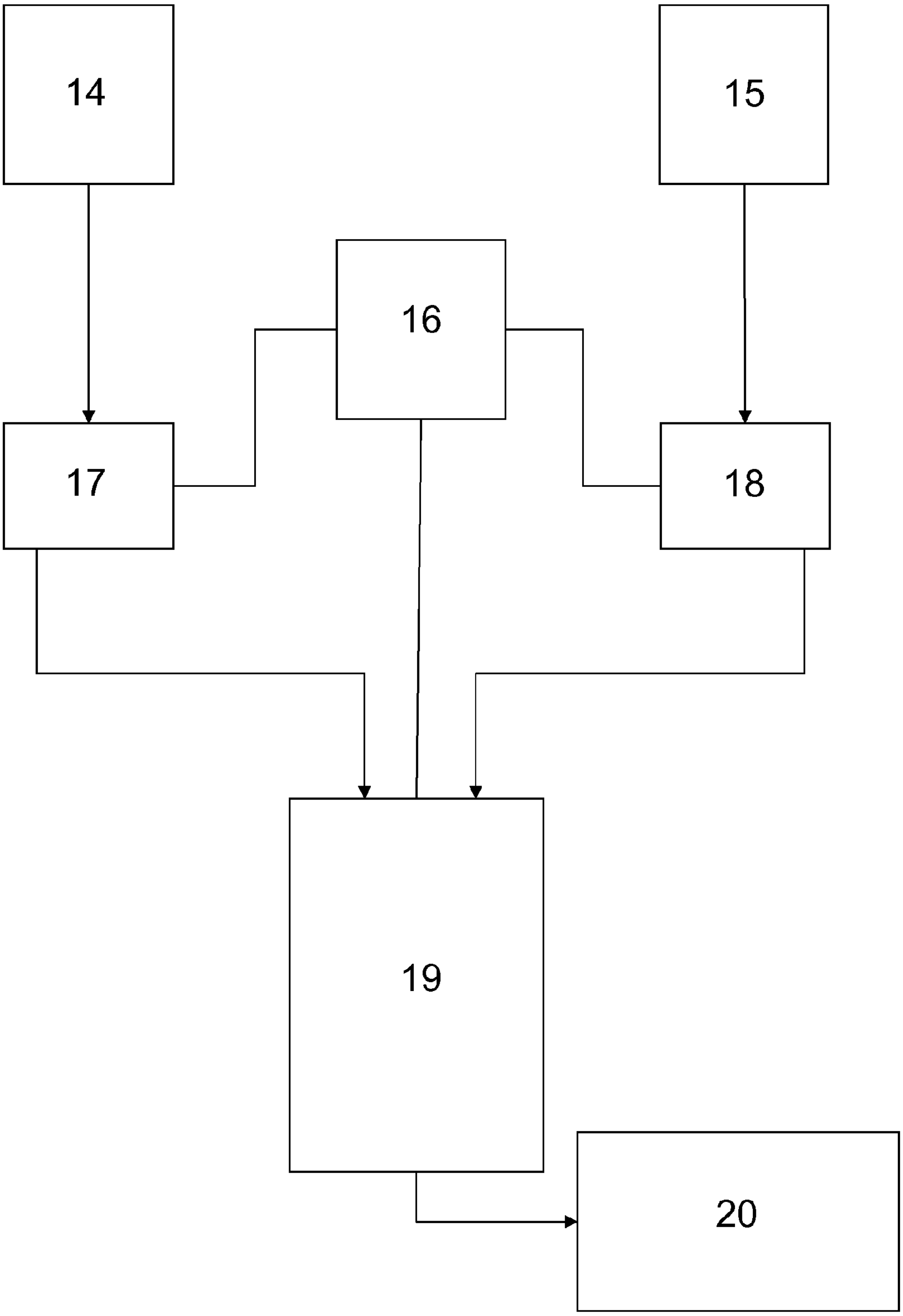

FIG. 2

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 09 16 7156

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 1 000 091 A (SHELL INT RESEARCH) 4 August 1965 (1965-08-04) * page 1, lines 10-24,63-78 * * page 2, lines 16-32,51-89,116-126 * * page 3, lines 5-40,50-64 * * page 3, line 127 - page 4, line 6 * * figure 1 * -----	1-19	INV. B01F3/12 B01F5/06 B01F7/18 B01F7/16 ADD. B01F5/00
X	US 4 076 681 A (BOEHME ROBERT EMERSON ET AL) 28 February 1978 (1978-02-28) * column 2, line 4 - column 3, line 64 * * abstract; figures 1,2 * -----	1-19	
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Place of search	Date of completion of the search	Examiner
Munich	1 February 2010	Brunold, Axel

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EUROPEAN SEARCH REPORT

Application Number
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