Equation:

[Triglyceride] + 3 [methanol] = [Fat acid methyl ester] + [glycerol]

Rate constant, k:

0.38

Conversion, X:

0.98

Step 1:

General equation for CSTR: FAo – FA + rA(V) =

Volume for CSTR: V =

Since, FA = FAo (1-X) then, V =

For 1st order reaction, -rA=kCA

Step 2:

Stoichiometry table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Symbol | Initial | Change | Remaining |
| Triglyceride | A | |  | | --- | | FAO | | |  | | --- | | -FAOX | | |  | | --- | | FA = FAO (1-X) | |
| Methanol | B | |  | | --- | | FBO | | |  | | --- | | -FAOX | | |  | | --- | | FB = FBO - FAOX | |
| Methyl ester | C | |  | | --- | | FCO = 0 | | |  | | --- | | FAOX | | |  | | --- | | FC = FAOX | |
| Glycerol | D | |  | | --- | | FDO = 0 | | |  | | --- | | FAOX | | |  | | --- | | FD = FAOX | |

Step 3:

*V*o= and CA=CAo (1-X)

So substitute, V =

Vo= (5 kg/day ) (901.3g/ ) = 5.548

V= =0.715 = Volume

D= = = 0.9691 m = Diameter

V = x L

L = = 0.9693 m =Height