MIXER

[PENCAMPURAN]

ALOGARITMA PERANCANGAN

1. **Menentukan bahan kontruksi**

   Dipilih bahan kontruksi yang sesuai dengan kondisi proses dan bahan yang akan dicampur. Tipe mixer dapat dilihat di tabel 4-16 hal 168, ‘A guide to chemical engineering process design and economics’, Gael D. Ulrich.

2. **Menentukan neraca massa**

   Menghitung massa umpan yang masuk ke dalam mixer sebelum pencampuran dan setelah pencampuran.

3. **Menetukan volume mixer**

   Menghitung densitas komponen umpan dengan persamaan :

   $\rho = A \cdot B^{-(1-T/Tc)^n}$

   dengan =

   ρ = massa jenis, kg/m^3

   A, B, n = konstanta

   Tc = temperatur kritis cairan, K

   Atau dengan data-data dari buku referensi lainnya.

   Kemudian menghitung laju volumetrik, $Fv = m/\rho$ dalam m^3/jam

   Diambil waktu tingal (τ) dalam mixer (dapat dilihat di Ulrich tabel 4-16 halaman 168)

   Sehingga volume mixer = $Fv.\ \tau$ dalam ft^3/jam

   Diambil over design tertentu.

   Volume perancangan = volume mixer x (1 + over design)

4. **Menetukan dimensi mixer**

   Dimensi mixer ditentukan dengan memperhatikan dimensi standar. Untuk menghitung volume head dapat digunakan persamaan :

V *head* = 0,000049 D^3 (torisperical dished head) (Brownell, eq.5.11)

dengan :

V = volume *head*, ft^3

D = diameter tangki, in

Atau dengan rumus lain disesuaikan dengan jenis head yang digunakan.

Diambil asumsi : H = 2D (Rase, table 8)

V mixer = V silinder + 2 V *head*

Sehingga akan diperoleh niali D dan H.

Dipilih tangki dengan ukuran standard. Dari Apendix E item 3, Brownell & Young diperoleh niali D dan H standard.

5. Menentukan tebal shell, tebal head dan tinggi head

a. Tebal shell

Dapat dihitung dengan persamaan :

$$t = \frac{p.ri}{(fE - 0{,}6p)} + c$$ (Brownell, eq.13.1)

dengan :

p = tekanan perancangan , psia

ri = jari – jari dalam reaktor, in

E = effisiensi pengelasan

f = *maximum allowable stress*, psia

c = *corrosion allowance*, in

Nilai f, E dan c sesuai dengan bahan yang digunakan dan dapat dilihat dari appendix D brownell & young.

Maka di dapat tebal dinding mixer (ts) dalam inchi, sedangkan untuk penggunaan dipakai tebal shell standard. (dapat dilihat di Brownell, halaman .90)

b. **Tebal head**

Dapat digunakan persamaan :

$$t = \frac{p.r.W}{(2fE - 0{,}2p)} + c$$ (Brownell, eq.7.77)

dengan :

W = *stress-intensificationfactor for torispherical dished heads*

r = *crown radius*

icr = *inside-corner radius*

atau dengan persamaan lain sesuai dengan head yang digunakan.

Asumsi :

OD head = ID shell + 2 t shell

Dipakai standar OD (Brownell, p.90)

Dari tabel 5.7 Brownell untuk : OD standar tersebut akan diperoleh :

icr dan r .

$W = \frac{1}{4} [3 + (r/icr)^{1/2}]$ (Brownell, eq.7.76)

W = stress-intensification factor

Sehingga akan diperoleh nilai tebal head. Untuk perancangan dipilih tebal standar .

c. Tinggi head

Dari tabel 5.6 Brownell, untuk tebal head tersebut maka *standard straight flange* (sf) akan dapat ditentukan.

Dari persamaan di fig. 5.8 halaman 87, Brownell :

$BC = r - icr$

$AB = (ID/2) - icr$

$AC = [BC^2 - AB^2]^{1/2}$

$b = r - AC$

Tinggi *head* (OA) = t *head* + b + sf

Tinggi mixer total = H + (2 x tinggi head)

6. Menetukan dimensi pengaduk

a. Menentukan dimensi pengaduk

Dari fig. 10.57 hal 372 Coluson, dengan vickositas tertentu maka impeller yang sesuai dapat ditentukan.

