RESEARCH ARTICLE

STRUCTURE AND DESIGN OF INSTRUMENTATION CIRCULAR HOSE AS FLOW INJECTION SYNTHESIS-FIS.

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Manuscript Info	*Abstract*
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Structure and design of the Flow Injection Synthesis-FIS were many kind, depend on the both propose and chemical process method. For chemical formation energy estimation propose isothermal tube reactor is one of simple rector, where formation energy could be estimate of the reactor dimension, flow of yield and temperature. Generally Non-Isothermal equations especially Mahadevan equation can be applied to get simply formation energy. The equations have to fractioned until be obtained both flow and temperature parameterin Non-Isothermal.

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Introduction:-
Many kind of the useful Flow Injection Synthesis reactor, one of the FIS is use tube reactor where reactance flowing in the structured tube, with base energy equation; Avrami, Ozawa and Kissinger.

The chemical reaction generally in Non-Ishothermal condition, temperature and pressure constante but pH reactanse (salt) and alkaline in variation state.

One of the advantage of co-precipitation synthesis of the physical characteristic of yield were easy to identify such as amount of formation energy, both particle size and shape.

The reaction and formation of nano-Ferrite material simply done by method co-precipitation in the reaction vessel. The container can be a test tube, flatbed, enclosed tub, etc. To obtain a uniform yield of raw material mixing is done by simultaneously mixing and stirring using a stirrer high speed reaction time with formation and deposition of particles that are relatively short and the possibility of changes in temperature, the formation and growth of particles cannot be uniform. So as to obtain a uniform particle size needed some way special treatment reaction parameters, among others;

The composition of the reactance (salt) and the base does not change. Because it is impossible to eliminate time variance is carried approaches such as limiting the amount of reactants with the risk of yielding only slightly. Improve fluid mixing process alkaline and salt with a particle size of yield risk is not very homogeneous. The Yield particles confined in a particular polymer shell template and using of computers to control speed of reaction raw material mixing process. The reaction temperature t [^{o}C] , pH of the raw material reactants use of non-isothermal reactor tube. ;ρ= density [gr/cm^{3}] ,q= energy/gr [joule/gr], Q= Total Energy = joule, QE= Energy [joule], dx/dt = velocity ,[m/sec] , dm/dt= rate = [gr/det], dq/dt= energy rate = [joule/sec], K = Avrami Constatnta.,R= Gas

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Costant, Y(t)= Fraction of Yield [mole], K_o= Frequency Factor, n= kinetic factor dY(t)/dt, χ = Fraction of Yield, α = cooling factor [^{o}/sec], Q_r= Energy , $t_{0.5}$ = half time (Reactor produce yield in half from time of Y(t)).

Non-Isothermal Hose Circular Reactor:-
In the The Non Isothermal Hose Circular reactor has advantages in terms of effective reaction mixing given; a) The reaction is concentrated in a relatively small dimensions. b) The reaction in the low flow is turbulent but resulting homogeneous mixture. c) The existence of a secondary collision between yield compounds with the pipe wall. d) Unconditioned reactants in the reactor.
The reaction is in Non-isothermal condition and no heater as energy flow in the system.

Batch Reaction Mechanism In the injector.
Activation of the pre-set power supply that is able to drive a DC motor peristaltic pump - has tested the linearity of the flow rate of the solution of the power supply voltage regulator, will activate peristaltic pump that is capable of producing an alkaline solution flow rate and chloride salt solution with appropriate to dose stoichiometry as follows;
a) 2 Pump primary alkaline solution-driven each pump is activated with a 10 Volt DC to 400 ml /
    800 ml Total discharge.
b) 1 second pump with the discharge drain precursor solution between 33 ml and 40 ml.

Supersaturated precursor solution was added to a batch reactor through a pressurized injector,

