**Table 7.IIb. Second series of tests - feeding solutions; $w_P$=40%.**

| Exp.no. | NaOH [mol/dm$^3$] | V [cm$^3$] | ρ [g/cm$^3$] | μ [Pa·s] |
|---|---|---|---|---|
| 1 | 0.1999 | 35.79 | 1.0686 | 0.330 |
| 2 | 0.2003 | 35.79 | 1.0682 | 0.328 |
| 3 | 0.1977 | 35.79 | 1.0687 | 0.329 |
| 4 | 0.1977 | 35.79 | 1.0687 | 0.329 |

**Table 7.IIc. Second series of tests - final solutions after experiment; n=400rev/min, a=19.**

| Exp.no. | $Q_f$ [cm$^3$/min] | Ester [mol/dm$^3$] | X [%] | V [cm$^3$] | ρ [g/cm$^3$] | μ [Pa·s] |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.008201 | 15.39 | 715.79 | 1.0679 | 0.304 |
| 2 | 0.59 | 0.008374 | 12.13 | 715.84 | 1.0681 | 0.305 |
| 3 | 0.385 | 0.008595 | 14.00 | 715.92 | 1.0680 | 0.307 |
| 4 | 0.3 | 0.008499 | 14.98 | 715.92 | 1.0680 | 0.306 |

The experimental results show that increasing the feeding time, $t_f$, has no effect on the final selectivity in the case when agitation speed equals 400 rev/min (Re=24). On the other hand, in the case when agitation speed equals 100 rev/min (Re=6) this effect is detectable even for long feeding times.

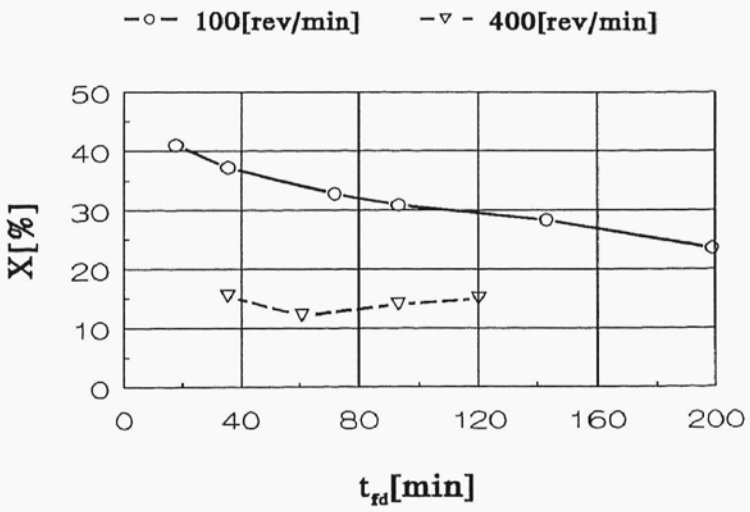


**Figure 7.2. Effect of the feeding time on the final selectivity in the semi-batch reactor - experimental data.**

### 7.2.2. Effect of the Rotational Speed on the Product Distribution.

The rate of mixing is strongly related to the local deformation rate of liquid elements - see chapter 3.1. The local deformation rates are directly dependent on the rotational speed of the pitched-blade turbine in the experimental system. The third series of experiments was performed to determine the magnitude of this effect.

The initial volume ratio, **a**, was equal to 19, whereas the feeding rate of the base solution was set to 1 $cm^3$/min. Tables IIIabc show compositions, volumes, viscosities and densities of solutions, rotational speeds and final selectivities obtained in these experiments. The plot of the final selectivity versus agitation speed is shown in figure 7.3. The related values of Reynolds number are also given in this figure to identify the flow regime in the vessel. The plot also includes two points obtained for 100 and 400 rev/min; these results were presented previously (exp.no. 2 in tables 7.I and exp.no.1 in tables 7.II).

**Table 7.IIIa. Third series of tests - initial reactor content; $w_P$=40%.**

| Exp.no. | HCl [mol/$dm^3$] | Ester [mol/$dm^3$] | V [$cm^3$] | ρ [g/$cm^3$] | μ [Pa·s] | KCl [g/kg] |
|---|---|---|---|---|---|---|
| 1 | 0.01029 | 0.01030 | 680.04 | 1.0684 | 0.305 | 11.56 |
| 2 | 0.01047 | 0.01007 | 680.04 | 1.0682 | 0.306 | 11.50 |
| 3 | 0.01054 | 0.01031 | 679.98 | 1.0679 | 0.304 | 11.25 |
| 4 | 0.01054 | 0.01031 | 679.98 | 1.0679 | 0.304 | 11.25 |
| 5 | 0.01047 | 0.01007 | 680.04 | 1.0682 | 0.306 | 11.50 |

