

CPC**COOPERATIVE PATENT CLASSIFICATION****C12M****APPARATUS FOR ENZYMOLOGY OR MICROBIOLOGY; [N]:
APPARATUS FOR CULTURING MICROORGANISMS FOR
PRODUCING BIOMASS, FOR GROWING CELLS OR FOR OBTAINING
FERMENTATION OR METABOLIC PRODUCTS, i.e. BIOREACTORS
OR FERMENTERS****NOTE**

In this subclass the term microorganism includes prokaryotic and eukaryotic cells. Viruses, human, animal or plant cells, protozoa, tissues and unicellular algae are considered microorganisms.

When classifying an apparatus according to its use in group [C12M 21/00](#), classification should also be given in at least one of the groups [C12M 23/00-C12M 99/00](#).

This subclass covers apparatus or devices for the fermentation or for growing microorganisms or animal tissues of both laboratory and industrial scale, i.e. bioreactors.

This subclass covers also apparatus or devices for the pre-treatment or after-treatment of the biomass or microorganisms to be cultured or that have been cultured.

This subclass does not cover the methods or processes taking place in the bioreactors that are not based on the use of the parts of the apparatus.

This subclass does not cover:

apparatus for culturing plant tissue, which are covered by [A01H 4/00B](#);

apparatus for preservation of living parts of bodies of humans or animals, which are covered by [A01N 1/0242](#);

apparatus or devices for testing sterility conditions not linked to a bioreactor or fermenter growing biomass, which are covered by [A61L 2/00](#), [G01N 31/22F](#);

apparatus for biological treatment of water, waste water, sewage or sludge, which are covered by [C02F 3/00](#), [C02F 11/00](#);

apparatus for brewing of beer, which are covered by C12C;

apparatus for production of wine or vinegar, which are covered by C12G, [C12J 1/10](#);

apparatus or devices for DNA and RNA technology, which are covered by [B01L 7/00D](#), [B01J 19/00C](#), [C12N 15/10A](#);

fermentation processes, which are covered by C12P;

apparatus for bioleaching of ores, which are covered by [C22B 3/18](#);

removing cellulose from cellulosic substances, which is covered by D21C;

apparatus or devices for sampling, detection, investigation or analysis of microorganisms or biosensors, which are covered by [G01N 33/48](#);

apparatus for automatic analysis not linked to a bioreactor or fermenter growing biomass, which are covered by [G01N 35/00](#);

testing or evaluating the effect of a chemical or biological compound involving human or animal cells, which are covered by [G01N 33/50D](#);

apparatus for immunological test processes, which are covered by [G01N 33/53B](#).

WARNING

Groups [C12M 1/00](#) to [C12M 3/10](#), and the indexing scheme under [C12M 2508/00](#) to [C12M 2540/00](#), are no longer used for the classification of new documents as from August 1, 2011. The backlog of these groups is being reclassified to groups [C12M 21/00](#) to [C12M 99/00](#).

Groups [C12M 21/00](#) to [C12M 99/00](#) do not correspond to former or current IPC groups.

Concordance CPC : IPC for these groups is as follows:

