Troubleshooting for the observed problems in processing latex concentrate from natural resource

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Abstract. Natural latex has special importance in the rubber industry for manufacturing different types of goods like gloves, balloons, male contraceptive and similar thin walled articles. This natural latex is much more sensitive a liquid to handle since it can easily become contaminated and thereby coagulated which makes it unfavourable for centrifuge and getting concentrate from it. Some other related measures also are included in consideration during the processing of concentrate latex from the natural raw latex. The problems that are being faced in a concentrate latex processing plant can be categorized in different groups like, problems related to the latex property, mechanical problems, electrical problems, handling and storage problems, transformation problems, problems related to environmental issues, etc. Among them, the most common and vital problems frequently observed in a concentrate latex processing plant are discussed here with a view to finding the measures for solution which will help to maintain the latex property in any latex processing plant.

1. Introduction

Latex processing industry plays a vital role to produce the raw material for manufacturing various rubber products. Natural rubber offers high tensile strength and resistance to fatigue, from wear such as chipping, cutting or tearing, which carries its acceptance to manufacture various rubber goods like contraceptives, hand gloves and other thin walled materials. Although the process to produce concentrate from natural latex is not intricate but it can easily arise so many complexity if some factors related to the operation is not maintained properly. The most important thing is, in a factory, where processing of concentrate latex is the main concern, it is very much important to take proper care in every stage of the operation, so that no occurrence makes the latex out of order that inhibits to manufacture the desired product. Otherwise, it may result to a huge loss of raw material, energy and money of course. It is therefore recommended to get ready for any unwanted problems in a concentrate latex processing factory as well as have a record of all the troubleshooting to understand the essential steps required to be taken while any obstruction is faced during the production.
2. Process related problems and the possible measures to solve them

2.1. Problems related to latex property

The main parameters of the finished concentrate which are essential to be maintained to ensure the concentrate quality are, Dry Rubber Content (DRC), Mechanical Stability Time (MST), Volatile Fatty Acid (VFA), Potassium Hydroxide No (KOH No.), Ammonia Content.

2.1.1. DRC is found low in the concentrate after centrifuge. DRC of the concentrate is accurately governed by the length of the skim screw, feed rate and the total running time. A slower rate gives a greater separation into cream of higher DRC, likewise short skim screw higher cream DRC. It is normal to run at 60.20% DRC in the concentrate and adjust it later to 60.10%. The skim fraction should be retained in the bowl for as long as possible to remove as much rubber as possible from it [7].

2.1.2. Low ammonia content in the latex after field collection. This may happen when ammonia is not added properly during field collection. To keep the latex free from the possibility of getting coagulated ammonia must be added to field latex during collection. When low ammonia is found, it is required to immediately add ammonia to the latex to save it from contamination.

2.1.3. MST low in latex concentrate. Mechanical stability is the term that defines the stability of the latex concentrate to mechanical shear forces. This is the most important parameter to determine the quality of the final product. For a perfect situation MST of concentrate latex should be within 600-1200 [12]. An amount of MST below 600 indicates that too much DAP may have added at the initial stage before centrifuge the latex which in turns results in low MST value [12]. Another thing is, the mechanical stability of latex may have affected by lowering the temperature. Therefore care should be taken that the sample is not cooled significantly between sampling and testing [7], [12].

2.1.4. High VFA. Another very important parameter for the concentrate latex is VFA or volatile fatty acid. The VFA is recommended to be found less than 0.06 for latex [12]. High VFA is the enemy for both the raw and finished latex. The presence of Mg in the latex normally contributes to increase the bacterial activity and higher VFA. Early ammonia addition is recommended to minimize the VFA increase. In spite of taking this precaution if VFA of the concentrate in the final storage tanks is found higher than the tolerable range, the solution to this problem is to return the latex from the storage into the reception tank, dilute it with water and add ammonia up to 0.4% [12], then re centrifuge it to the desired grade.

2.1.5. Control of KOH Number. It is the measure of the ionic strength of the serum in the presence of ammonia. Thus, if latex is bacterially degraded, the ionic strength increases and also the KOH no. Poorly preserved latex will have a high KOH no but a high KOH no does not necessarily indicate of poorly preserved concentrate. The favourable value of KOH no is 1% [12], if it becomes high it is recommended to dilute the field latex and re centrifuge it.