Batch reactor had previously been fully charged alkaline supersaturated solution.
  Flow Injection Ferrite Materials Synthesis.
Section of the essential part consists of;
1) inlet for saline. 2) inlet for alkaline solutions. 3) The nozzle salt solution. 4) Space Reactor (Bath reactor) 5) laminar flow conditioning channel (channel orifice). 6) Hose conditioning particle growth.
    In order to obtain complete reaction between the salt solution as a precursor to the super-saturated solution of lye, which need to be considered, among others;
o Availability of the two reactants sufficiently.
o When interfacing the two reactants in the reactor bath enough.
o Substitution between segments that are continuous followed simultaneously by nucleation and growth process completely, following the movement patterns as follows;
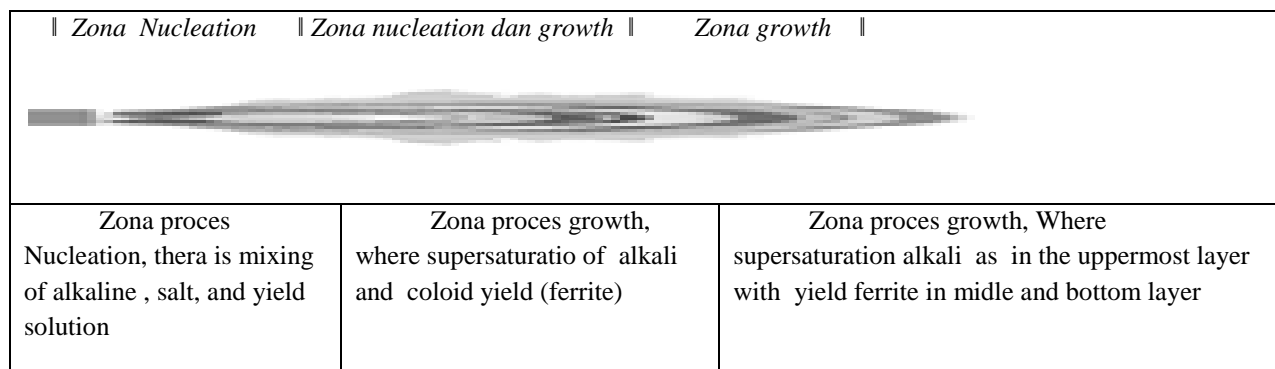
‖ *Zona Nucleation*   ‖ *Zona nucleation dan growth* ‖   *Zona growth*   ‖

Zona proces Nucleation, thera is mixing of alkaline , salt, and yield solution	Zona proces growth, where supersaturatio of alkali and coloid yield (ferrite)	Zona proces growth, Where supersaturation alkali as in the uppermost layer with yield ferrite in midle and bottom layer

Figure :-. Zone Process of Nucleation and Growth in the Circuler Hose Reaction.

The mechanism of the Flow Injection Synthesis-FIS process described as follows;
Nucleation mechanism at the solid-liquid system is divided into two categories, namely:
1. Primary Nucleation (primary nucleation).

Nucleation due to the incorporation of molecules of dissolved substance (solute) to form clusters, which later grew into crystals. In a supersaturated solution (super saturation), there will be the addition of solute that diffuses into clusters and grow to be more stable. Crystals enlarged size, solubility resulting in down, otherwise if the crystal size is small then the solubility rose. Therefore, if there is a larger crystals then crystals will grow, while the smaller crystals will be dissolved again, this is called the Theory of Miers.[1] In the super saturation state solution contains more of the dissolved material than could be dissolved by the solvent . In the diagram of the concentration and the solution to changes in temperature and Miers theory is described as follows:
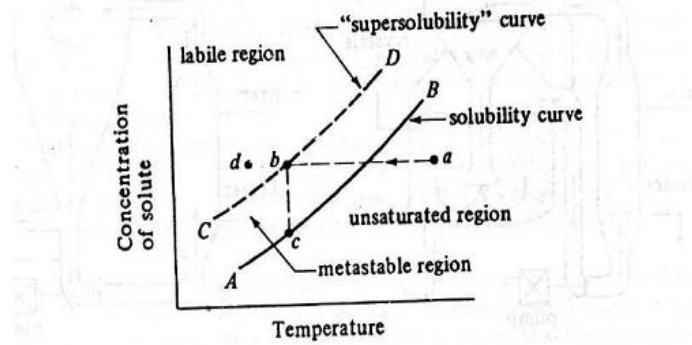
Figure 2:-. The Solubility Miers diagram [1]

Seen: cooling solution of the point a. (having the condition in point a).

During cooling to pass solubility curve has no crystallize and cooling continues until the point b, and the crystals begin to form, and the concentration of the solution be at point C (as the mother liquor / mother liquor). Solubility curve is the boundary where the nucleus formation begins spontaneous, and crystallization began to form. The several proposed mechanisms of crystal growth may be discussed such as theories of; Surface energy , layer , Kinematic , Diffusion - reaction models, Adsorption

Theory of Non-Isothermal In the tube Reactor Process:-

There is a trend: the super solubility curve as an area where nucleation rate increased sharply.
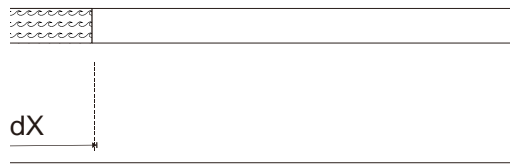

Figure 3:- Reactants In the Circular Flow Model Hose.