- [C12M 21/00](#) : [C12M 1/00](#)- [C12M 21/02](#) : [C12M 1/00](#)-
[C12M 21/04](#) : [C12M 1/107](#)- [C12M 21/06](#) : [C12M 3/00](#)-
[C12M 21/08](#) : [C12M 3/00](#)- [C12M 21/10](#) : [C12M 3/10](#)- [C12M 21/12](#)
: [C12M 1/00](#)- [C12M 21/14](#) : [C12M 1/00](#)- [C12M 21/16](#) :
[C12M 1/16](#)- [C12M 21/18](#) : [C12M 1/40](#)- [C12M 23/00](#) : [C12M 1/00](#)-
[C12M 23/02](#) : [C12M 1/00](#)- [C12M 23/04](#) : [C12M 1/12](#)- [C12M 23/06](#)
: [C12M 1/12](#)- [C12M 23/08](#) : [C12M 1/24](#)- [C12M 23/10](#) :
[C12M 1/22](#)- [C12M 23/12](#) : [C12M 1/32](#)- [C12M 23/14](#) : [C12M 1/00](#)-
[C12M 23/16](#) : [C12M 3/06](#)- [C12M 23/18](#) : [C12M 1/00](#)- [C12M 23/20](#)
: [C12M 1/00](#)- [C12M 23/22](#) : [C12M 1/00](#)- [C12M 23/24](#) :
[C12M 1/04](#)- [C12M 23/26](#) : [C12M 1/00](#)- [C12M 23/28](#) : [C12M 1/00](#)-
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[C12M 23/44](#) : [C12M 3/00](#)- [C12M 23/46](#) : [C12M 3/00](#)- [C12M 23/48](#)
: [C12M 3/00](#)- [C12M 23/50](#) : [C12M 1/00](#)- [C12M 23/52](#) :
[C12M 1/00](#)- [C12M 23/54](#) : [C12M 3/00](#)- [C12M 23/56](#) : [C12M 1/09](#)-
[C12M 23/58](#) : [C12M 1/00](#)- [C12M 25/00](#) : [C12M 1/12](#)- [C12M 25/02](#)
: [C12M 1/12](#)- [C12M 25/04](#) : [C12M 1/12](#)- [C12M 25/06](#) :
[C12M 1/12](#)- [C12M 25/08](#) : [C12M 1/12](#)- [C12M 25/10](#) : [C12M 1/12](#)-
[C12M 25/12](#) : [C12M 1/12](#)- [C12M 25/14](#) : [C12M 1/12](#)- [C12M 25/16](#)
: [C12M 1/12](#)- [C12M 25/18](#) : [C12M 1/12](#)- [C12M 25/20](#) :
[C12M 1/12](#)- [C12M 27/00](#) : [C12M 1/02](#)- [C12M 27/02](#) : [C12M 1/06](#)-
[C12M 27/04](#) : [C12M 1/04](#)- [C12M 27/06](#) : [C12M 1/06](#)- [C12M 27/08](#)
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[C12M 1/26- C12M 33/02](#) : [C12M 1/30- C12M 33/04](#) : [C12M 1/26-](#)
[C12M 33/06](#) : [C12M 1/32- C12M 33/08](#) : [C12M 1/26- C12M 33/10](#)
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[C12M 33/20](#) : [C12M 1/26- C12M 35/00](#) : [C12M 1/42- C12M 35/02](#)
[: C12M 1/42- C12M 35/04](#) : [C12M 1/42- C12M 35/06](#) :
[C12M 1/42- C12M 35/08](#) : [C12M 1/42- C12M 37/00](#) : [C12M 1/12-](#)
[C12M 37/02](#) : [C12M 1/12- C12M 37/04](#) : [C12M 1/12- C12M 37/06](#)
[: C12M 1/12- C12M 39/00](#) : [C12M 1/00- C12M 41/00](#) :
[C12M 1/34- C12M 41/02](#) : [C12M 1/21- C12M 41/04](#) : [C12M 1/34-](#)
[C12M 41/06](#) : [C12M 1/00- C12M 41/08](#) : [C12M 1/00- C12M 41/10](#)
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[C12M 41/20](#) : [C12M 1/02- C12M 41/22](#) : [C12M 1/02- C12M 41/24](#)
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[C12M 45/02](#) : [C12M 1/33- C12M 45/04](#) : [C12M 1/00- C12M 45/06](#)
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[C12M 3/08- C12M 45/12](#) : [C12M 3/08- C12M 45/14](#) : [C12M 3/08-](#)
[C12M 45/16](#) : [C12M 3/08- C12M 45/18](#) : [C12M 1/00- C12M 45/20](#)
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[C12M 1/00- C12M 47/00](#) : [C12M 1/00- C12M 47/02](#) : [C12M 1/00-](#)
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[C12M 1/00- C12M 47/14](#) : [C12M 1/00- C12M 47/16](#) : [C12M 1/00-](#)
[C12M 47/18](#) : [C12M 1/00- C12M 47/20](#) : [C12M 1/00](#)

C12M 1/00**Apparatus for enzymology or microbiology****NOTE**

This group covers:

apparatus where micro-organisms or enzymes are produced or isolated;

apparatus where the characteristics of micro-organisms or enzymes are investigated, e.g. which growth factors are necessary;

apparatus specially adapted to employ micro-organisms or enzymes as "reactants" or biocatalysts;

apparatus of both laboratory and industrial scale.

C12M 1/002

. {Photo bio reactors}

C12M 1/005

. {Incubators}

- C12M 1/007 . {Flexible bags or containers}
- C12M 1/02 . with agitation means; with heat exchange means
- C12M 1/04 . with gas introduction means
- C12M 1/045 .. {providing an anaerobic atmosphere}
- C12M 1/06 .. with agitator, e.g. impeller
- C12M 1/065 ... {on a horizontal axis}
- C12M 1/08 .. with draft tube
- C12M 1/09 .. Flotation apparatus
- C12M 1/10 . rotatably mounted
- C12M 1/107 . with means for collecting fermentation gases, e.g. methane (producing methane by anaerobic treatment of sludge [C02F 11/04](#))
- C12M 1/113 .. with transport of the substrate during the fermentation
- C12M 1/12 . with sterilisation, filtration or dialysis means
- C12M 1/121 .. {with sterilisation means}
- C12M 1/123 .. {with flat plate filter elements}
- C12M 1/125 ... {Culture inserts}
- C12M 1/126 .. {with hollow fibres or tubular filter elements}
- C12M 1/128 .. {with moving or mobile filter elements}
- C12M 1/14 . with means providing thin layers or with multi-level trays
- C12M 1/16 . containing, or adapted to contain, solid media
- C12M 1/165 .. {treated with gel punching devices}
- C12M 1/18 .. Multiple fields or compartments
- C12M 1/20 ... Horizontal planar fields
- C12M 1/203 {Disc dispensing devices therefor}
- C12M 1/206 {Multiple discs supporting devices}
- C12M 1/21 . Froth suppressors
- C12M 1/22 . Petri type dish
- C12M 1/24 . Tube or bottle type (anaerobic jars [C12M 1/045](#))
- C12M 1/26 . Inoculator or sampler
- C12M 1/261 .. {Airborne micro-organism samplers}
- C12M 1/262 .. {Handle streaking devices}
- C12M 1/263 .. {Replica plating devices}
- C12M 1/264 .. {Devices involving centrifugal, centripetal or rotational forces}
- C12M 1/265 .. {Pipettes; Syringes; Suction devices}
- C12M 1/266 .. {Magnetic separators}

