LATEX LABORATORY REPORT
EBP 316/2
SEMESTER II 2020/2021

Code & Course Title: EBP 316/2 (Latex Laboratory)
Experiment No: 3
Experiment title: Measurement of MST of NR latex
Name: Cheang Mun Kit
Matrix No: 143980
Group No: 4
Group Members: Iman Firdaus Bin Ismail, Chin Wing Foong, Mohd Nidzam Adha Atan
Lecturer: Dr. Danial
Date of experiment: 20/4/21
Submission Due Date: 27/4/21

LAB REPORT ASSESSMENT SCHEME BASED ON THE RUBRIC

Introduction	Section Marks	Marks
Abstract and Objective	5	
Introduction	10	
Experimental	15	
Results and Discussion	50	
Conclusion	10	
Format and References	10	
Total		

EBP 316/2 – Latex Laboratory - Academic Year: 2020/2021
Lab Report Assessment Rubric

Student Name : Cheang Mun Kit
Matrix No. : 143980
Group : 4
Experiment No. : 3
Date of Experiment : 20/4/21
Submission due date : 27/4/21

	Beginning (1-2)	**Developing (3-5)**	**Accomplished (6-7)**	**Exemplary (8-10)**	**Weightage**	**Marks (%)**
Abstract/Objective	Abstract misses major items of the experiment, lack of understanding on how to write an abstract	Abstract misses one or moremajor items of the experiment and the results obtained	Abstract contains 3/4 of the major items of the experiment and the results obtained	Abstract contains every major items of the experiment and the results obtained was well written	5	4.5
Introduction	Very little background information provided or information is incorrect.	Some introductory information provided, but missing some major points	Introduction is nearly complete, missing some minor points. References are used to support the content	Introduction complete and well-written. Reliable references are used to support the content.	10	8
Experimental procedure	Not written in paragraph format, missing important experimental details	Written in paragraph format, still missing some important experimental details	Written in paragraph format,important experimental details are covered, some minor details are missing	Well-written in paragraph format, all experimental details are covered	15	13.5
Results & analysis	Figures, graphs, tables contain errors or are poorly constructed, missing titles, captions or numbers, units missing or in correct, etc.	Most figures, graphs, tables are appropriate but missing some important or required features	All figures, graphs, tables are appropriate but could still be improved	All figures, graphs, tables are excellently produced with error bars are included (wherever applicable).	20	16
Discussion	Some of the results and questions (if applicable) have been incorrectly interpreted and discuss, lack of understanding of the results.	Some of the results and questions (if applicable) have been correctly interpreted and discussed; partial but incomplete understanding of the results	Almost all of the results and questions (if applicable) have been correctly interpreted and discussed, only minor improvements are needed.	All-important results have been interpreted correctly and discussed; good understanding of results is conveyed. All questions (if applicable) have been answered correctly.	30	24
Conclusions	No conclusions or missing the important points	Some important points are concluded	All important points are concluded	All important points are concluded and precisely constructed	10	8
References	No reference cited	Reference cited but not relevant	Reference cited and almost relevant	All reference are cited and highly relevant	5	5
Format	Poor formatting/ unreadable handwritten	Fair formatting / partially readable handwritten	Good formatting/ readable handwritten	Excellent formatting/ readable handwritten	5	5
					Total Marks (%)	84

Experiment 3: Measurement of mechanical stability time (MST) of NR latex

Abstract

This experiment was carried out to measure the effects of temperature on mechanical stability time (MST) value of natural rubber latex according to ISO 35-Third edition-1989-0915. Mechanical stability test was used to investigate colloidal stability of new latex at temperature of 35°C and 65°C. The new latex was diluted to 55% (m/m) total solid contents with 1.6% ammonia solution. Next, the latex was subjected to mechanical stirring at 14000 rpm at 35°C and 65°C. The time taken for the latex to flocculate was recorded. The MST of new latex was reduced at higher temperature (65°C) compared to the temperature at 35°C. The low value of MST indicates low quality of latex which is due to low colloidal stability caused by the microorganism activity which produce the volatile fatty acids.

1.0 Objective

To measure the effects of temperature on the mechanical stability time (MST) of NR latex according to the ISO 35-Third edition-1989-0915.

2.0 Introduction

According to Blackley (1997), the term *mechanical stability* is used to denote the ability of a latex to withstand mechanical agitation or shearing without becoming obviously colloidal destabilized. The principal factors responsible for the colloidal destabilization of latices by increasing agitation are the increases in collision frequency and in average kinetic energy of the particles brought about by the agitation. The latex particles in consequence have increased opportunity to surmount any potential-energy barrier between them. The mechanical stability of latices is a property of great industrial importance. It has implications for the pumping, transportation and processing of lattices. The latices must have sufficient mechanical stability to withstand the shearing forces which arise during handling without suffering colloidal destabilization.