If the element of volume of reactants as d_{Volum} = A. dx., Then the mass of the is dm = ρ.dVolum = ρ.A.dx / dt. For the mass flow, which in occurs the mass change at any time dm / dt = ρ. dVolum / dt. The amount of energy formation of the mass of material is dQE / dt = qE.dm/dt = QE, ρ.A.dx / dt with QE as energy formation of moles K seconds

Particle crystal growth rate according to Arrhenius $K(T) = K_0.e^{-(\frac{Q_E}{R.T})}$ [2]   ….…...…1

Ko fraction of material that formed isothermal

expressed by $Y(t) = 1 - e^{-(K.t)^n}$ [2-12] …................ 2

 k and n constant of the kinetics reaction

Y(t)is fraction volume yield after t seconds or relative crystalline at crystallization in time t, n as kinetic exponent value or the composite rate constant [7] and depend on the mechanism of crystal growth and size, the reaction rate constant K which is generally expressed by the Arrhenius equation,

    The reaction rate yield formation at constant temperature

$$\frac{dY(t)}{dt} = n.K^n.t^{n-1}(1-x)$$ [2-5]   …………3

$$= n.K.(1-y)[-\ln(1-y)]^{\frac{(n-1)}{n}}$$

On the isothermal treatment frequency factor K parameter values and parameter kinetic exponent n obtained from the data y (t), ie. the double logarithmic behavior Avrami equation as follows;

$$Ln[-\ln(1-y)] = n.\ln K + n \ln t \quad . \qquad [5] \quad .... \ 4$$

N and K values obtained from the graph least square Ln {-ln (1-y) versus ln t, for each t different activation energy value obtained from the graph Ln K QE versus 1 / T. [4]

In the case of treatment of Non-Isothermal reaction is determined by the number of atoms that move / move because of changes in the temperature, so that the necessary phase transformation equation applies in general namely;

$$y(t) = 1 - \exp[-(\int_0^1 K[T(t')]dt')^n] = 1 - \exp(-L^n) \qquad [5] \ ....\dots\dots 5$$

$$\textbf{and} \quad L = (\int_0^1 K[T(t')dt') \qquad \qquad \dots\dots\dots\dots\dots\dots 6$$

$$\frac{dy}{dt} = n.K.(1-y).L^{n-1} \quad [5] \quad ....\dots\dots\dots\dots 7$$

of course

The maximum crystallization speed is obtained by making twice differential y of t = 0,

$$\frac{d^2 y}{dt^2} = 0, \quad n.K.(1-y)(n-1)L^{n-2} = 0 \quad \frac{dy}{dt}(n-1)L^{n-2} = 0;$$

$$[5] \qquad ....\dots\dots\ 8$$

$$\frac{dy}{dt} = cons\tan ta, \quad then \ (n-1)L^{n-2}, \quad C = cons\tan ta$$

In the Non-Isothermal activation energy Ec crystal growth process is more emphasis on the speed of change in energy (heating or cooling) constant. Ec value can be determined by several methods namely[5] ;

a) Method of Matusita

b) Methods of Coats-Redfern-Sestak

c) Methods Kissinger

d) The method Mahadevan.

e) The method Ozzawa-Chan

If in the Avrami equation m obtain from relationship as in equation 4 as to obtain the activation energy of crystallization in the crystallization process is isothermal then the non-isothermal processes need to modify the equation 4 as in the method as follows;

a) Method Matusita

The Fraction yield crystals formed on the heating rate α χ constant with the activation energy follow equation

$$\ln[-\ln(1-\chi)] = -n \ln \alpha - 1.052.m.\frac{Ec}{R.T} + const \quad and \quad int \ eger \ depend \ on$$

$$the \ mechanisme \ and \ size \ of \ the \ kristal \ growth$$

To evaluate the growth of small-sized crystalline particles then follow the equation least square d

$$\frac{d \ln[-\ln(1-\chi)}{d \ln(\alpha)} = -n \quad \text{the n-value is } 2.71 \pm 0{:}01 \ [6] \text{ in non-integer value of n indicates that the}$$

Crystallization occurs fractal $\alpha = \dfrac{d[\Delta T]}{dt} = \dfrac{d|T_0 - T_t|}{dt}$ [6]

b) Methods of Coats-Redfern-Sestak.