- C12M 1/267 .. {Biofilm separators}
- C12M 1/268 .. {Positioning tools for sampling or inoculating devices}
- C12M 1/28 .. being part of container
- C12M 1/30 ... Sampler being a swab
- C12M 1/32 .. Multiple field or continuous type

- C12M 1/33 . Disintegrators

- C12M 1/34 . Measuring or testing with condition measuring or sensing means, e.g. colony counters
- C12M 1/3407 .. {Measure of electrical or magnetical factor}
- C12M 1/3415 .. {Pressure measure, e.g. with manometers, respirometers}
- C12M 1/3423 .. {Calorimetry}
- C12M 1/343 .. {Mass spectrometry}
- C12M 1/3438 .. {with use of isotopes, e.g. radiorespirometers, scintillometers}
- C12M 1/3446 .. {Photometry, spectroscopy, laser technology}
- C12M 1/3453 ... {Opacity, turbidity or light transmission measure; Nephelometry}
- C12M 1/3461 ... {Bio- or chemi-luminescence}
- C12M 1/3469 ... {Infra red spectroscopy}
- C12M 1/3476 ... {Fluorescence spectroscopy}
- C12M 1/3484 .. {Pen or contact colony counters}
- C12M 1/3492 .. {with use of lecture and interpretation devices, grids}

- C12M 1/36 . including condition or time responsive control, e.g. automatically controlled fermentors (controlling or regulating in general [G05](#))
- C12M 1/38 .. Temperature-responsive control

- C12M 1/40 . Apparatus specially designed for the use of free, immobilised, or carrier-bound enzymes, e.g. apparatus containing a fluidised bed of immobilised enzymes

- C12M 1/42 . Apparatus for the treatment of micro-organisms or enzymes with electrical or wave energy, e.g. magnetism, sonic waves

- C12M 3/00 Tissue, human, animal or plant cell, or virus culture apparatus**

- C12M 3/003 . {for culture in eggs}
- C12M 3/006 . {Cell injection or fusion devices}

- C12M 3/02 . with means providing suspensions

- C12M 3/04 . with means providing thin layers
- C12M 3/043 .. {rotatably mounted}
- C12M 3/046 ... {Roller bottles}

- C12M 3/06 . with filtration, ultra-filtration, inverse osmosis or dialysis means
- C12M 3/062 .. {with flat plate filter elements}

- C12M 3/065 . . {with hollow fibres or tubes}
- C12M 3/067 . . {with moving or mobile filter elements}
- C12M 3/08 . Apparatus for tissue disaggregation
- C12M 3/10 . for culture in eggs
- C12M 21/00** { Bioreactors or fermenters specially adapted for specific uses (digesters for manure [A01C 3/023](#); apparatus for PCR **B01L 7/00D**; destroying or transforming solid waste [B09B 3/00](#); methods for genetic engineering [C12N 15/00](#), [C12Q 1/68](#); nucleic acid amplification reactions [C12Q 1/6844](#))}
- C12M 21/02 . { Photobioreactors (culturing algae [A01G 33/00](#), [A01H 4/001](#), [C12N 1/12](#))}
- C12M 21/04 . { for producing gas, e.g. biogas (digesters for manure with production of biogas [A01C 3/028](#), biological treatment of water, waste water or sewage [C02F 3/00](#), [C02F 11/02](#), preparation of natural gas or syngas [C10L 3/06](#), [C10L 3/10](#))}
- C12M 21/06 . { for in vitro fertilization}
- C12M 21/08 . { for producing artificial tissue or for ex-vivo cultivation of tissue (prostheses [A61F 2/00](#), grafts [A61L 27/00](#))}
- C12M 21/10 . { adapted for the cultivation of avian eggs or in avian eggs, e.g. for vaccine production}
- C12M 21/12 . { for producing fuels or solvents ([C12M 21/04](#) takes precedence; liquid carbonaceous fuels [C10L 1/00](#), solid fuels [C10L 5/00](#))}
- C12M 21/14 . { for producing enzymes}
- C12M 21/16 . { Solid state fermenters, e.g. for koji production}
- C12M 21/18 . { Apparatus specially designed for the use of free, immobilized or carrier-bound enzymes}
- C12M 23/00** { Constructional details, e.g. recesses, hinges (flow directing inserts in [C12M 27/18](#)-[C12M 27/24](#); apparatus for chemical or physical processes in general B01J, chemical or physical laboratory apparatus in general B01L)}
- C12M 23/02 . { Form or structure of the vessel (large containers [B65D 88/00](#))}
- C12M 23/04 . . { Flat or tray type, drawers ([C12M 23/10](#), [C12M 23/12](#), [C12M 23/16](#) take precedence)}
- C12M 23/06 . . { Tubular ([C12M 23/08](#), [C12M 23/16](#) take precedence)}
- C12M 23/08 . . { Flask, bottle or test tube}
- C12M 23/10 . . { Petri dish (crystallising dishes [B01L 3/06](#))}
- C12M 23/12 . . { Well or multiwell plates ([C12M 25/04](#) takes precedence)}
- C12M 23/14 . . { Bags}
- C12M 23/16 . . { Microfluidic devices; Capillary tubes (integrated microfluidic structures [B01L 3/5027](#); microreactors [B01J 19/0093](#))}
- C12M 23/18 . . { Open ponds; Greenhouse type or underground installations}