Generally, the colloidal stability of latex can be approach through mechanical, chemical or heat testing. The experimental determination of mechanical stability time is done according to ISO 35- third edition 1989-09-15. According to Perez (1993), the mechanical stability test is a rapid, simple method of estimating the colloidal stability or quality of natural rubber latex by high speed stirring, in which latex is stirred rapidly (14,000 rpm) under standardized conditions and the time required for visual flocculation to occur is noted. The mechanical stability of natural latex should be more than 650s. This test is inapplicable to most of the synthetic lattices, since it does not yield coagulum on agitation at 12000 to 15000 rev/min even at 1 hour of time.

According to Blackley (1997), there are two distinct types of mechanical stability test which are commonly used for rubber lattices, the one being used for NR latex concentrate and the other for synthetic rubber lattices. In the test for NR latex concentrates, a specified amount of latex of specified total solid content is subjected to mechanical agitation under specified conditions. The MST is measured and it is usually expressed in either seconds or minutes. Thus, the greater the MST observed, the more mechanically stable is the latex. In the test for synthetic rubber lattices, a specified amount of latex of specified total solid content is subjected to mechanical agitation under specified conditions for a specified time. The mass of coagulum produced is then determined by filtration and weighing. The actual mass of dried coagulum is expressed as a fraction of the mass of the latex test sample. Thus, the greater is the number observed, the less mechanically stable is the latex.

Dawson (1949) stated that the time required to reach a certain degree of agglomeration depend upon the colloidal characteristics of the latex being tested in a constant mechanical shearing test. Mechanical stability tends to decrease with the increasing of the periods of transportation and storage owing to the slow hydrolysis of the stabilizers by the ammonia. Temperature is also one of the factors that influence mechanical stability time of natural rubber latex. In this experiment, it is observed that heating latex at 35ºC and 65ºC caused a decrease in mechanical stability time.

Mechanical stability is important for latex used with hydraulic cements. This is because latex often subjected to high shear in metering and transfer pumps, exposed to the extremely active chemical environment provided by hydraulic cements, and subjected to wide variations in temperature encountered in transportation related construction (Chen and Ng, 1984).

3.0 Materials and experimental procedure

3.1 Apparatus

Electronic weight balance, Beakers, Glass rod, Thermometer, Water bath, Mechanical stability apparatus, Stopwatch and Cups

3.2 Materials

Natural latex (NR) latex (New) and 1.6% ammonia solution

3.3 Experimental Procedure

Firstly, 100 g of new latex concentrate was weighed and diluted to 55.0% (m/m) ± 0.2% (m/m) total solid content (TSC) with 1.6% ammonia solution. The diluted latex was warmed to 65°C on heater with gentle stirring the latex immediately. The diluted latex was immediately filtered through sieve and 80.0g ± 0.5g of filtered latex was weighed into a flat-bottomed latex container. The container was placed in position and the latex was stirred ensuring that the rotational frequency of the stirrer is 14000 rpm throughout the test until the end point was passed.

The arrival of the end point was preceded by a marked decrease in the depth of the vortex around the stirring shaft. After a few minutes, a drop of latex was removed from the container with a clean glass rod at intervals of 15 seconds and the sample was gently spared on the surface of water in cup. The endpoint was taken as the first appearance of flocculum. The end point was confirmed by the presence of the increased amount of flocculum in a sample taken after stirring the latex for an additional 15 seconds. The steps above were repeated for the new latex at 35°C.

4.0 Results and Discussion

At different temperature, natural rubber (NR) latex shows different effects on the mechanical stability time (MST). Figure 4.1 shows the MST value of new natural rubber latex obtained at different temperature (35°C and 65°C) during mechanical stability test.

