

INTISARI

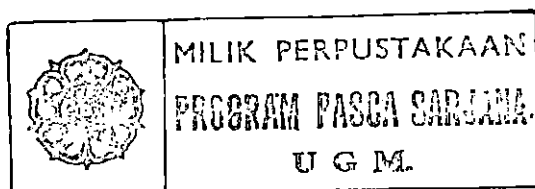
Reaksi polimerisasi akrilamid dengan mekanisme radikal bebas menggunakan metoda *mixed-solvent precipitation* merupakan reaksi polimerisasi adisi. Penelitian ini dilakukan untuk mempelajari kinetika reaksi polimerisasi akrilamid melalui pengembangan model pada tahap inisiasi, yaitu model 1 untuk order satu dan model 2 untuk order 2.

Polimerisasi akrilamid dilakukan secara *batch* di dalam labu leher tiga yang dilengkapi dengan pengaduk, termometer, alat pengambil cuplikan, pendingin tegak, *water-bath* dan pemanas. Larutan akrilamid dimasukkan ke dalam labu leher tiga dan dipanaskan sampai mencapai suhu yang telah ditentukan, kemudian ditambahkan inisiator kalium persulfat. Suhu dijaga tetap selama proses polimerisasi. Cuplikan diambil pada selang waktu 30 menit dalam 3 jam kemudian disaring dan dianalisa dengan cara gravimetri. Peubah yang dipelajari meliputi variasi suhu (45-60 °C), konsentrasi monomer ($3,52 \cdot 10^{-4}$ - $1,41 \cdot 10^{-3}$ mol/mL) dan konsentrasi inisiator ($2,8 \cdot 10^{-5}$ - $5,5 \cdot 10^{-5}$ mol/mL).

Berdasarkan hasil penelitian, dapat disimpulkan bahwa model 1 maupun model 2 dapat menjelaskan kinetika polimerisasi akrilamid dengan mekanisme radikal bebas menggunakan metoda *mixed-solvent precipitation*, akan tetapi model 1 memberikan ralat rata-rata yang lebih kecil dibandingkan dengan model 2. Konstanta kecepatan reaksi sebagai fungsi suhu untuk kisaran 45 °C dalam pelarut campuran metanol-air, dapat dinyatakan sebagai berikut.

- k_d (model 1) = $7,78 e^{(-3697,39/RT)}$ (menit)⁻¹, ralat rata-rata = 3,15 %
- k_i (model 2) = $2,70 \cdot 10^8 e^{(-8393,51/RT)}$ (mL/mol). menit⁻¹, ralat rata-rata = 0,07 %
- $k_p/k_t^{1/2}$ = $1,37 \cdot 10^{23} e^{(-32900,47/RT)}$ (ml/mol.menit)^{1/2}, ralat rata-rata = 13,56 %

Kata kunci : akrilamid, kalium persulfat, *mixed-solvent precipitation*, polimerisasi, kinetika reaksi





ABSTRACT

Free-radical polymerization of acrylamide using mixed-solvent precipitation method was studied by emphasizing on the kinetics aspect. Acrylamide was polymerized in methanol-water solution with potassium persulfate as initiator. Two models of polymerization can be developed based on the initiation stage. Model 1 described the first order of the initiation stage and the second order of initiation was represented by model 2.

Polymerization of acrylamide was carried out in batch process in a three necked flask equipped with a stirrer, thermometer, samples device, condenser, water-bath and heater. A methanol-water solution of acrylamide was charged into the flask and heated to the desired temperature. When the desired temperature was reached, the initiator potassium persulfate was introduced quickly into the reaction medium. During the process, the temperature was kept constant. Aliquots were taken from the reaction medium at a regular time then analyzed its polymer content by gravimetric method. Variables investigated were temperature (45-60 °C), amounts of initiator ($2.8 \cdot 10^{-5}$ - $5.5 \cdot 10^{-5}$ mole/mL) and monomer concentration ($3.52 \cdot 10^{-4}$ - $1.41 \cdot 10^{-3}$ mole/mL). The molecular weight was determined by viscometric method. The agitation speed was fixed at 919 rpm in all experiments.

It can be concluded that both model 1 and model 2 can predict well the polymerization of acrylamide. The average error of model 1 is less than model 2. The relations between rate constant and temperature in range of 45 °C (318 K) to 60 °C (333 K) and in methanol-water solution, are as follows :

- a. k_d (model 1) = $7.78 e^{(-3697.39/RT)}$ (min)⁻¹, average error = 3.15 %
- b. k_i (model 2) = $2.70 \cdot 10^8 e^{(-8393.51/RT)}$ (mL/mole). min⁻¹, average error = 0.07 %
- c. $k_p/k_t^{1/2}$ = $1.37 \cdot 10^{23} e^{(-32900.47/RT)}$ (ml/mole. min)^{1/2}, average error = 13.56 %

Key words : acrylamide, potassium persulfate, mixed-solvent precipitation, polymerization, the kinetics aspect