- C12M 23/20 . { Material Coatings (Immunocoatings [C12M 25/00](#))} [C1204
- C12M 23/22 . { Transparent or translucent parts (glassware for laboratory use **B01L 3/00B8**)}
- C12M 23/24 . { Gas permeable parts}
- C12M 23/26 . { flexible (flexible containers for laboratory use **B01L 3/00C4**)}
- C12M 23/28 . { disposable or single use}
- C12M 23/30 . { biodegradable}
- C12M 23/32 . { Frangible parts}
- C12M 23/34 . { Internal compartments or partitions}
- C12M 23/36 . { Means for collection or storage of gas; Gas holders}
- C12M 23/38 . { Caps; Covers; Plugs; Pouring means}
- C12M 23/40 . { Manifolds; Distribution pieces (fluid transfer means **B01L 3/00B3**)}
- C12M 23/42 . { Integrated assemblies, e.g. cassettes or cartridges}
- C12M 23/44 . { Multiple separable units; Modules}
- C12M 23/46 . { Means for fastening}
- C12M 23/48 . { Holding appliances; Racks; Supports (holding devices for laboratory apparatus [B01L 9/00](#))}
- C12M 23/50 . { Means for positioning or orientating the apparatus ([C12M 41/08](#) takes precedence)}
- C12M 23/52 . { Mobile; Means for transporting the apparatus (transportable laboratories **B01L 99/00K**)}
- C12M 23/54 . { hand portable}
- C12M 23/56 . { Floating elements}
- C12M 23/58 . { Reaction vessels connected in series or in parallel (combinations of bioreactors with other apparatus, [C12M 43/00](#))}
- C12M 25/00** { Means for supporting, enclosing or fixing the microorganisms, e.g. immunocoatings}
- C12M 25/01 . { Drops}
- C12M 25/02 . { Membranes; Filters (filters or filtration in general [B01D 24/00-B01D 41/00](#))}
- C12M 25/04 . . { in combination with well or multiwell plates, i.e. culture inserts}

- C12M 25/06 . { Plates; Walls; Drawers; Multilayer plates}
- C12M 25/08 .. { electrically charged}
- C12M 25/10 . { Hollow fibers or tubes (hollow fiber modules in general [B01D 63/02](#))}
- C12M 25/12 .. { the culture medium flowing outside the fiber or tube}
- C12M 25/14 . { Scaffolds; Matrices (in general [C12N 5/0068](#))}
- C12M 25/16 . { Particles; Beads; Granular material; Encapsulation (chemical or physical processes conducted in the presence of fluids and solid particles [B01J 8/00](#))}
- C12M 25/18 .. { Fixed or packed bed}
- C12M 25/20 .. { Fluidized bed (in chemical or physical processes [B01J 8/18](#))}

- C12M 27/00** { Means for mixing, agitating or circulating fluids in the vessel (by introduction of gas [C12M 29/06](#), [C12M 29/14](#), mixing in general or mixers per se B01F; mixing in apparatus for chemical or physical processes B01J)}

- C12M 27/02 . { Stirrer or mobile mixing elements}
- C12M 27/04 .. { with introduction of gas through the stirrer or mixing element}
- C12M 27/06 .. { with horizontal or inclined stirrer shaft or axis}
- C12M 27/08 .. { with different stirrer shapes in one shaft or axis}

- C12M 27/10 . { Rotating vessel}
- C12M 27/12 .. { Roller bottles; Roller tubes}

- C12M 27/14 . { Rotation or movement of the cells support, e.g. rotated hollow fibers}

- C12M 27/16 . { Vibrating; Shaking; Tilting}

- C12M 27/18 . { Flow directing inserts}
- C12M 27/20 .. { Baffles; Ribs; Ribbons; Auger vanes}
- C12M 27/22 .. { Perforated plates, discs or walls}
- C12M 27/24 .. { Draft tube ([C12M 29/08](#) takes precedence)}

- C12M 29/00** { Means for introduction, extraction or recirculation of materials, e.g. pumps (pumps per se F04B)}

- C12M 29/02 . { Percolation}

- C12M 29/04 . { Filters; Permeable or porous membranes or plates, e.g. dialysis}

- C12M 29/06 . { Nozzles; Sprayers; Spargers; Diffusers (per se [B01F 3/04106](#), [B01J 19/26](#))}
- C12M 29/08 .. { Air lift}

- C12M 29/10 . { Perfusion}

- C12M 29/12 . { Pulsatile flow}

- C12M 29/14 . { Pressurized fluid}
- C12M 29/16 . { Hollow fibers (hollow fiber modules in general [B01D 63/02](#))}
- C12M 29/18 . { External loop; Means for reintroduction of fermented biomass or liquid percolate (loop type reactors for chemical or physical processes [B01J 19/2435](#))}
- C12M 29/20 . { Degassing; Venting; Bubble traps (means for collection or storage of gas [C12M 23/36](#); gas collection apparatus for laboratory use [B01L 5/02](#))}
- C12M 29/22 . . { Oxygen discharge}
- C12M 29/24 . { Recirculation of gas}
- C12M 29/26 . { Conditioning fluids entering or exiting the reaction vessel}