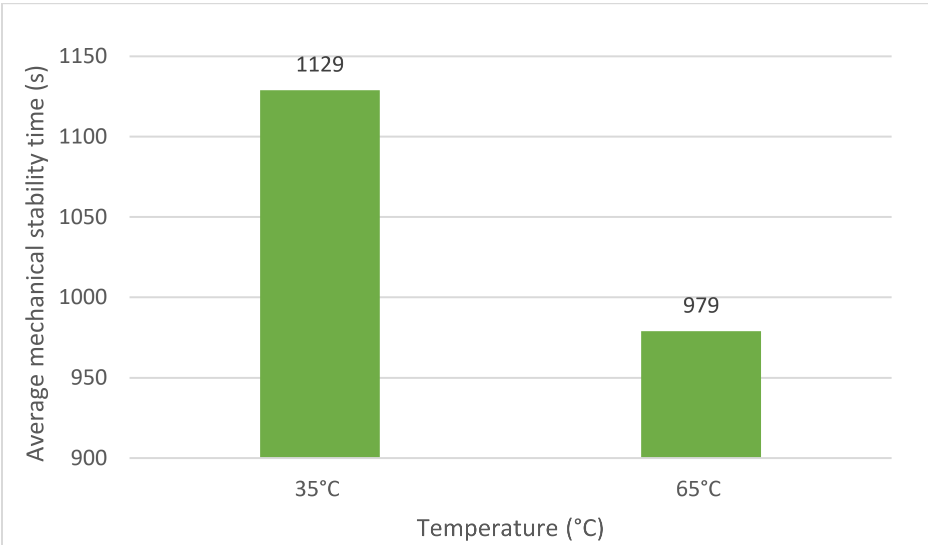

Figure 1: MST of the new natural rubber latex at 35°C and 65°C

From this experiment, mechanical stability time (MST) of the natural rubber (NR) latex reduced with the increase of temperature. MST of new NR latex is higher at 35°C as compared to that at 65°C. At 35°C, the average mechanical stability time of new NR latex was found to be 1129 seconds. When the mechanical stability test carried out at 65°C, the average mechanical stability time of new NR latex was found to be 979 seconds, which was lower than that at 35°C. It showed that the lower the temperature, the higher the MST value, thus, the slower the colloidal destabilization effects on the NR latex. This shows the colloidal destabilization rate increases by raising the temperature. The stability or flocculation behaviour of latex is governed by the various attractive and repulsive forces between the particles. The high temperature applied on the latex sample will provide the additional speed and kinetic energy that being imposed upon the particles by agitation. Thus, the heat energy that imparted on the latex particles through the increasing of temperature causes the increment in their particle movement and induce more kinetic energy. Hence, it increases average kinetic energy of particles which responsible for the colloidal destabilization. The latex particles collide to each other more rapidly with a higher average kinetic energy. Thus, the colloidal destabilization rate is increased when temperature is increased (Perez, 1993).

In addition, the low mechanical stability time is inversely proportional to the colloidal destabilization rate. From the experiment, the decrements in mechanical stability time of the new NR latex was said to have high colloidal destabilization rate when the mechanical test carried out at 65°C. From the results obtained in this experiment, the mechanical stability time for the new NR latex samples at both temperatures were lied in the range of the standard mechanical stability time as stated in ISO 35. The typical mechanical stability time range of a HA natural rubber latex concentrate is 650 seconds to 1250 seconds according to the specification limit.

5.0 Conclusion

Throughout the experiment, it was concluded that the mechanical stability time (MST) of the NR latex was dependent on the temperature (35°C and 65˚C) in which the NR latex was subjected to mechanical agitation. It was found that the mechanical stability time for the new latex is lower at higher temperature (65°C). The higher the temperature of the latex, the lower the colloidal stability due to the increment in colloidal destabilization. Thus, the MST value and the quality of the new NR latex were lower. As a result, the quality of the latex was based on the applied processing temperature.

6.0 References

Blackley, D.C. (1997). Polymer Latices: Science and Technology, Volume 1: Fundamental Principles, 2nd Edition, pg: 427 - 431. New York: Chapman & Hall.

Blackley, D.C. (1997). High Polymer Latices, Vol 2: Types of Latices, Applied Science. New York: Chapman & Hall.

Chen, S.F., and Ng, C.S. (1984). The natural higher fatty acid soaps in natural rubber latex and their effect on the mechanical stability of the latex. *Rubber Chemistry Technology. 57:243*.

Dawson, H. G. (1949). Mechanical Stability Test for Hevea Latex. Analytical Chemistry, Volume 21, No.9, 1066-1071.

Perez, J (1993). Natural Latex: Control and Industrial Procedures. France: Humana Press Inc.

Appendix

Appendix A: Determination of ammonia solution used for latex dilution

The NR latex was diluted with 1.6 % ammonia solution to 55.0% (m/m) ± 0.2% (m/m). By using the formula below, the amount of ammonia solution needed to reduce the TSC value of latex concentrate to 55.0% (m/m), is calculated.

$$M_1V_1 = M_2V_2$$

$$(61.5)\ (100) = (55)\ (x + 100)$$

$$x = 11.82 \text{ g}$$

M_1 = 61.50% (m/m) TSC of NR latex

M_2 = 55.0% (m/m) TSC of NR latex (required)

V_1 = mass of latex

V_2 = mass of ammonia solution + mass of latex

x = mass of ammonia solution needed

Appendix B: MST of the new natural rubber latex at different temperatures.

Latex	Temperature (˚C)	Average time for the floccs to appear (s)
New latex	35	1129
	65	979