Dari Brown halaman 507, untuk jenis tersebut akan didapatkan persamaan- persamaan :

Dt/Di ; Zi/Di; L/Di ; w/Di ; baffle.

dengan :

Dt = diameter dalam mixer

Di = diameter pengaduk

Zi = jarak pengaduk dari dasar mixer

Z_L = tinggi cairan dalan tangki

w = lebar baffle

L = panjang blade

Sehingga akan didaptkan nilai :

Di , Zi, L, w

b. Menentukan tionggi cairan (Z_L)

Tinggi cairan dapat ditentukan dengan persamaan :

V mixer = V silinder + 2 V *head*

V shell = ¼ . 3,14 . D^2 . H

V hed = 2 x $0{,}000049D^3$

Volume cairan dalam shell = Volume mixer – volume head

Luas penampang cairan (A_{shell}) = (0,25 /3,14) x D^3

Tinggi cairan dalam shell (Z_{sh}) = Volume shell/ (A_{shell})

Tinggi cairan total (Z_L) = tinggi cairan dalam shell + tinggi head.

7. Menentukan jumlah pengaduk

Digunakan persamaan sebagai berikut :

Jumlah turbin = WELH / D (Rase, eq.8.9)

dengan :

WELH = Z_L x *specific gravity*

Specific gravity = 1/ ρ

8. Menetukan kecepatan pengadukan

Persamaan kecepatan pengadukan :

$$\frac{WELH}{2D_i} = \left[\frac{3{,}14 D_i N}{600}\right]^2$$ (Rase, eq.8.8)

dengan :

WELH = *water equivalent liquid height,* ft

Di = diameter pengaduk, ft

N = kecepatan pengadukan, rpm

$$N = \frac{600\left[\frac{WELH}{2D_i}\right]^{0,5}}{3{,}14D_i}$$ (Rase, eq.8.8)

9. Menetukan power pengaduk

Dihitung viscositas campuran dengan persamaan :

Viskositas campuran = (1/ ∑ xi/μi)

Sehingga akan didapat bilangan Reynold :

$$N\,\mathrm{Re} = \frac{\rho\, ND_i^2}{\mu}$$

Dari fig. 8.8 rase halaman 349, dengan bilangan reynold tersebut akan diperoleh harga Np. Besarnya daya yang dibutuhkan untuk pengadukan dirumuskan dengan persamaan sebagai berikut :

$P = 3{,}52.10^{-3}$ Np (ρ / 62,4) $(N/60)^3$ $(Di/12)^5$ (Rase fig.8.8)

dengan : Np = *power number*

ρ = densitas, lb/ft^3

N = kecepatan putar, rpm

Di = diameter pengaduk, in

Kemudian ditentukan efesiensi motor dengan refeerensi yang ada. Sehingga akan diperoleh power yang diperlukan.

ALOGARITMA PERANCANGAN MIXER

1. **Menentukan bahan kontruksi**
2. **Menentukan neraca massa**
3. **Menetukan volume mixer**

   Densitas komponen umpan dengan persamaan :

   $\rho = A \cdot B^{-(1-T/Tc)^n}$

   Laju volumetrik,

   Fv = m/ ρ dalam m^3/jam

   Diambil waktu tingal (τ) dalam mixer (dapat dilihat di Ulrich)

   Sehingga volume mixer = Fv. τ dalam ft^3/jam
4. **Menetukan dimensi mixer**

   V *head* = 0,000049 D^3 (torisperical dished head) (Brownell, eq.5.11)

   Atau dengan persamaan lain sesuai dnegan head yang dipakai.

   Diambil asumsi : H = 2D (Rase, table 8)

   V mixer = V silinder + 2 V *head*
5. **Menentukan tebal shell, tebal head dan tinggi head**

   a. **Tebal shell**

   Dapat dihitung dengan persamaan :

   $$t = \frac{p.ri}{(fE - 0{,}6p)} + c$$ (Brownell, eq.13.1)

   b. **Tebal head**

   Dapat digunakan persamaan :

   $$t = \frac{p.r.W}{(2fE - 0{,}2p)} + c$$ (Brownell, eq.7.77)

   atau dengan persamaan lain sesuai dengan head yang digunakan.

   c. **Tinggi head**

   Tinggi *head* (OA) = t *head* + b + sf

Tinggi mixer total = H + (2 x tinggi head)

6. **Menetukan dimensi pengaduk**

   a. **Menentukan dimensi pengaduk**

      Dari Brown halaman 507, untuk jenis tersebut akan didapatkan persamaan- persamaan :

      Dt/Di ; Zi/Di; L/Di ; w/Di ; baffle.

   b. **Menentukan tionggi cairan (Z_L)**

      Tinggi cairan dapat ditentukan dengan persamaan :

      V mixer = V silinder + 2 V *head*

      V shell = ¼ . 3,14 . D^2 . H

      V hed = 2 x $0{,}000049D^3$

      Volume cairan dalam shell = Volume mixer – volume head

      Luas penampang cairan (A_{shell}) = (0,25 /3,14) x D^3

      Tinggi cairan dalam shell (Z_{sh}) = Volume shell/ (A_{shell})

      Tinggi cairan total (Z_L) = tinggi cairan dalam shell + tinggi head.