- C12M 31/00** { Means for providing, directing, scattering or concentrating light ([C12M 41/06](#) takes precedence)}

- C12M 31/02 . { located outside the reactor}
- C12M 31/04 . . { Mirrors}
- C12M 31/06 . . { Lenses}

- C12M 31/08 . { by conducting or reflecting elements located inside the reactor or in its structure}
- C12M 31/10 . { by light emitting elements located inside the reactor, e.g. LED or OLED}
- C12M 31/12 . { Rotating light emitting elements}

- C12M 33/00** { Means for introduction, transport, positioning, extraction, harvesting, peeling or sampling of biological material in or from the apparatus (chemical or physical laboratory apparatus in general B01L, devices for taking cell samples [A61B 10/0045](#), withdrawing or distributing predetermined quantities of fluid [B01L 99/00G](#))}

- C12M 33/02 . { by impregnation, e.g. using swabs or loops (fluid transport using swabs [B01L 3/00C6S](#))}
- C12M 33/04 . { by injection or suction, e.g. using pipettes, syringes, needles (pipettes in general [B01L 3/02](#))}
- C12M 33/06 . . { for multiple inoculation or multiple collection of samples}
- C12M 33/07 . . { Dosage or metering devices therefore}

- C12M 33/08 . { by vibration}
- C12M 33/10 . { by centrifugation (centrifuges in general [B04B](#)); Cyclones (cyclones in general [B04C](#))}
- C12M 33/12 . { by pressure}
- C12M 33/14 . { with filters, sieves or membranes}

- C12M 33/16 . { Screw conveyor}
- C12M 33/18 . { Rollers}
- C12M 33/20 . { Ribbons}
- C12M 33/22 . { Settling tanks; Sedimentation by gravity (settling tanks per se [B01D 21/02](#))}
- C12M 35/00** { Means for application of stress for stimulating the growth of microorganisms or the generation of fermentation or metabolic products; Means for electroporation or cell fusion (machines for extracting juice from animal or plant tissue by electroporation [A23N 1/006](#), processes employing electric or wave energy [B01J 19/08](#); treatment of microorganisms or enzymes with electrical or wave energy [C12N 13/00](#); methods for cell fusion [C12N 15/02](#); introduction of foreign genetic material [C12N 15/87](#))}
- C12M 35/02 . { Electrical or electromagnetic means, e.g. for electroporation or for cell fusion}
- C12M 35/04 . { Mechanical means, e.g. sonic waves, stretching forces, pressure or shear stimuli}
- C12M 35/06 . { Magnetic means ([C12M 35/02](#) takes precedence)}
- C12M 35/08 . { Chemical, biochemical or biological means, e.g. plasma jet, co-culture}
- C12M 37/00** { Means for sterilizing, maintaining sterile conditions or avoiding chemical or biological contamination ([C12M 23/38](#) takes precedence; filtration in general and filters per se [B01D 24/00-B01D 41/00](#); autoclaves [B01J 3/04](#); treatment of microorganisms with electrical or wave energy [C12N 13/00](#))}
- C12M 37/02 . { Filters}
- C12M 37/04 . { Seals}
- C12M 37/06 . { Means for testing the completeness of the sterilization (testing for sterility conditions [C12Q 1/22](#))}
- C12M 39/00** { Means for cleaning the apparatus or avoiding unwanted deposits of microorganisms (apparatus for cleaning laboratory receptacles or instruments [B01L 99/00D](#); cleaning in general [B08B](#))}
- C12M 41/00** { Means for regulation, monitoring, measurement or control, e.g. flow regulation (controlling or regulating chemical, physical or physicochemical processes [B01J 19/006](#); heating or cooling apparatus for laboratory use [B01L 7/00](#); electro optical investigation of individual particles, flow cytometers [G01N 15/14](#); automatic analysis [G01N 35/00](#); controlling or regulating in general [G05N](#))}
- C12M 41/02 . { of foam (foam prevention during gasification of liquids [B01D 19/02](#))}
- C12M 41/04 .. { Means for foam enhancement (making foam by mixing [B01F 3/04446](#))}
- C12M 41/06 . { of illumination}