The fractions of yield crystals formed on the heating rate α χ constant with the activation energy follow equation ;

$$\ln\left[\frac{-\ln(1-\chi)}{T^{2n}}\right] = -n\frac{E_c}{RT} + n\ln(\frac{k_0.R}{n\alpha E_c}) \quad [6].....E_c \quad as \quad Crystall \quad formation \quad energy$$

c) Methods Kissinger.

The fractions of yield crystals formed on the heating rate α χ constant with the activation energy Ec follow equation ;

$$\ln\left(\frac{\alpha}{T_p^2}\right) = -\frac{E_c}{RT_p} + const. \qquad ....[6]$$

Methods Mahadevan.

The fractions of yield crystals formed on the heating rate α χ constant with the activation energy follow equation.

$$\ln\alpha = -\frac{E_c}{RT_p} + const \qquad\qquad [6]$$

e) The method of Ozawa-Chen

The Fraction of yield crystals formed on the heating rate α χ constant with the activation energy   follow equation

$$\ln\left(\frac{\alpha}{T^2}\right) = -\frac{Q_{Ec}}{RT} + const \qquad [6].$$

In this study will be used method of Ozawa-Chen with constant α that the modified value in the parameter mileage stream flow X and z as;

$$we \quad must \ first \ calculate \quad z = \frac{dvolume}{dt}, \alpha = \frac{d|\Delta T|_{x0-xt}}{dt} = \frac{d|\Delta T|_{x0-xt}}{dVolume|_{t_0}-t_t}.z$$

$$z = \frac{z}{A.(X_0-X_t)}.|\Delta T|_{x0-xt} \quad ; z = \left(\frac{z}{A.\Delta X}\right)(T_{x0}-T_{xt})......... \quad [6]$$

Ozawa-chen equation becomes

$$\ln\left(\frac{\frac{z.\Delta T}{A.\Delta X}}{T_i^2}\right) = -\frac{Q_{Ec}}{R}(\frac{1}{T_i}) + const, \ln\left(\frac{zT_i^2}{A}.\frac{T_{Xo}-T_{Xt}}{X_0-X_t}\right) = -\frac{Q_{Ec}}{R}(\frac{1}{T_i}) + const,$$

$$\ln\left(\frac{z}{A}.(\frac{T_{Xo}-T_{Xt}}{X_0-X_t}).T^2\right) = -\frac{Q_{Ec}}{R}(\frac{1}{T_i}) - const \qquad ....9$$

At constant α, the applicable equation as *Mahadeva*

$$For \ z = \frac{dvolume}{dt}, \alpha = \frac{d|\Delta T|_{x0-xt}}{dt} = \frac{d|\Delta T|_{x0-xt}}{dVolume|_{t_0}-t_t}. \quad z = \frac{z}{A.(X_0-X_t)}.|\Delta T|_{x0-xt}$$

$$\alpha = \left(\frac{z}{A.\Delta X}\right)(T_{x0}-T_{xt}).$$

$$α = K. (T_{x0}-T_{0.5}) \qquad ....10$$

shows appear $z = \dfrac{dvolume}{dt}, \alpha = \dfrac{d|\Delta T|_{x0-xt}}{dt} = \dfrac{d|\Delta T|_{x0-xt}}{dVolume|t_0 - t_t}$

.........10 b

$$z = \frac{z}{A.(X_0 - X_t)}.|\Delta T|_{x0-xt} = \left(\frac{z}{A.(X_0 - X_{0.5})}\right)(T_{x0} - T_{0.5})$$

The theoretical $\log aritmic,$ $Ln\left\{\left(\dfrac{z}{A.(X_0 - X_{0.5})}\right)(T_{x0} - T_{0.5})\right\} = -\dfrac{Q_E}{RT} - Kons\tan ta.$

In the specially case process where the yield system as both constant temperature exchange and isothermal, then

$$Ln(T_0 - T0.5) - Ln\left(\frac{A(X_0 - X_{0.5})}{z}\right) = -\frac{Q_E}{RT} - kons\tan 1., \qquad Ln\left(\frac{A(\Delta X_{0.5})}{Z}\right) = \frac{Q_E}{RT} + kons\tan t2$$

T= yield temperature

A= Cross section of tube. Activation Energy - $Q_E = m.q_E$ [joule] , material mass -m = mole

energy/mol - q_E = joule/mole

$mass/\sec;$ $m/\sec = \dfrac{\sum mole}{dt}dt = \dfrac{1}{M_w}.\int \dfrac{m_g}{dt},dt$