7. **Menentukan jumlah pengaduk**

   Digunakan persamaan sebagai berikut :

   Jumlah turbin = WELH / D (Rase, eq.8.9)

   dengan :

   WELH = Z_L x *specific gravity*

   Specific gravity = 1/ ρ

8. **Menetukan kecepatan pengadukan**

   Persamaan kecepatan pengadukan :

   $$\frac{WELH}{2D_i} = \left[\frac{3{,}14 D_i N}{600}\right]^2$$ (Rase, eq.8.8)

   dan

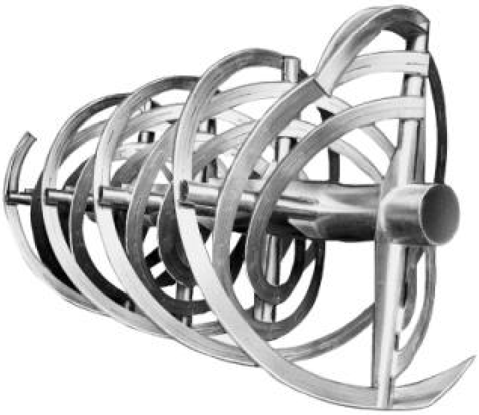
   $$N = \frac{600\left[\frac{WELH}{2D_i}\right]^{0{,}5}}{3{,}14 D_i}$$ (Rase, eq.8.8)

9. **Menetukan power pengaduk**

   P = $3{,}52.10^{-3}$ Np (ρ / 62,4) (N/60 $)^3$ (Di/12 $)^5$ (Rase fig.8.8)

***literature**

Manufactures of Quality Machinery Since 1894
DAVIS Mixing Agitators



DOUBLE RIBBON AGITATOR

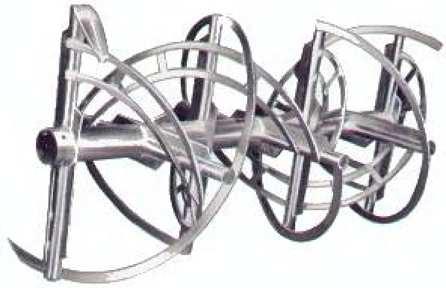
Davis Mixing Agitators: Each is designed for a specific group of ingredients. If you'll provide us a complete list of the items you plan to mix, we will be glad to help you select the agitator best suited to your particular need. Furthermore, we have Davis Mixers at our plant strictly for the purpose of blending items sent in by prospective buyers. At no cost or obligation, we will mix your specific ingredients and send samples to the laboratory of your choice for analysis. Make no mistake about it, *Mixing is serious business* which leaves little or no room for error. Anyone who suggests that one mixing system is ideal for *every* application either lacks the necessary experience needed to make a recommendation, or even worse .

HD-60

The ribbon agitator is our most efficient agitator. It excels in applications where small amounts of ingredients (also known as micro-ingredients) are added to the batch.

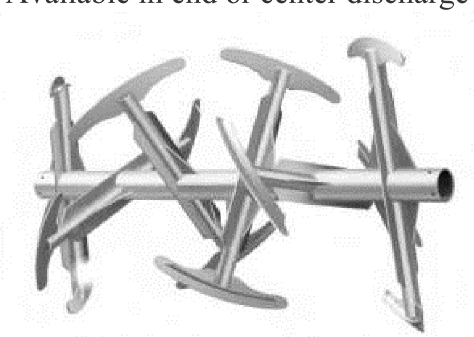
All of the material in the mixer is constantly circulated from end to end. The outer ribbons move ingredients toward the discharge while the inner ribbons constantly circulate material in the opposite direction. Sweeps may be added to the outer ribbon to enhance cleanout. Center and End discharge ribbon agitators are available.

