What is claimed is:

1. A mixer of the stator-rotor type comprising a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, the mixer having the construction that is designed by using the Equation 1 given below in such a manner that a particular mixer running time and a particular drop diameter during the particular mixer running time can be obtained when a fluid being processed is subjected to the emulsification, dispersion, particle size breakup or mixing process and by estimating the particular mixer running time and the resulting drop diameter by using the Equation 1:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{ the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

2. The mixer as defined in Claim 1, wherein the stator and rotor are arranged in such a manner that they can be moving closer to each and moving farther away from each other in the direction in which the rotary shaft of the rotor extends.

3, The mixer as defined in Claim 1 or 2, wherein the mixer includes a plurality of stators each having a different diameter and a rotor disposed on the inner side of each of the stators and spaced by a particular gap away from said each stator.

4. The mixer as defined in any one of Claims 1 through 3, wherein the fluid being processed is introduced into the gap between each of the stators and the rotor disposed on the inner side of each of the stators and spaced by a particular gap away from said each stator.

5. The mixer as defined in any one of Claims 1 through 4, wherein the rotor includes a plurality of agitating blades extending radially from the center of rotation.

6. A method for estimating the performance of a mixer of the rotor-stator type comprising a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, wherein the method includes the steps of: using the Equation 1 given below to obtain the values for the total energy dissipation rate ε_t, measuring the components included in the Equation1, such as the respective size of the rotor and stator and the power requirements and flow rate during the running time of the

mixer, estimating the magnitude (smallness or greatness) of the values for the configuration dependent term in the gap that is specific to the mixer, and estimating the performance of the mixer:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

7. A method for scaling up or scaling down a mixer of the rotor-stator type comprising a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and

spaced by a particular gap away from the stator, wherein the method includes the steps of: using the Equation 1 given below to obtain the value for the total energy dissipation rate ε_t on the experimental mixer installation and/or the pilot plant mixer installation, matching the thus obtained values for the total energy dissipation rate ε_t against the values for the total energy dissipation rate ε_t on the actual mixer installation so that the former ε_t values can conform with the latter ε_t values, and scaling up or scaling down the mixer accordingly:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

8. Foods, pharmaceutical medicines or chemical products which are manufactured by subjecting a fluid being processed to the emulsification, dispersion, particle size breakup or mixing process that occurs using the mixer of the stator-rotor type which comprises a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, wherein the foods. pharmaceutical medicines or chemical products are manufactured by using the Equation 1 given below ,estimating the mixer running time and the drop diameters thus obtained during the mixer running time for the fluid being processed, and subjecting the fluid being processed to the emulsification, dispersion, particle size breakup or mixing process that occurs using the mixer:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{ the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

f_s_h: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

9. A method for manufacturing foods, pharmaceutical medicines or chemical products by subjecting a fluid being processed to the emulsification, dispersion, drop breakup or mixing process using a mixer of the stator-rotor type which comprises a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed inside the stator and spaced by a particular gap away from the stator, wherein the method includes the steps of: using the Equation 1 given below, and estimating the mixer running time and the drop diameter thus obtained during the mixer running time for the fluid being processed:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{ the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

f_s_h: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

Claims

1. A mixer of the stator-rotor type comprising a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, wherein the stator and rotor are arranged in such a manner that they can be moving closer to each and moving farther away from each other in the direction in which the rotary shaft of the rotor extends, the mixer having the construction that is designed by using the Equation 1 given below in such a manner that a particular mixer running time and a particular drop diameter during the particular mixer running time can be obtained when a fluid being processed is subjected to the emulsification, dispersion, particle size breakup or mixing process and by calculating the particular mixer running time and the resulting drop diameter by using the Equation 1:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

2. The mixer as defined in Claim 1, wherein the mixer includes a plurality of stators each having a different diameter and a rotor disposed on the inner side of each of the stators and spaced by a particular gap away from said each stator.

3. The mixer as defined in Claims 1 or 2, wherein the fluid being processed is introduced into the gap between each of the stators and the rotor disposed on the inner side of each of the stators and spaced by a particular gap away from said each stator.

4. The mixer as defined in any one of Claims 1 through 3, wherein the rotor includes a plurality of agitating blades extending radially from the center of rotation.