$m_g = \rho.volum.$ $maka$ $m = \dfrac{\rho}{M_w}\int \dfrac{dvolum}{dt}.dt = \dfrac{\rho}{M_w}\int z.dt, \quad m = \dfrac{\rho.A}{M_w}\int \dfrac{dx}{dt}.dt = \dfrac{\rho.A}{M_w}\int r.dt$

$A = cross$ $\sec tion$ $area$ $,dx = elemen \; long \; dis\tan ce, \quad dx/dt = flow \; rate = r$

$z = \dfrac{dvolum}{dt}$ $obtained$ $Q_E = m.q_E = \dfrac{\rho.A.q_E}{M_w}\int r.dt$

From equation 2, to fraction yield 50%, then the relationship between the position of mile age solution that moves with velocity r with the activation energy per mole is obtained by the following equation;

$Q_E = m.q_E,$ $dengan \; m = \dfrac{\sum mol}{dt}.dt = \dfrac{\int\{\frac{m_g}{M_W}\}}{dt}.dt,$

$m = \dfrac{1}{M_w}\int(\dfrac{m_g}{dt}).dt = \dfrac{\rho}{M_W}\int \dfrac{volum}{dt}.dt = \dfrac{\rho.A}{M_W}\int r.dt =$

$\dfrac{Q_E}{R.T} = \ln t_{0.5} = \ln \dfrac{x_{0.5}}{r}$ $and \; \ln \dfrac{x_{0.5}}{r} = \dfrac{\rho.A.q_E}{M_W.RT}\int r.dt,$ $\qquad Ln\dfrac{x_{0.5}}{r} = \dfrac{\rho.A.q_E}{M_W.RT}.x_{0.5} .$ 11

Or $x_{0.5} = \dfrac{M_W.RT}{\rho.A.q_E}.\ln \dfrac{x_{0.5}}{r} = \dfrac{M_W.RT}{\rho.q_E}.\ln \dfrac{x_{0.5}}{z}.$ 12

$z = debit \; aliran = r.A, \quad r = rate \; of \; fluide, A = Cross \; Section \; Fluid .$

for case

$$\ln t_{0.5} = \frac{Q_E \cdot}{RT} = \ln \frac{x_{0.5}}{r} = \frac{\rho.A.q_E}{M_w.R.T}\int r.dt; \quad thus \quad \ln \frac{x_{0.5}}{r} = \frac{\rho.A.q_E}{M_w.R.T} x_{0.5} = \ln \frac{x_{0.5}}{r}$$

$$\ln \frac{A.x_{0.5}}{z} = \frac{\rho.A.q_E}{M_w.R.T} x_{0.5} \quad ; \quad \frac{1}{T} = \frac{M_w.R}{\rho.A.q_E.x_{0.5}}.\ln[\frac{A.x_{0.5}}{z}]$$

$$or \quad T = \frac{\rho.A.q_E.x_{0.5}}{M_w.R}.\{\ln[\frac{A.x_{0.5}}{z}]\}^{-1} \quad and \quad T = -\beta\ln[\frac{A.x_{0.5}}{z}] \quad with \ \beta = \frac{\rho.A.q_E.x_{0.5}}{M_w.R}$$

$$q_E = \frac{M_w.RT}{\rho.A.x_{0.5}}.Ln[\frac{A.x_{0.5}}{z}]$$

Value of A / z needs to be corrected, Volume of Yield = Volume residual reaction Raw materialism. Raw material volume = z / m. The volume of residual reaction V.exs = Vraw- Vyield,

Mass density (ρ), ρ = mass density of fluid reactant solution with an alkaline solution can be determined from the mass of solution to volume of solution. Weight of salt; $ZnCl_2$= 4.8 gram. $FeCl_2.4H_2O$ = 6 gram., $FeCl_3.6H_2O$ = 16.2 gram ., NaOH = 9 gram. H_2O = 360gram weight solution = 395 gram.

The volume of solution = 378 cc, Mass density solution before reaction = 395/378 = 1.045. In the reaction process there is no mass loss, unless the changes in the chemical formula (chemical phase change), so the average mass density solution before and after the reaction the same value ie ρ = 1,045.The molecular weight obtained relationship measurement system T to r and linear graph between T against ln [r / x0.5].