- C12M 41/08 . . { Means for changing the orientation}
- C12M 41/10 . . { Filtering the incident radiation}
- C12M 41/12 . { of temperature (controlling the temperature of chemical or physical processes [B01J 19/0013](#), heating or cooling apparatus for laboratory use [B01L 7/00](#))}
- C12M 41/14 . . { Incubators; Climatic chambers (per se [B01L 1/00](#))}
- C12M 41/16 . . { by recirculation of culture medium at controlled temperature}
- C12M 41/18 . . { Heat exchange systems, e.g. heat jackets or outer envelopes}
- C12M 41/20 . . . { the heat transfer medium being a gas}
- C12M 41/22 . . . { in contact with the bioreactor walls}
- C12M 41/24 . . . { inside the vessel}
- C12M 41/26 . { of pH}
- C12M 41/28 . { of redox potential}
- C12M 41/30 . { of concentration}
- C12M 41/32 . . { of substances in solution}
- C12M 41/34 . . { of gas}
- C12M 41/36 . . { of biomass, e.g. colony counters or by turbidity measurements (electrooptical investigation of individual particles [G01N 15/14](#), flow cytometers [G01N 15/1404](#))}
- C12M 41/38 . . { of metabolites or enzymes in the cells}
- C12M 41/40 . { of pressure}
- C12M 41/42 . { of agitation speed}
- C12M 41/44 . { of volume or liquid level}
- C12M 41/46 . { of cellular or enzymatic activity or functionality, e.g. cell viability}
- C12M 41/48 . { Automatic or computerized control (automatic analysis [G01N 35/00](#))}
- C12M 43/00** { Combinations of bioreactors or fermenters with other apparatus}
- C12M 43/02 . { Bioreactors or fermenters combined with devices for liquid fuel extraction; Biorefineries}
- C12M 43/04 . { Bioreactors or fermenters combined with combustion devices or plants, e.g. for carbon dioxide removal ([C12M 43/06](#) takes precedence; recovery of carbon dioxide [C12F 3/02](#))}
- C12M 43/06 . { Photobioreactors combined with devices or plants for gas production different from a bioreactor or fermenter}
- C12M 43/08 . { Bioreactors or fermenters combined with devices or plants for production of electricity}

- C12M 45/00** { Means for pre-treatment of biological substances}
- C12M 45/02 . { by mechanical forces; Stirring; Trituration; Comminuting (crushing, pulverizing, disintegrating in general [B02C](#))}
- C12M 45/03 . { by control of the humidity or content of liquids; Drying}
- C12M 45/04 . { Phase separators; Separation of non fermentable material; Fractionation}
- C12M 45/05 . { by centrifugation (centrifuges in general [B04B](#))}
- C12M 45/06 . { by chemical means or hydrolysis}
- C12M 45/07 . { by electrical or electromagnetic forces}
- C12M 45/09 . { by enzymatic treatment}
- C12M 45/20 . [Heating; Cooling (heating or cooling apparatus for laboratory uses [B01L 7/00](#))]
- C12M 45/22 . { Means for packing or storing viable microorganisms (casings for storing cell samples [A61B 10/0096](#), preservation of living parts of the human or animal body [A01N 1/02](#))}
- C12M 47/00** { Means for after-treatment of the produced biomass or of the fermentation or metabolic products, e.g. storage of biomass (filters in general [B01D 23/00-B01D 41/00](#))}
- C12M 47/02 . { Separating microorganisms from the culture medium; Concentration of biomass (separating microorganisms from their culture media [C12N 1/02](#))}
- C12M 47/04 . { Cell isolation or sorting (purging biological preparations of unwanted cells [C12N 5/0081](#), determining the presence or kind of microorganism [C12Q 1/04](#))}
- C12M 47/06 . { Hydrolysis; Cell lysis; Extraction of intracellular or cell wall material (lysis of microorganisms [C12N 1/06](#); extracting or separating nucleic acids from biological samples [C12N 15/1003](#))}
- C12M 47/08 . { Homogenizing}
- C12M 47/10 . { Separation or concentration of fermentation products (bioreactors combined with means for distillation or extraction of liquid fuel [C12M 43/02](#))}
- C12M 47/12 . { Purification ([C12M 47/04](#) takes precedence)}
- C12M 47/14 . { Drying}
- C12M 47/16 . { Sterilization (autoclaves in general [B01J 3/04](#))}
- C12M 47/18 . { Gas cleaning, e.g. scrubbers; Separation of different gases (separating dispersed particles from gases or vapours [B01D 45/00](#); separation of gases or vapours [B01D 53/00](#); gas washing apparatus for laboratory uses [B01L 5/04](#))}
- C12M 47/20 . { Heating or cooling (heating or cooling apparatus for laboratory uses [B01L 7/00](#))}

C12M 99/00 { Subject matter not otherwise provided for in other groups of this subclass}

C12M 99/02 . { Disc dispensing devices}

C12M 2508/00 Photobioreactors

- C12M 2508/01 . Constructive details, e.g. materials or flow directing inserts
- C12M 2508/012 . . Solid support for biological material
- C12M 2508/013 . . Flexible walls; Disposable parts
- C12M 2508/014 . . Floating elements
- C12M 2508/015 . . Membranes, filters, walls or granular materials for supporting biological species
- C12M 2508/016 . . Outdoor installations, e.g. open ponds, green-house type installations

- C12M 2508/02 . Means for mixing; Rotating drums

- C12M 2508/03 . Light providing, directing, scattering or concentrating means
- C12M 2508/032 . . situated outside the reactor
- C12M 2508/033 . . . Mirrors
- C12M 2508/034 . . . Lenses
- C12M 2508/035 . . by conducting or reflecting elements inside the reactor or in its structure
- C12M 2508/036 . . by light emitting elements inside the reactor, e.g. LED or OLED
- C12M 2508/037 . . . Rotating elements

- C12M 2508/04 . Means for harvesting or separating the biomass

- C12M 2508/05 . Combinations with other apparatus; Plants
- C12M 2508/052 . . Photobioreactors combined with system for liquid fuel production
- C12M 2508/054 . . Photobioreactors combined with combustion system e.g. CO₂ removal
- C12M 2508/056 . . Photobioreactors combined with system for gas production, e.g. biogas

