CLAIMS

What is claimed is:

1. A method for estimating the performance of the mixer of the a rotor-stator type, wherein the method includes the step of:

measuring a size of the rotor-stator and power and flow rate of the mixer;s

obtaining the total energy dissipation rate ε_a by using Equation 1 given below;

obtaining a magnitude of a values of a configuration dependent term for the mixer in its entirely: Kc which is the component included in the Equation 1; and

estimating the performance of the mixer based on the magnitude of values for the configuration dependent term for the mixer in its entirely: Kc:

$$\varepsilon_a = \varepsilon_g + \varepsilon_s$$

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

$$= \left[\left(N_p - N_{qd}\pi^2\right)\cdot n_r\right]\cdot\left[D^3\left(K_g + K_s\right)\right]\cdot\left(\frac{N^4\cdot t_m}{V}\right)$$

$$= K_c\cdot\left(\frac{N^4\cdot t_m}{V}\right) \quad \cdots\cdots\cdots \text{Equation 1}$$

In the Equation 1,

ε_a : Total energy dissipation rate (m^2/s^3)

ε_g : Local shear stress in the gap between the rotor and stator (m^2/s^3)

ε_s : Local energy dissipation rate in the stator(m^2/s^3)

N_p : Number of powers (-)

N_{qd} : Number of flow rates (-)

n_r : Number of rotor blades (-)

D : Diameter of rotor (m)

b : Thickness of rotor blade tip (m)

δ: Gap between rotor and stator (m)

n_s : Number of stator holes (-)

d : Diameter of stator hole (m)

1 : Thickness of stator (m)

N : Number of rotations (1/s)

t_m : Mixing time (s)

V : Flow rate (m^3)

K_g : Configuration dependent term (m^2)

K_s : Configuration dependent term in stator (m^2)

K_c : Configuration dependent term for the mixer in its entirety.

2. A method of scaling up or scaling down a mixer of a rotor-stator type, wherein the method includes the steps of:

obtaining a value for a total energy dissipation rate ε_a on an experimental mixer installation or a the pilot plant mixer installation by using Equation 1 given below;

obtaining the value for a total energy dissipation rate ε_a on a production mixer installation by using the Equation 1; and

allowing the value ε_a obtained on the experimental mixer installation or pilot plant mixer installation to agree with the value ε_a obtained on the production mixer installation scaled up or down:

$$\varepsilon_a = \varepsilon_g + \varepsilon_s$$

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

$$= \left[\left(N_p - N_{qd}\pi^2\right)\cdot n_r\right]\cdot\left[D^3\left(K_g + K_s\right)\right]\cdot\left(\frac{N^4\cdot t_m}{V}\right)$$

$$= K_c\cdot\left(\frac{N^4\cdot t_m}{V}\right) \quad \cdots\cdots\cdots \text{Equation 1}$$

In the Equation 1,

ε_a : Total energy dissipation rate (m^2/s^3)

ε_g : Local shear stress in the gap between the rotor and stator (m^2/s^3)

ε_s : Local energy dissipation rate in the stator(m^2/s^3)

N_p : Number of powers (-)

N_{qd} : Number of flow rates (-)

n_r : Number of rotor blades (-)

D : Diameter of rotor (m)

b : Thickness of rotor blade tip (m)

δ: Gap between rotor and stator (m)

n_s : Number of stator holes (-)

d : Diameter of stator hole (m)

1 : Thickness of stator (m)

N : Number of rotations (1/s)

t_m : Mixing time (s)

V : Flow rate (m^3)

K_g : Configuration dependent term (m^2)

K_s : Configuration dependent term in stator (m^2)

K_c : Configuration dependent term for the mixer in its entirety.

3. A method for manufacturing the foods, pharmaceutical medicines

or chemical products by subjecting a fluid or liquid being processed to an emulsification, dispersion, particle size breakup, mixing process by using the mixer of the rotor-stator type, wherein the method includes the steps of:

calculating the Equation 1 given below to estimate the mixer's running time and a resulting drop diameters to be obtained for the fluid or liquid being processed during the mixer's running time; and

manufacturing the foods, pharmaceutical medicines or chemical products:

$$\varepsilon_a = \varepsilon_g + \varepsilon_s$$

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

$$= \left[\left(N_p - N_{qd}\pi^2\right)\cdot n_r\right]\cdot\left[D^3\left(K_g + K_s\right)\right]\cdot\left(\frac{N^4\cdot t_m}{V}\right)$$

$$= K_c\cdot\left(\frac{N^4\cdot t_m}{V}\right) \quad \cdots\cdots\cdots \text{Equation 1}$$

In the Equation 1,

ε_a : Total energy dissipation rate (m^2/s^3)

ε_g : Local shear stress in the gap between the rotor and stator (m^2/s^3)

ε_s : Local energy dissipation rate in the stator(m^2/s^3)

N_p : Number of powers (-)

N_{qd} : Number of flow rates (-)

n_r : Number of rotor blades (-)

D : Diameter of rotor (m)

b : Thickness of rotor blade tip (m)

δ: Gap between rotor and stator (m)

n_s : Number of stator holes (-)

d : Diameter of stator hole (m)

1 : Thickness of stator (m)

N : Number of rotations (1/s)

t_m : Mixing time (s)

V : Flow rate (m^3)

K_g : Configuration dependent term (m^2)

K_s : Configuration dependent term in stator (m^2)

K_c : Configuration dependent term for the mixer in its entirety.