Table Model 1. $x_{0.5}$ Ti of $Ln[z_i/A.x_{0.5,i}]$

I	z_i	$X_{0.5,i}$	Ti	$1/T_i$	T_i^2	$\Delta T_{i,i-1}= T_i - T_{i-1}$	$Ln[z_i/A.x_{0..5,i}]$	$\Delta X_{i,i-1}=X_i-X_{i-1}$	$Ln(z_i/A(\ \Delta T_{i,i-1}/\ \Delta X_{i,i-1}$

As the initialization process X0.5 measurement determined by reference parameter ρ, QE, Mw, and R, by the following equation X0.5.i value at constant PHF = 0.5 will depend on Ti and zi

Setting Zi based on the position of X0.5, i and has a pH value = pH0.5 as the original (value pH0.5) constant. Given the value of T allowing changes while the value of the position X0.5, I have determined there will be a change in the value of Zi is quite significant. Fraction Yield based pH of the solution before and after the formation of crystals is expressed by the equation;

$$f(t) = \frac{10^{-pH_0} - 10^{-pH_t}}{10^{-pH_0} - 10^{-pH\infty}} ., f(t) = \frac{10^{-pH_0}}{10^{-pH_0} - 10^{-pH\infty}} - \frac{1}{10^{-pH_0} - 10^{-pH\infty}}.10^{-pH_t}$$

$$f(t) = M - N.10^{-pH_T}; with \ M = \frac{10^{-pH_0}}{10^{-pH_0} - 10^{-pH\infty}} \quad andN = \frac{1}{10^{-pH_0} - 10^{-pH\infty}}$$

then

$$\frac{M - f(t)}{N} = 10^{-pH_T} \quad ; pH_t = \log\left[\frac{N}{M - f(t)}\right]$$

$$if \ f(t) = 0.5 \quad then \ pH_{t(0.5)} = \log\left[\frac{N}{M - 0.5}\right]$$

M and N depend on pH and temperature. or pH liquid both depend on M,N and t finction.

Table Model 2:-. M , N and pH_t as pHx function, x distance of proces Y(t)

pH_0	pHt	M	N	pHx=1	pHt ,
12,6	11,87	-0,264110017	-0,083294218	-1,18117	-0,96254104
12,6	11,85	-0,249260175	-8,84408E+11	11,85	12,0720202
12,6	11,8	-0,216290421	-7,67427E+11	11,8	12,0299481
12,5	11,9	-0,335449831	-1,06079E+12	11,9	12,1037072
12,5	11,8	-0,249260175	-7,8823E+11	11,8	12,0220202
12,3	7,6	-1,9953E-05	-39811511,4	7,6	7,90102133
13	11,8	-0,067344911	-6,73449E+11	11,8	12,0744576

The Stages of Measurement:-

The measurement of half chemical proces is is not too easy, due to the yield movements were volatile, thus requires calmness and not in a hurry. The step measurement, among others;

a)   As an initialization process X0.5 measurement determined based on the reference
          parameter ρ, QE, Mw, and R.

   b)   The value of PHF = 0.5 x0.5. the constant will depend on Ti and zi ..

   c)   c) Setting Zi based on the position of X0.5, i and has a pH value = pH0.5 as before (value
         pH0.5)   constant. Given the value of T allows changed while the value of the position of
         X0.5, I have determined there will be a change in the value of Zi are quite significant.

Fraction Yield based pH of the solution before and after the formation of crystals expressed by Avrami equation as follows;

$$f(t) = \frac{10^{-pH_0} - 10^{-pH_t}}{10^{-pH_0} - 10^{-pH\infty}} = \frac{10^{-pH_0}}{10^{-pH_0} - 10^{-pH\infty}} - \frac{10^{-pH_0}}{10^{-pH_0} - 10^{-pH\infty}} . 10^{-pH_t}$$

$$f(t) = M - N.10^{-pH_T} ; \quad with\ M = \frac{10^{-pH_0}}{10^{-pH_0} - 10^{-pH\infty}}, N = \frac{1}{10^{-pH_0} - 10^{-pH\infty}} ., \frac{M - f(t)}{N} = 10^{-pH_T}$$

$$pH_t = \log\left[\frac{N}{M - f(t)}\right] \quad then, \quad if \quad f(t) = 0.5 \quad pH_{t(0.5)} = \log\left[\frac{N}{M - 0.5}\right] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 14$$

Table Model 3:-   for Examples of z and setting the table setting pH, innuendo obtained the activation energy of the linear graph X0.5 to 0.5 / z, as follows.

pH_0	pHt	M	N	pHx=1	Setting pHt	Z [CC/dt]	X0.5	N=Ln X0.5	M=NxpHo
12.55	11.87	-0.2641	-0.083294	-1.181	-0.962541				
12.55	11.85	-0.2493	-8.84E+11	11.85	12.07202				
12.55	11.8	-0.2163	-7.67E+11	11.8	12.029948				
12.55	11.9	-0.2884	-1.02E+12	11.9	12.113294				
12.55	11.8	-0.2163	-7.67E+11	11.8	12.029948				
12.55	7.6	-1E-05	-39811164	7.6	7.9010251				
12.55	11.8	-0.2163	-7.67E+11	11.8	12.029948				

Notification.