**Table 7.IIIb. Third series of tests - feeding solutions; $w_P$=40%.**

| Exp.no. | NaOH [mol/$dm^3$] | V [$cm^3$] | ρ [g/$cm^3$] | μ [Pa·s] |
|---|---|---|---|---|
| 1 | 0.2008 | 35.79 | 1.0682 | 0.330 |
| 2 | 0.1999 | 35.79 | 1.0687 | 0.334 |
| 3 | 0.1991 | 35.79 | 1.0686 | 0.332 |
| 4 | 0.1991 | 35.79 | 1.0686 | 0.332 |
| 5 | 0.1999 | 35.79 | 1.0687 | 0.334 |

**Table 7.IIIc. Third series of tests - final solutions after experiment; $Q_f$=1$cm^3$/min, a=19.**

| Exp. no. | n [rev/min] | Ester [mol/$dm^3$] | X [%] | V [$cm^3$] | ρ [g/$cm^3$] | μ [Pa·s] |
|---|---|---|---|---|---|---|
| 1 | 50 | 0.005763 | 40.04 | 716.03 | 1.0681 | 0.305 |
| 2 | 150 | 0.006615 | 29.51 | 715.78 | 1.0683 | 0.305 |
| 3 | 200 | 0.007202 | 26.03 | 715.79 | 1.0679 | 0.304 |
| 4 | 250 | 0.007772 | 20.31 | 715.79 | 1.0679 | 0.304 |
| 5 | 300 | 0.007815 | 17.50 | 715.78 | 1.0683 | 0.305 |

The results of the experiments presented in figure 7.3 indicate very strong influence of the stirrer speed on the final selectivity for Reynolds numbers ranging from 3 to 24. In the case of the lowest agitation speed (50rev/min) the selectivity exceeds 0.4; notice that the upper limit for the selectivity equals 0.5. When the agitation speed is increased 8 times the final selectivity drops 2.6 times to 0.154.

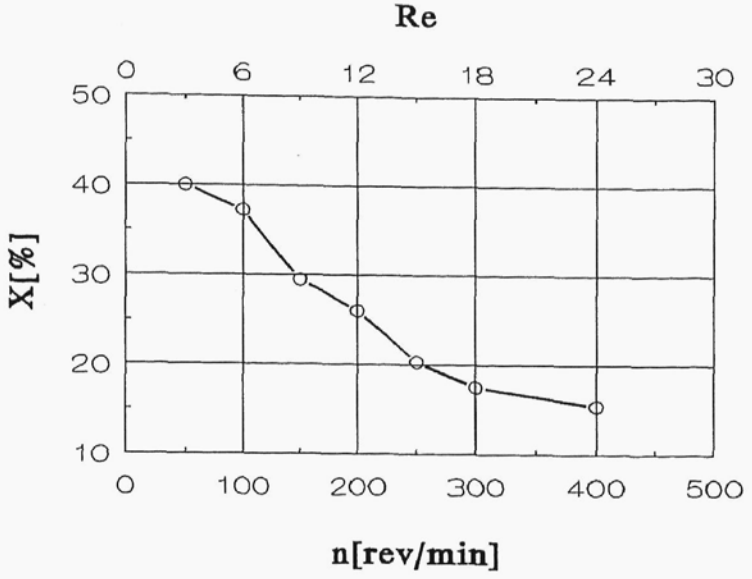


**Figure 7.3. Effect of the stirrer speed on the final selectivity in the semi-batch reactor - experimental data.**

### 7.2.3.Effect of the Initial Volume Ratio on the Product Distribution.

In the fourth and fifth series of experiments the effect of the initial volume ratio was studied for two revolution speeds of the pitched-blade turbine 100 and 400 rev/min. In all the experiments the feeding rate of the base solution was equal to 1 $cm^3$/min.

Tables 7.IVabc report compositions, volumes, viscosities and densities of solutions and final selectivities obtained in these experiments. The plot of the final selectivity versus volume ratio is shown in figure 7.4. This plot includes two points obtained for 100 and 400 rev/min when **a** was equal to 19 (exp.no.2 in tables 7.I and exp.no.1 in tables 7.II).

**Table 7.IVa. Forth and fifth series of tests - initial reactor content; $w_P$=40 %.**

| Exp.no. | HCl [mol/$dm^3$] | Ester [mol/$dm^3$] | V [$cm^3$] | ρ [g/$cm^3$] | μ [Pa·s] | KCl [g/kg] |
|---|---|---|---|---|---|---|
| 1 | 0.01070 | 0.01031 | 675.42 | 1.0671 | 0.312 | 9.812 |
| 2 | 0.01058 | 0.01044 | 667.21 | 1.0660 | 0.309 | 7.588 |
| 3 | 0.01129 | 0.01102 | 651.27 | 1.0639 | 0.308 | 4.934 |
| 4 | 0.01070 | 0.01031 | 675.42 | 1.0671 | 0.312 | 9.812 |
| 5 | 0.01058 | 0.01044 | 667.21 | 1.0660 | 0.309 | 7.588 |
| 6 | 0.01160 | 0.01109 | 651.21 | 1.0638 | 0.308 | 5.000 |