2.2. Mechanical problems

2.2.1. Field latex overflows into the latex concentrate and skim collection chute. The reason behind this problem is, coagulum completely may have blocked the distributor or the sludge cavity of the centrifuge machine; to avoid this type of problem during production care must be taken on the machine running time. Generally a centrifuge machine can be operated for 3 hours. 10 minutes to reach its operating speed, 2.50 hours to run the field latex into the bowl and the rest 20 minutes for braking and stopping the bowl and letting the motor cool down [7], [12]. It is recommended that the centrifuge machine should not run over its capacity time otherwise it may cause such problem.
2.2.2. Abnormal vibration in centrifuge machine. This type of problem is really dangerous for a centrifuge machine. A centrifuge machine consists of many discs, around 140 discs for 60% concentrate and it generally runs at a speed of 1400 RPM [12]. At this high level of speed, if vibration is observed that means the machine’s bowl has not been properly assembled before. There may be some discs missing, or the discs of two different centrifuge machines may have interchanged, or there may be some damage or wear inside. It is highly recommended that if such vibration is observed the machine should be stopped at once to avoid any unexpected accident or damage of the machine.

2.2.3. Problem related to mechanical agitation. Mechanical agitation or stirring of latex in the storage tank creates friction, shear and turbulence which reduces the stability of latex, it is important that any mechanical stirring must be done slowly, using a slow speed stirrer at 20 to 40 RPM [7], [12].

2.2.4. Pump selection problem. Since the raw material and the finished product both are liquid, it requires pumps to transfer the latex in different zones of the production area. In such case, a right selection of pump is very much important so that no unwanted system loss or hindrance occurs. Generally it is best for latex factories to employ the gravitational method for moving latex, if mechanical pumping is unavoidable, then the latex can be pumped by means of compressed air which is applied at the top of the container/tanker that is to be emptied. Mechanical pumps have regions in which the liquid is subjected to a high shear or which involve regions of sliding contact, are unsuitable for use with latex, because coagulum may occur at these points. Besides, the latex may be contaminated with lumps of coagulum, causing blockage and seizure of the pump to occur. A further requirement is that the pump should not introduce significant quantities of air into the latex. This condition limits the selection of pumps to only the centrifugal, single screw and diaphragm types [12].

2.3. Handling and storage problem

2.3.1. Ice formation at the nozzle of ammonia cylinder: Ammonia is a case II substance, means it liquefies at standard temperature but increased pressure. As more gas is pulled off, the pressure continually decreases and more gas is able to escape. Because the ammonia is evaporating, the gas cylinder gets very cold. To prevent the valve from freezing and to keep the container at semi-reasonable temperatures, it is better to simply run water over it [4].

2.3.2. No Copper and Magnesium in contact with the latex. The effect of copper or copper material in latex is very severe. Since the presence of copper forms copper amine complex which brings the latex to damage, coagulation occurs and as a result the target of getting concentrate is ceased. Mg is also detrimental in the same way for latex; it reacts with the sugar in the field latex and forms acid which also may be responsible for high VFA. Care should be specially given while handling the latex, that no copper, magnesium or instruments made of these elements are used in latex processing, otherwise it will bring contamination.

2.4. Electrical Problem. 
Centrifuge machines are driven by electrical motors, the machine should not run above the rated power. The machine should always run at the specified speed and this should be checked periodically using a tachometer [12]. The time requirement for the bowl to reach its operating speed is important and is determined by the efficiency of the linings in centrifugal clutch built into the driving pulley. If the accelerating time increases, then the clutch linings should be examined for wear and replaced if necessary [7], [12].

3. Conclusion
In spite of the advent of synthetic latex, natural latex is still being used as the raw material in different countries like Malaysia, Thailand, Bangladesh, etc. due to its availability from natural resources in those countries.
Almost in every latex processing factory, more or less, the cited problems are observed frequently; sometimes more than one problem is faced at a time. If proper cautions are not taken during the operation these problems may cause severe outcome and sometimes failure of process. It needs further study to search for further obstructions that may arise in this type of process and more research to find their advanced solution. Especially, a more detail study is required on environmental issues. The waste water that comes out from latex processing plant is one of the main concerns of rubber industry. There should be more research to find better solution in this case.

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