Center Discharge Ribbon Agitator



The two outer ribbons bring material to the center of mixer's tank while the inside ribbons move ingredients back to each end. Sweeps may be added to the outer ribbons to provide better cleanout.
The ribbon is strictly designed to mix free flowing ingredients including plastics, chemicals, colorings, lubricants, insulation and fire retardant, it is a must for fine powders. In the feed industry, it is used for mixing feed for pork and poultry, premixes and mineral mixes containing vitamins, trace minerals and medications. This agitator is also generally used when the product to be mixed is for human consumption due to its efficiency and mixing accuracy. We distinctly like its inherent mixing action for blending; donut mixes, all purpose flour, corn meal, ice cream powder, cake and biscuit mixes, spices and cures. It's also an excellent mixing system for; dog food, bird and grass seed, and insecticides.

Paddle Agitator
Available in end or center discharge



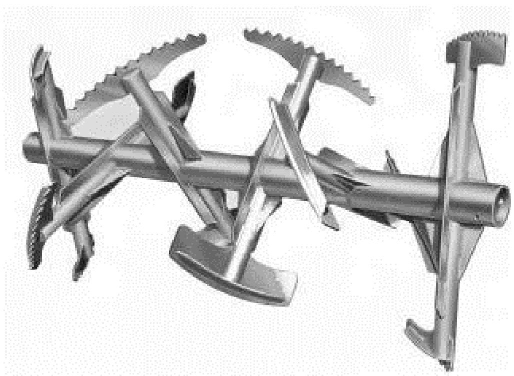
"The Most versatile Agitator We Build."

This is the most versatile agitator we build. It contains an equal number of forward and reversing paddles which constantly move the ingredients from one end of the mixer's tank to the other. Paddles, which move material toward the outlet, are fitted to within 1/8" of the bottom of the tank. Furthermore, they're adjustable to assure optimum clean out as well as compensate for wear. The agitator's reversing paddles are located several inches from the bottom of the tank. This provides 3 distinct advantages. Because forward and reversing action occurs on different planes the ingredients are able to flow easier and faster from end to end. The result is better circulation and faster mixing with less power required for operation. Unloading is also faster and clean out more thorough due to the fact only the forward paddles come in contact with the material in the tank when the last part of the load is being discharged. Furthermore there's no interference caused by the reversing paddles attempting to move the material away from the outlet. The result is reduced unloading time and more thorough clean out than was previously possible.

Another distinct advantage of this agitator is its ability to precision mix small batches. The mixer may be loaded to only 20% by volume without affecting mixing accuracy. Consequently, a larger mixer may also be employed to mix an occasional small batch without sacrificing mixing accuracy.

This agitator is excellent for mixing both wet and dry ingredients. It's recommended for mixing heavy, resistant items such as fertilizers, plaster, chemicals, vitamins and minerals, detergents, sweeping compounds, drywall products and caulking, as well as coffee, teas, and soil mixes.

Our paddle agitator is also extensively employed in the feed manufacturing industry mixing feed rations for; pork, poultry, cattle, dairy, horses and sheep with and without liquid molasses and fat.



SAWTOOTH PADDLE AGITATOR

This agitator is very similar to our paddle agitator except for one basic difference. The agitator's forward paddles have notches or saw teeth cut in them to prevent a pinch point from occurring between the paddles and the bottom of the mixer's tank. These serrations relieve the strain on both tank and agitator, which could occur when a high percentage of non-free-flowing materials is being mixed. They're also very helpful with fraiable (or easily broken) materials such as dog and cat food, bird and grass seed, soil mixes containing peat, vermiculite, chemicals, fertilizer, micro-nutrients, as well as sand, soil, bark, wood chips and styrofoam.

Sawteeth not only cut down the pinch point between paddle and tank, which makes handling these items easier, they also provide a much gentler mixing action which prevents unnecessary damage to these valuable ingredients. In this way the ***integrity of the mix*** is maintained and protected.

The agitator's reversing paddles are attached to posts, which are shorter. This provides mixing action in the center of the agitator, which is ***absolutely necessary*** to blend rations that contain high percentages of ingredients that are not free flowing.

DAVIS Adjustable Paddle Agitators

Paddles are individually adjustable in order to compensate for even the slightest variance in the curvature of the mixer's tank. We've rolled tanks for over 75 years and frankly no two have come out absolutely identical. Consequently the possibility to compensate for slight irregularities, a high or low spot in any given area, is a real asset especially in these days when smaller and smaller amounts of varying high potency additives are regularly used. Ingredients lying dormant in a low spot run the risk of improper mixing or contamination between batches. Today thorough clean out is a must and a mixer lacking this feature is, in our opinion, incomplete and inadequate. For operations with dual requirements a set of adjustable paddles may be bolted on in front of the saw tooth paddles. Installation or removal is only a matter of inserting or removing the bolts, which hold these paddles in place.