5. A method for manufacturing the mixer of the stator-rotor type comprising a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, the mixer having the construction that is designed by using the Equation 1 given below in such a manner that a particular mixer running time and a particular drop diameter during the particular mixer running time can be obtained when a fluid being processed is subjected to the emulsification, dispersion, particle size breakup or mixing process and by calculating the particular mixer running time and the resulting drop diameter by using the Equation 1:

$$\varepsilon_t = \varepsilon_t f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_1: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

6. The method for manufacturing the mixer as defined in Claim 5, wherein the stator and rotor are arranged in such a manner that they can be moving closer to each and moving farther away from each other in the direction in which the rotary shaft of the rotor extends.

7. The method for manufacturing the mixer as defined in Claims 5 or 6, wherein the mixer includes a plurality of stators each having a different diameter and a rotor disposed on the inner side of each of the stators and spaced by a particular gap away from said each stator.

8. The method for manufacturing the mixer as defined in any one of Claims 5 through 7, wherein the fluid being processed is introduced into the gap between each of the

stators and the rotor disposed on the inner side of each of the stators and spaced by a particular gap away from said each stator.

9. The method for manufacturing the mixer as defined in any one of Claims 5 through 8, wherein the rotor includes a plurality of agitating blades extending radially from the center of rotation.

10. A method for estimating the performance of a mixer of the rotor-stator type comprising a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, wherein the method includes the steps of: using the Equation 1 given below to obtain the values for the total energy dissipation rate ε_t, measuring the components included in the Equation1, such as the respective size of the rotor and stator and the power requirements and flow rate during the running time of the mixer, estimating the magnitude (smallness or greatness) of the values for the configuration dependent term in the gap that is specific to the mixer, and estimating the performance of the mixer in a fluid being processed is subjected to the particle size breakup, emulsification, dispersion, mixing, dissolving and agitation process:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

11. A method for scaling up or scaling down a mixer of the rotor-stator type comprising a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, wherein the method includes the steps of: using the Equation 1 given below to obtain the value for the total energy dissipation rate ε_t on the experimental mixer installation and/or the pilot plant mixer installation, matching the thus obtained values for the total energy dissipation rate ε_t against the values for the total energy dissipation rate ε_t on the actual mixer installation so that the former ε_t values can conform with the latter ε_t values, and scaling up or scaling down the mixer accordingly:

$$\varepsilon_t = \varepsilon_t f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_1: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

12. Foods, pharmaceutical medicines or chemical products which are manufactured by subjecting a fluid being processed to the emulsification, dispersion, particle size breakup or mixing process that occurs using the mixer of the stator-rotor type which comprises a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed on the inner side of the stator and spaced by a particular gap away from the stator, wherein the foods. pharmaceutical medicines or chemical products having the desired drop diameters are manufactured by using the Equation 1 given below, calculating the mixer running time and the drop diameters thus obtained during the mixer running time for the fluid being processed, and subjecting the fluid being processed to the emulsification, dispersion, particle size breakup or mixing process that occurs using the mixer:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{ the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]

13. A method for manufacturing foods, pharmaceutical medicines or chemical products having the desired drop diameters by subjecting a fluid being processed to the emulsification, dispersion, drop breakup or mixing process using a mixer of the stator-rotor type which comprises a mixer unit that includes a stator having a plurality of openings (holes) and a rotor disposed inside the stator and spaced by a particular gap away from the

stator, wherein the method includes the steps of: using the Equation 1 given below, and calculating the mixer running time and the drop diameter thus obtained during the mixer running time for the fluid being processed:

$$\varepsilon_t = \varepsilon_l f_{s,h} t_m$$

$$= \left[A\pi^4 n_r (D+2\delta) D^3 h \left(\frac{4\ell}{d} + 1 \right) \left(\frac{N_p}{N_{qd}\pi^2} - 1 \right) \right] \left(\frac{N^4}{V} t_m \right)$$

$$= C_h \left(\frac{N^4}{V} t_m \right) \cdots \text{the Equation 1}$$

In the Equation 1,

ε_t: Total Energy Dissipation Rate [m^2/s^3] ε

ε_l: Local Energy Dissipation Rate in Stator's Opening [m^2/s^3]

$f_{s_}h$: Shear Frequency

t_m: Mixing Time [s]

A: Stator's Opening Rate [-]

N_r: Number of Rotor Blades [-]

D: Diameter of Rotor [m]

δ : Gap between Rotor and Stator [m]

h: Height of Stator [m]

l: Thickness of Stator [m]

d: Hole Diameter of Stator [m]

N_p: Number of Powers [-]

N_{pd}: Number of Flow Rates [-]

N: Number of Rotation [1/s]

V: Amount of Liquid [m^3]

C_h : Configuration Dependent Term for Gap [m^5]