- C12M 2508/06 . Measurement or control of illumination; Filtering the incident radiation; Control of illumination devices

<NO TITLE>

C12M 2510/00 Bioreactors for gas production, e.g. biogas (from sewage or sludge [C02F 11/04](#); from waste materials with compost production [C05F 17/02](#))

- C12M 2510/01 . Constructive details, e.g. materials or flow directing inserts
- C12M 2510/02 . Means for gas collection or gas separation
- C12M 2510/03 . Means for feed or discharge for solids or liquids; Means for gas input

- C12M 2510/032 . . Percolation
- C12M 2510/04 . Means for mixing or transportation inside the reactor
- C12M 2510/05 . Pre-treatment of substrate materials, e.g. hydrolysis or grinding
- C12M 2510/06 . Physical or chemical after-treatment of the product
- C12M 2510/062 . . Cleaning of biogas
- C12M 2510/07 . Production of other gas than methane or carbon dioxide
- C12M 2510/08 . Aerobic aspects
- C12M 2510/09 . Multistep production of gas
- C12M 2510/10 . Combinations with other apparatus ([C12M 2508/056 takes precedence](#)); Plants

- C12M 2512/00 Bioreactors for production of liquid fuels or solvents**
- C12M 2512/01 . Means for pre-treatment or conditioning of the substrates
- C12M 2512/02 . using immobilized microorganisms or enzymes
- C12M 2512/03 . Means for recovery or purification of final products
- C12M 2512/04 . Combinations with other apparatus; Plants

- C12M 2514/00 Bioreactors for enzyme production or containing enzymes as reactants**
- C12M 2514/01 . using immobilized microorganisms
- C12M 2514/02 . using immobilized enzymes
- C12M 2514/03 . Means for extraction and purification of enzymes

- C12M 2516/00 Bioreactors for solid phase fermentation ([composting apparatus C05F 17/02](#))**
- C12M 2516/01 . Means for mixing or transportation in the reactor
- C12M 2516/012 . . Rotating container
- C12M 2516/014 . . with inserts, e.g. baffles or ribs
- C12M 2516/016 . . Stirrers, paddles or blades
- C12M 2516/018 . . with forced entry of gas; Fluidized bed
- C12M 2516/02 . Means for feed or discharge
- C12M 2516/03 . Means for recirculation of media
- C12M 2516/04 . Pre-treatment, e.g. disintegration means

- C12M 2516/05 . Physical or chemical after-treatment
- C12M 2516/06 . Automatically controlled operation
- C12M 2516/07 . Combinations with other apparatus; Plants
- C12M 2518/00** **Bioreactors for fermentation in liquid phase; Details of bioreactors in general not covered by groups [C12M 2508/00](#)-[C12M 2516/00](#)**
- C12M 2518/01 . Constructive details
 - C12M 2518/011 .. Flow directing inserts
 - C12M 2518/012 ... Baffles
 - C12M 2518/013 ... Draft tube
 - C12M 2518/014 .. Flexible walls
 - C12M 2518/015 .. Membranes, filters, walls or granular materials for supporting biological species
 - C12M 2518/016 ... Fixed or packed bed
 - C12M 2518/017 ... Fluidized bed
- C12M 2518/02 . Means for mixing
 - C12M 2518/021 .. Stirrer or mobile mixing elements, e.g. paddles or blades
 - C12M 2518/022 ... Special shapes
 - C12M 2518/023 ... with introduction of gas through the stirrer
 - C12M 2518/024 ... with horizontal or inclined stirrer shaft
 - C12M 2518/025 ... with different stirrer shapes on one shaft
 - C12M 2518/026 ... rotated by magnetic coupling
 - C12M 2518/027 .. by injection of liquid
- C12M 2518/03 . Means for (re-)circulation of media, e.g. percolation
- C12M 2518/04 . Means for the introduction or circulation of gas; Means for degassing
 - C12M 2518/042 .. through nozzles
 - C12M 2518/044 .. through porous material, e.g. membranes or porous plates
- C12M 2518/05 . Means for measurement or control
 - C12M 2518/051 .. of temperature ([heat exchange systems C12M 2518/07](#))
 - C12M 2518/052 .. of pH
 - C12M 2518/053 .. of concentration
 - C12M 2518/054 ... of substances in solution
 - C12M 2518/055 ... of gas
 - C12M 2518/056 ... of biomass, i.e. microorganisms or enzymes
 - C12M 2518/057 .. of pressure
 - C12M 2518/058 .. of agitation speed
 - C12M 2518/059 .. of volume or liquid level
 - C12M 2518/062 .. of enzyme activity