Setting is done by regulating the discharge pH z, the pH is read from the pH meter with the one shown in the above table. Create a graph to Ln x0.5 (x0.5 / z). The coefficient value will be tangent direction of the chart and the activation energy value will be crystal formation

See the configuration of the Flow Injection Synthesis Reactor.   The third reactor limitation above can be filled with liquid reactants reacting in a narrow space and flowing , so that the onset of the nucleation process is not to be the same but the age of the nucleus particles and the growth environment can be conditioned - growth same nucleus.

The synthesis process is a method of synthesis of the Flow Injection Synthesis- FIS, the liquid reactant material is injected into the flow of the relative speed laminar alkaline solution. T laminar flow may occur in pipes or hoses with a relatively small diameter orifice or a pipe that has undergoing the process of deflection for this purpose can be made on the flow in the hose is wound in a coiled shape.

From the equation above, there is a relationship between t0.5 parameter with the particle growth rate;

$$t_{0.5} = \frac{1}{v}(\frac{0.17}{N})^{\frac{1}{3}}, \quad X0.5 = (z. t0.5)/A$$

$v = $ d Vol partikel/ dt.

$$X0.5 = (\frac{z}{A}).\frac{1}{v}(\frac{0.17}{N})^{1/3} \quad ; \quad (\frac{Xo.5.A}{Z})v = (\frac{0.17}{N})^{1/3} \quad ; \quad v = \frac{d(.\phi_p^3)}{dt} = (\frac{z}{A.x_{0.5}})(\frac{0.17}{N})^{1/3},$$

With in Φ d particle diameter , $N = 6.25 \times 10^{23}$

$$\phi_p = 0.001864\left[\frac{z.t}{A.X_{0.5}}\right]^{1/3}$$

Was obtained provisions of the parameters that determine the particle size of the ocean inlet hose dimensions yield among others; sectional area of the channel, the channel spacing when the half-life and flow. the greater the hose cross-sectional area smaller the particle radius (particle diameter) or particle size yields.

$$A = 0.001864\left[\frac{z.t}{\phi_p.^3 X_{0.5}}\right] \quad ; \quad t\max = 2 \times t0.5 \quad ; \quad \text{Then } A_{\max imum} = 0.001864\left[\frac{z.2t_{0.5}}{\phi_p.^3 X_{0.5}}\right]$$

If the surface area of the initial flow parameters as a standard in the estimation of particle size then apply the equation;

$$\phi_d = 3.728..\left[\frac{z.t_{0.5}}{A_{\max}.X_{0.5}}\right]^{1/3}.10^{-3} \quad ;$$

From the equation above shows that the minimum size of particles occurs if the maximum flow surface area expanded.

Example of a cross-section Hose, From pH Data Logger,
rate and data solution Specific precipitants On X0.5 position.

No	pH seting 0.5	z [m3/det]	X0.5	Ln(x0.5/z)
1	11.85	1.5E-06	3.5	14.6628
2	11.85	1.40E-06	3	14.5777
3	11.85	1.60E-06	3.8	14.6805
4	11.85	1.80E-06	4	14.614
5	11.85	1.90E-06	4.1	14.5846
6	11.85	2.00E-06	4.05	14.5211

From the equation of the equation, Ln X0.5 / z = (1 / k) X0.5 - A Ln
And data Ln X0.5 / z, and X0.5 create linear graph to interpret graph linear equations are concerned. Liken the theoretical equations are obtained slope and intercept as follows;

ln X0.5 / z = -0.0223.X0.5 +14.69

$\quad$ 1 / k = - 0.0223 ----> k = -44.84

ln (A) = -14.69 ---> A = 0.4 10 ^ -7, ----> r = 0.0367 mm

Given at the beginning of the precipitation process nanometer-sized particles, the particles will form a colloidal solution remaining precipitant alkaline, alkaline precipitant which has exhausted precursor to form yield. Turbulence will increase the yield of motion brown particles in all directions. This will create a new situation in which the particle precursor solution will more quickly collide with particles precipitant solution. In this study is limited (does not discuss in detail) the mechanism of micro-precipitation process in turbulent solution flow. The discussion conducted concerning macro thermodynamic parameters induction results after the yield parameters in the form of powder.

