Aalto University
Chemical Engineering

AGITATION

___ / ___ 200__
Work done

____
Work group

____
Made by

________	________________	____________
No	Department	Student number

MARKINGS:

Given in:	___ / ___ 200__	
Examined:	___ / ___ 200__	**RET / PASS**
	___ / ___ 200__	**RET / PASS**
	___ / ___ 200__	**RET / PASS**
	___ / ___ 200__	**RET / PASS**
Passed:	___ / ___ 200__	

1. GENERAL

In this laboratory work power consumption of agitation is measured using four (4) different impellers to water and one to viscous fluid. The power number is calculated as function of agitator Reynolds numbers, impellers are compared between each other and agitation with Newtonian and non-Newtonian fluid is also compared.

2. VISCOSITY

Temperature of mixed water is _____ ^{o}C.

Viscosity of water is:

Temperature of mixed viscous fluid is _____ ^{o}C.

Density of viscous fluid is determined by weighting volume and mass. Results are illustrated in appendix 1 sheet 9-seko.xls.Visko.

Assume that viscosity of viscous fluid follows equation (1):

$$\tau = \frac{F}{A} = K'\left(\frac{du}{dy}\right)^{n'} \tag{1}$$

The following equation can be used defining viscosity parameters *K'* and *n'*:

$$\eta' = K'\left(\frac{4\pi n}{n'}\right)^{n'-1} \tag{2}$$

Apparent viscosity η' is measured numerous values of velocity gradient *du/dy* aka values of rotational speed *n*. The viscosity parameters *K'* and *n'* are calculated from these measurements and results are illustrated in appendix 1 9-seko.xls.Visco.

Thus *K'* = and *n'* =

Value of parameter *n'* can be seen that viscous fluid is behaving in this region as

___________________________ fluid.

3. POWER CONSUMPTION

The following equation can be used for calculation power consumption:

$$P_B = \omega M = \omega F l = \omega m g l = 2\pi n m g l \tag{3}$$

Calculation on power consumption to water and viscous fluid is illustrated in appendix _____ sheet 9-seko.xls.Power.

4. POWER NUMBER TO WATER

Power number *Po* and Reynolds number *Re* for water is illustrated in appendix _____ sheet 9-seko.xls.Water.

In the same sheet also the power consumption vs. volume and Froude number *Fr* is calculated.

With larger Reynolds numbers the power number is independent of the Reynolds number but it is specific parameter K_T for each type of impeller.

Power numbers aka parameters K_T for each impeller are compared to literature data.

In appendix ___ is shown graphically data for impeller _________________ comparing to literature

data from:

In appendix ___ is shown graphically data for impeller _________________ comparing to literature

data from:

In appendix ___ is shown graphically data for impeller _________________ comparing to literature

data from:

In appendix ___ is shown graphically data for impeller _________________ comparing to literature

data from:

5. COMPARING WATER AND VISCOUS FLUID WITH SAME IMPELLER

Power number *Po* and Reynolds number *Re* to water and viscous fluid with same impeller is illustrated in appendix _____ sheet 9-seko.xls.Water-and-visco.

In the same sheet power consumption per unit volume and Froude number *Fr* is also calculated.

In appendix ___ is shown graphically data for impeller _________________ to water and viscous fluid.

In appendix ___ is shown graphically data for impeller _________________ to viscous fluid comparing to literature

data from:

6. RISE OF TEMPERATURE

Loss of mechanical energy in agitation is:

P_h =

Heat loss is:

$P_{H,GEN}$ =

Rate of temperature rise in the system is

$$\frac{dT}{dt} =$$

Because of rate of temperature rise temperature would rise in 10 minutes:

ΔT =

Summary of temperature rise in sheet 9-seko.xls.Temperature is shown in appendix ____.

7. INCORRECT ESTIMATE

8. RESULTS AND SUMMARY

9. APPENDICES