- C12M 2518/064 . . Automatic or computerized control
- C12M 2518/07 . Heat exchange systems
- C12M 2518/08 . Feed, discharge or sampling means, e.g. centrifugal separators
- C12M 2518/082 . . through filters
- C12M 2518/084 . . Sampling means
- C12M 2518/086 . Pre-treatment or after-treatment means
- C12M 2518/09 . Froth suppression means
- C12M 2518/10 . Sealing means
- C12M 2518/11 . Sterilizing or sterility maintaining means
- C12M 2518/12 . Means for cleaning the apparatus
- C12M 2518/13 . Disposable parts
- C12M 2518/14 . Application of energy sources other than light radiation or heat, e.g. electrical, magnetic or electromagnetic fields, ionizing radiation or sound waves
- C12M 2518/15 . Combinations with other apparatus; Plants
- C12M 2518/152 . . with reactors connected in series or parallel
- C12M 2540/00** **Small scale or laboratory fermentators; Bioreactors adapted for culturing animal or plant cells ([C12M 2508/00](#) to [C12M 2514/00](#) take precedence)**
- C12M 2540/01 . Type of container
- C12M 2540/011 . . Flask, bottle or tube
- C12M 2540/012 . . Petri dish
- C12M 2540/013 . . Well or multiwell plates
- C12M 2540/014 . . Flexible bags or containers
- C12M 2540/015 . . with internal constructive elements, e.g. baffles, partitions or perforated discs
- C12M 2540/016 . . Microdevices, microfluidic devices or capillary tubes
- C12M 2540/02 . Means for supporting or immobilizing the microorganisms or enzymes
- C12M 2540/021 . . Plates or walls
- C12M 2540/022 . . . Multilayer plates
- C12M 2540/023 . . with culture inserts, e.g. filters, membranes or porous material
- C12M 2540/024 . . Hollow fibers or tubes
- C12M 2540/025 . . . the culture medium flowing outside the fiber or tube
- C12M 2540/026 . . Scaffolds or matrices
- C12M 2540/027 . . Beads, particles, fluidized or fixed beds
- C12M 2540/028 . . Carrier bound enzymes

- C12M 2540/03 . Other constructive aspects
- C12M 2540/031 .. Material
- C12M 2540/032 ... Use of gas permeable materials
- C12M 2540/033 ... Use of materials permitting observation from outside
- C12M 2540/034 .. Integrated assemblies, e.g. cassettes or cartridges
- C12M 2540/035 .. Multiple separable units; Modules
- C12M 2540/0355 ... Means for fastening
- C12M 2540/036 .. Use of holding appliances, e.g. racks
- C12M 2540/037 .. Disposable parts
- C12M 2540/038 .. Positioning or orientating means
- C12M 2540/039 .. Devices involving the cultivation of avian eggs or for the cultivation in avian eggs, e.g. for vaccine production

- C12M 2540/04 . Inoculation, cell positioning, sampling or sorting, harvesting or cell separation means
- C12M 2540/041 .. Swabs; Loops
- C12M 2540/042 .. Suction or dispensing devices, e.g. pipettes or syringes
- C12M 2540/043 ... for multiple inoculation
- C12M 2540/044 .. involving vibration, centrifugal, centripetal or rotational forces
- C12M 2540/045 .. with filters
- C12M 2540/046 .. with membranes, e.g. hollow fibres
- C12M 2540/047 .. with means for inoculating single cells
- C12M 2540/048 .. with magnetic means

- C12M 2540/05 . Means for positioning of tools or manipulating of samples, e.g. automatic or robotic devices

- C12M 2540/06 . Mixing or agitating means
- C12M 2540/062 .. by introduction of gas
- C12M 2540/063 .. Rotating vessel
- C12M 2540/064 ... Roller bottles or roller tubes
- C12M 2540/065 .. Stirred bioreactor
- C12M 2540/066 .. by shaking, vibrating or tilting
- C12M 2540/068 .. by liquid circulation ([by means of internal constructive elements in C12M 2540/015](#))

- C12M 2540/07 . Means for introduction of fluids ([mixing effect C12M 2540/062, C12M 2540/068](#))
- C12M 2540/072 .. Perfusion

- C12M 2540/08 . Means for discharge of fluids

- C12M 2540/09 . Means for culturing in anaerobic conditions

- C12M 2540/10 . Means for altering, manipulating or stimulating microorganisms or enzymes, e.g. for genetic engineering, for tissue disaggregation or for cell conditioning
- C12M 2540/102 .. Electrical means, e.g. for electroporation, cell fusion
- C12M 2540/104 .. Mechanical means, e.g. sonic waves, stretching forces, pressure, shear stimuli

- C12M 2540/106 .. Magnetic means
- C12M 2540/108 .. Chemical means, e.g. for cell lysis

- C12M 2540/11 . Means for cell killing, for sterilizing or maintaining sterile conditions
- C12M 2540/111 .. Means for testing the completeness of the sterilization

- C12M 2540/12 . Means for measurement or control
- C12M 2540/121 .. of temperature, e.g. means for heat exchange or incubators
- C12M 2540/122 ... the heat transfer medium being a gas
- C12M 2540/1221 ... the heat transfer medium being a liquid
- C12M 2540/1223 ... Incubators
- C12M 2540/1224 CO2 incubators
- C12M 2540/123 .. of pH
- C12M 2540/124 .. of concentration
- C12M 2540/125 ... of nutrients
- C12M 2540/126 ... of substances in gaseous phase, e.g. water or anaerobic conditions
- C12M 2540/127 ... of biomass, i.e. microorganisms or enzymes
- C12M 2540/128 .. of enzyme activity or cellular activity or functionality
- C12M 2540/129 .. of pressure
- C12M 2540/13 .. Automatic or computerized control

- C12M 2540/14 . Means for cleaning the apparatus

- C12M 2540/15 . Means for foam production, reduction or suppression