

CPC**COOPERATIVE PATENT CLASSIFICATION****C12M**

APPARATUS FOR ENZYMOLOGY OR MICROBIOLOGY ; { 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 7/52](#), [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 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](#) - [C12M 23/30](#) : [C12M 1/00](#) - [C12M 23/32](#) : [C12M 1/00](#) - [C12M 23/34](#) : [C12M 1/00](#) - [C12M 23/36](#) : [C12M 1/107](#) - [C12M 23/38](#) : [C12M 1/00](#) - [C12M 23/40](#) : [C12M 1/00](#) - [C12M 23/42](#) : [C12M 3/00](#) - [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](#) : [C12M 1/06](#) - [C12M 27/10](#) : [C12M 3/04](#) - [C12M 27/12](#) : [C12M 3/04](#) - [C12M 27/14](#) : [C12M 3/06](#) - [C12M 27/16](#) : [C12M 3/06](#) - [C12M 27/18](#) : [C12M 1/00](#) - [C12M 27/20](#) : [C12M 1/00](#) - [C12M 27/22](#) : [C12M 1/00](#) - [C12M 27/24](#) : [C12M 1/08](#) - [C12M 29/00](#) : [C12M 1/00](#) - [C12M 29/02](#) : [C12M 1/00](#) - [C12M 29/04](#) : [C12M 1/00](#) - [C12M 29/06](#) : [C12M 1/00](#) - [C12M 29/08](#) : [C12M 1/00](#) - [C12M 29/10](#) : [C12M 1/00](#) - [C12M 29/12](#) : [C12M 1/00](#) - [C12M 29/14](#) : [C12M 1/00](#) - [C12M 29/16](#) : [C12M 1/00](#) - [C12M 29/18](#) : [C12M 1/00](#) - [C12M 29/20](#) : [C12M 1/00](#) - [C12M 29/22](#) : [C12M 1/00](#) - [C12M 29/24](#) : [C12M 1/00](#) - [C12M 29/26](#) : [C12M 1/00](#) - [C12M 31/00](#) : [C12M 1/00](#) - [C12M 31/02](#) : [C12M 1/00](#) - [C12M 31/04](#) : [C12M 1/00](#) - [C12M 31/06](#) : [C12M 1/00](#) - [C12M 31/08](#) : [C12M 1/00](#) - [C12M 31/10](#) : [C12M 1/00](#) - [C12M 31/12](#) : [C12M 1/00](#) - [C12M 33/00](#) : [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](#) : [C12M 1/26](#) - [C12M 33/12](#) : [C12M 1/26](#) - [C12M 33/14](#) : [C12M 1/26](#) - [C12M 33/16](#) : [C12M 1/26](#) - [C12M 33/18](#) : [C12M 1/26](#) - [C12M 33/20](#) : [C12M 1/26](#) - [C12M 35/00](#) : [C12M](#)

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Guidance heading:

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 7/52](#); 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](#)) }

- C12M 23/22 . { Transparent or translucent parts (glassware for laboratory use [B01L 3/00](#)) }

- C12M 23/24 . { Gas permeable parts }
- C12M 23/26 . { flexible (flexible containers for laboratory use [B01L 3/505](#)) }
- 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 3/563](#)) }
- 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 99/00](#)) }
- 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 99/00](#)) }
- C12M 33/02 . { by impregnation, e.g. using swabs or loops (fluid transport using swabs [B01L 3/5029](#)) }
- 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 99/00](#); 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 19/0006](#); 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 }