The parameter to be a reference, among others; precursor flow rate along the same flow of precipitant solution, pH alkaline solution, colloidal fluid temperature.

The Energy Levels Precursor Solution and Solution precipitants.

The reaction between the solution of precursors with the precipitant will absorb or release energy in their environment that is the solution. Will change the energy level of the solution. If the nature of the exothermic reaction the temperature of the solution will increase, whereas if the reaction temperature endothermal then the solution will decrease.

According to the effect of temperature on the solubility is expressed as follows:

$$\frac{dLn\,S}{dT} = \frac{\Delta H}{RT^2}\,,\quad \int_{\ln S1}^{\ln S2} dLnS = \int_{T1}^{T2} \frac{\Delta H}{RT^2}\,dT$$

$$[LnS2 - LnS1] = \frac{\Delta H}{R}(T_1^{-1} - T_2^{-1}) = Ln\frac{S2}{S1};\qquad Ln\,S = \frac{-(\Delta H)}{RT} + Con\tan ta$$

In terms of :. S1, S2 = solubility of each - each substance at temperatures T1 and T2 is expressed in units of [g / 1000gram solvent] , So for pure solvent = water, 1000 grams = 1 liter, 1 gram = mole x M.
$\quad$ M = Σ g / mole, so that S = M x 10-pOH
2. The dissolution ΔH = heat (hot dissolution / g (g)).
3. R = general gas constant.

Obtained $\quad$ *S1 = M1 x 10^{-pOH1}$ $\;$ *Ln S1= Ln M1 + Ln 10^{-pOH1}*

$$Ln\;S2 = Ln\;M2 + Ln\;10^{-pOH2}$$

LnS2-LnS1 = Ln M2-LnM1+ Ln10^{-pOH2}- Ln 10^{-pOH} = Ln M2/M1 + Ln 10^{(pOH1-pOH2)}

or

$$Ln\frac{M2}{M1} + Ln10^{(pOH1-pOH2)} = \frac{-(\Delta H)}{R}(T_1^{-1} - T_2^{-1})$$

For this type of dissolved materials do not change, then the M2 / M1 = 1 Ln M2 / M1 = 0.
Was obtained

$$Ln10^{(pH2-pH1)} = \frac{-(\Delta H)}{R}(T_1^{-1} - T_2^{-1})$$

To PH2 = pH end = pH∞, PH1 = initial pH = pH0

Then $Ln\{10^{(pH_\infty - pH_0)}\} = \frac{-Q_{solution}}{R}(T_0^{-1} - T_\infty^{-1})$

Q solution as changes in the level of energy in the solution.

With the same way the middle ($t_{0.5}$) way can be obtained;
1. The Mechanism of Mode reactant streaming solution
2. The Planning Long Flow In Section Half Time Yield.
3. Size / diameter of the particle to the distance reactants and yield.

In the physically crystal growth to achieve a fraction yield 50% disbursed in regularly hose wound on cylindrical tubes with diameter of about 20 cm. The length of the hose is designed in accordance with the flow rate (discharge solution yield) and a 50% fraction of the formation of crystals yield (half-life t0.5).   For determine the half-life requires parameter data precipitant solution pH, pH of the solution yields at any time up to the steady state.

Parameter pH when the yield reaches 50% or half of the overall yield of the parameter data required initial pH, pH steady state, as well as a number of IPM parameter data in the time interval between the beginning until a pH steady state.
In this case illustrates the pH $_{initial}$ of precipitant before reacting with the precursor, pH describes the pH precipitant steady state after reacted with precursors.

Conclution:-
There are many kind of the chemical reactor, one of the reactor is circular reactor that use of the gravity energy as potensial energy, mixing energy that the size of reactor may adjusted by the size of yield .

In the circlar hose the half energy-$X_{0.5}$ is $q_E = \frac{M_w.RT}{\rho.A.x_{0.5}}.Ln[\frac{A.x_{0.5}}{z}]$, where $X_{0.5}$ can from half time from Y(T)

100% in the Avrami equation, the end of the first coil as the position of the injector while the other end of the coil as a restraint on the growth of the particles. In half time of process are in the different or the same, but may be the same of product.

We have apportunity if we have the halfe time where $pH_{t(0.5)} = log[\frac{N}{M - 0.5}]$. The crystall size can be designed

by half time and generally at the end of coil result of yield still in alkaline pH, but not too far from the pH of the formation of yield. It is important to note that the washing process reactants is not too different, to obtain material washing time shorter.

In a time not too long can estimate the time and the particle size, of course, pay attention to the proper parameters.

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